National Institute for Health and Care Excellence

Final

Vaccine uptake in the general population

[E] Evidence review for education interventions to increase the uptake of routine vaccines

NICE guideline NG218

Evidence review underpinning recommendations 1.1.19 to 1.1.21, 1.2.13, 1.3.2 to 1.3.5 and 1.3.11 to 1.3.14 and a research recommendation in the NICE guideline

May 2022

Final

This evidence review was developed by the Guideline Development Team

Disclaimer

The recommendations in this guideline represent the view of NICE, arrived at after careful consideration of the evidence available. When exercising their judgement, professionals are expected to take this guideline fully into account, alongside the individual needs, preferences and values of their patients or service users. The recommendations in this guideline are not mandatory and the guideline does not override the responsibility of healthcare professionals to make decisions appropriate to the circumstances of the individual patient, in consultation with the patient and/or their carer or guardian.

Local commissioners and/or providers have a responsibility to enable the guideline to be applied when individual health professionals and their patients or service users wish to use it. They should do so in the context of local and national priorities for funding and developing services, and in light of their duties to have due regard to the need to eliminate unlawful discrimination, to advance equality of opportunity and to reduce health inequalities. Nothing in this guideline should be interpreted in a way that would be inconsistent with compliance with those duties.

NICE guidelines cover health and care in England. Decisions on how they apply in other UK countries are made by ministers in the Welsh Government, Scottish Government, and Northern Ireland Executive. All NICE guidance is subject to regular review and may be updated or withdrawn.

Copyright

ISBN: 978-1-4731-4587-0

Contents

1 Education and information interventions to increase vaccine uptake

1.1 Review question

What are the most effective education and information interventions for increasing the uptake of routine vaccines?

1.1.1 Introduction

The UK has a routine vaccination schedule covering key vaccinations for different stages in life including childhood, adolescence, pregnancy, and old age (65 years and older). Current practice is for healthcare practitioners to advise people to accept these vaccinations at the relevant times unless contraindicated. However, the incorrect linking of the MMR vaccine to autism resulted in a reduction in MMR vaccination which is now being reflected in an increase in the number of cases of measles. There were 991 confirmed cases of measles in England in 2018 compared with 284 in 2017 and the World Health Organization no longer considers measles 'eliminated' in the UK. Although vaccination levels in general in the UK are relatively high, levels of uptake vary between vaccines and the age groups they are targeted at. For example, 5-in-1 coverage of children measured at 5 years was 95.2% in 2019/2020, while 83.9% of Year 9 females completed the 2-dose HPV vaccination course in 2018/19. By contrast, from April 2018 to March 2019, shingles vaccine uptake for the 70-year-old routine cohort was only 31.9%, pneumococcal vaccine uptake for all people aged 65 years and over was 69.2%, and pertussis vaccine coverage in pregnant women was 68.8%. However, vaccination rates need to be actively maintained and ideally increased in the face of increasing vaccine scepticism and misinformation. The COVID-19 pandemic has also reduced routine vaccination rates and is likely to continue to disrupt routine vaccinations in the foreseeable future. In addition, certain population groups (such as some Gypsy, Roma and Travellers and migrants) have lower levels of vaccination than the general public and additional or different actions may be required to increase their vaccination rates.

Reasons for low uptake may include poor access to healthcare services; inaccurate claims about safety and effectiveness, which can lead to increased concerns and a reduction in the perceived necessity of vaccines; and insufficient capacity within the healthcare system for providing vaccinations. In addition, problems with the recording of vaccination status and poor identification of people who are eligible to be vaccinated may have contributed to this problem. This review aims to identify effective education and information interventions to increase the uptake of routine vaccines. It follows the protocol and overarching review question detailed in Appendix A, which has been divided across several review documents by intervention type and is summarised in Table 1.

1.1.2 Summary of the protocol for education/ information interventions

Table 1 PICO table for education/ information interventions to increase routine vaccine uptake

Population	• All people who are eligible for vaccines on the routine UK immunisation schedule and their families and carers (if appropriate). • Staff including, but not limited to, those providing advice about or administering vaccines and those people with relevant administrative or managerial responsibilities.
Intervention	Information/education interventions including, but not confined to:

1. Information, education and methods of communicating them
    - Interventions to provide information such as:
        - online campaigns including social media and apps
        - radio campaigns
        - letters by mail
        - printed materials (e.g. leaflets)
        - multi-media campaigns
        - TV and online advertising (including pop up adverts)
        - posters
        - online information exchange- fill in questionnaire and get information

    - Educational interventions (delivery methods):
        - face-to-face sessions
        - telephone conversations
        - social media with responses
        - interactive multi-media interventions (e.g. case studies on GP websites; e-learning)
        - interactive community events (e.g. talks with question and answer sessions)
        - peer education (carried out by a community member who shares similar life experiences to the community they are working with)
        - lay education (carried out by community members working in a non-professional capacity)
        - multicomponent interventions targeting education
        - vaccine hotlines and special advisory clinics for health professionals

    - Who provides the information and/or advice and how they do so, including:
        - Vaccine champions:
            - Practitioners
            - Peers
            - Community leaders
        - Interventions to train staff and other people on how best to communicate the information/ run educational sessions.
        - Recommendations to vaccinate from people/groups including:
            - Medical and other staff (for example, GPs, nurse, health visitors, midwives,)
            - Social workers
            - Community leaders
            - Religious leaders
            - Peers
            - Teachers

Reminders interventions including, but not confined to:

Vaccination reminders aimed at providers or individuals including:

- Reminder and recall systems (aimed at provider)
    - clinical alerts and prompts
    - national alerts to local teams
    - local recall initiatives

- Personal invitation to be vaccinated from:
    - GP
    - community pharmacist
    - health or social care worker
    - from several professionals

	• Reminders to individuals/ eligible groups by:
	  • text messages
	  • electronic invitations (via apps)
	  • emails
	  • letter
	  • phone calls
	  • posters
	  • postcards

Comparators	• Usual approaches to increase vaccine uptake
	• Other interventions to increase vaccine uptake
	  • Other interventions targeting same issue/ theme (for example education)
	  • Other interventions targeting different issues/ theme (for example education versus infrastructure)

Outcomes	• Changes in:
	  • Vaccine uptake (overall for a specific vaccine or vaccines and for each dose where a vaccine is administered in multiple doses)
	  • the proportion of people offered vaccinations
	  • the numbers of people who develop the disease the vaccination was aimed at preventing
	• Cost/resource use associated with the intervention

1.1.3 Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocol in appendix A and the methods document. Declarations of interest were recorded according to NICE's conflicts of interest policy.

This review is one of a series of reviews looking at interventions to increase uptake (see appendix A for the full protocol covering all of the intervention types). Some of the following text has been duplicated as it applies to all reviews, but other sections are specific to this review.

The following additional methods apply across intervention types:

1. This review refers to the UK routine vaccination schedule. The November 2019 schedule was used when these reviews were carried out and is available with the current version of the complete routine immunisation schedule. Influenza vaccination is not covered by this guideline because there is a separate NICE guideline on Flu vaccination: increasing uptake.
2. In this guideline, the term pregnant woman is used to include women who are pregnant as well as transgender or non-binary people who are pregnant. This terminology is used to maintain consistency with NHS websites.
3. A date limit of 1990 was used for all reviews because the vaccination schedule for babies changed in 1990. This will include papers published after the MMR scandal of 1998 when attitudes to vaccinations changed in the UK and the numbers of vaccine related studies increased greatly.
4. A search for systematic reviews (SRs) of interventions to increase routine vaccine uptake was carried out. This was used to identify any SRs that could be used to answer the review questions directly with/ without additional searching being required to update them. However, all but 4 of them were subsequently excluded because they did not map sufficiently well to our review protocols. The most recent SRs were used to help design the search strategies to identify relevant primary intervention studies, and as a source of references.
5. Targeted searches were carried out to fill the gaps focusing on identifying primary studies that corresponded to each type of intervention as listed in the PICO in Table 1. These searches used RCT study type limits where it had been determined by reference to the

SRs that there were many RCTs for this intervention type (for example, reminders). Where there was less certainty no study type limits were used during the search. These primary searches were pooled with the SR search results in a single database for sifting and included studies were divided by intervention type for analysis. The search results were pooled to enable deduplication of results because the search results for particular types of interventions also frequently returned references for other types of interventions.

6. At the start of each intervention review, the included studies were examined in more detail and a decision was made whether to limit the included studies to RCTs and cluster RCTs, or whether additional study types were needed. Where insufficient RCT or cluster RCT evidence was identified then non-randomised controlled studies, cohort studies or interrupted time series studies were included. Where there was still a very limited evidence base then controlled before-and-after studies and finally uncontrolled before-and-after studies were included. Decisions were made in consultation with the committee. Where the study type limits were used then the remaining studies for that intervention type that did not met the additional inclusion criteria were excluded.
7. Where studies have more than 2 arms they may be included in more than one review if the intervention types differ, but a single comparison is only presented in a single review.
8. Where studies have multicomponent interventions they are included in the main intervention reviews if they have 2 components (for example, education and reminders), but where they have more than 2 vaccine specific interventions they have been included in the multicomponent review. However, if the intervention has two types of the same group of interventions (for example, provider and patient education or provider audit with feedback) these have not been counted separately. Table 2 in the multicomponent review (evidence review H) summarises where these studies have been analysed.
9. The committee agreed not to include grey literature in the search for this topic because they thought it would be time consuming to identify and that it would be hard to find relevant literature. They agreed that if insufficient evidence is identified from the included study types, they would consider a focused call for evidence instead or look at indirect evidence.
10. Where no or limited direct evidence was available, indirect evidence was obtained by looking at the NICE guideline on Flu vaccination: increasing uptake. This evidence was limited that covering routine flu vaccination, not vaccination of high-risk groups (that are not covered by the routine schedule) or vaccinations that are purchased privately. Where the flu guideline did not address the review question directly, we referred to any relevant recommendations the flu committee made instead.
11. The countries of interest were limited to those in the Organisation for Economic Co-operation and Development (OECD) because less economically developed countries are likely to have different reasons for low levels of vaccine uptake associated with less well-developed healthcare systems. As a result, interventions to improve uptake in these countries are less likely to be relevant for the UK.
12. For studies looking at specific vaccines to be considered for inclusion, the vaccinations included in the study must be in the routine vaccination schedule of the UK and the country where the study was conducted. Routine vaccination schedules of countries other than the UK were checked using the WHO vaccine-preventable diseases: monitoring system unless a more up -to-date, approved, national/regional immunisation schedule was identified online.
13. If a study presented data on multiple vaccines, that are not all on the UK routine schedule and we cannot extract data separately for the vaccines on the UK schedule then the study was excluded.
14. If study reports uptake of childhood vaccinations (e.g. up to date by 2 years old) and doesn't specify the vaccination, but we know that the schedule in that country (US normally) has some differences to UK schedule, we have included the study and not downgraded for applicability if the majority of the vaccinations on the schedule are the same as UK. This approach was agreed with the committee.

15. Studies using vaccine formulations that differ from those used in the UK have not been excluded if the vaccines included in the formulation target the same diseases as the UK versions and are used at the same time as on the UK routine schedule. The committee agreed that it was the presence of a vaccination against a disease on the routine schedule rather than the formulation of the vaccination that was important.
16. Interventions may be generic or targeted (tailored to the needs of the individual/ group.) They may target individuals or groups of individuals (ie. a community). Interventions targeting individuals may be provided at the individually or as a group.
17. Where the comparator in an analysis is listed as the usual approach this defined as whatever is the standard approach to vaccination in at the time that an eligible study was carried out. If further details are available, then they are provided in the evidence tables.
18. Studies looking at catch-up campaigns were included if the campaigns were as follows:
    - opportunistic in those that missed a vaccination, and
    - catch-up campaigns in under-vaccinated groups.

Catch-up campaigns following a disease outbreak were not included.

19. Outcomes:
    - Vaccine uptake is defined as the proportion of people being vaccinated with individual vaccines or overall (for all eligible vaccines). It is a dichotomous outcome.
    - Occurrence of disease is defined however the study reports it at the end of the intervention.
    - Any studies that only reported change in offers and not uptake were excluded from the review because the committee are only interested in how changes in the numbers of offers relate to changes in uptake. Increased uptake may be caused by increased offers or an increase in offers may not translate into increased uptake.
20. Network meta-analyses were not prioritised for the intervention reviews due to the expected variability between interventions, populations and types of vaccine. Instead, additional analysis time was used to try to triangulate the findings from the quantitative and qualitative reviews using a mixed methods approach. (See below in the review specific methods for more details about the approach used in this review.)
21. Since non-randomised trials and cohort studies are assessed for risk of bias using ROBINS-I they could be combined in a meta-analysis with RCTs in GRADE (starting at high quality). However, although the inclusion of these NRS could be used to provide more precise estimates in summary effects they were not combined in the intervention reviews because the NRS are expected to be much larger and may dominate such estimates.
22. No clinically meaningful differences were identified by the committee, and they were unwilling to define MIDs here because they thought the clinically meaningful change in uptake may differ between vaccinations. Therefore, the line of no effect was used to downgrade for imprecision.
23. The interpretations in the GRADE summary tables of evidence are as follows:
    - We state that the evidence showed that there is an effect (e.g., increase or decrease) if the 95% confidence interval (CI) does not cross the line of no effect.
    - The evidence could not differentiate between comparators if the 95% CI crosses the line of no effect.

Qualitative evidence

The qualitative evidence for this review was taken from evidence review B. Please see the methods detailed there for more information about how the findings were derived.

Information/education and reminders review specific methods

1. In this review 'education' may be used to refer collectively to education and information interventions. Where the distinction is important the separate terms are used. These interventions are differentiated as follows based on their level of intensity of engagement:
    - Information- passive one- way interaction (given information)
    - Education – active two-way interaction (people able to discuss issues that concern them and the evidence).
2. In this review staff education was limited to education about how to communicate to eligible people about vaccination and being provided with information on topics such as the benefits and risks of vaccination, disease severity and incidence. Studies looking at interventions that involved staff training in how to carry out processes related to vaccination such as checking records for eligible people, sending reminders, giving injections and update records afterwards were included in the infrastructure review unless they were thought to be more relevant for inclusion in the specific intervention review.
3. This review does not include provider audit and feedback, or the hiring of additional staff with responsibilities for training practitioners, answering complex questions, or co-ordinating immunisations because these are included in the infrastructure review. This is because the provision of audit and feedback, and the hiring of additional staff require changes to infrastructure.
4. The committee combined interventions targeting communication (which was listed separately in the original review question) into this review or the 'reminders' review (evidence review C) depending on whether the communication aimed to convey information or educate or was a reminder that a vaccination is due or late, respectively.
5. These interventions may be aimed at:
    - everybody who is eligible for vaccination or their family members/ carers or community
    - specific groups of people who might decide to be vaccinated themselves or decide on behalf of others ((for example, posters targeting parents visiting GP surgeries, leaflets sent home with children from school, local radio campaigns)
    - staff who are involved in providing information/education about or delivering the vaccinations (to be vaccinated themselves and/or to help them inform the above groups).
6. Interventions may be generic or targeted (tailored to the needs of the individual/ group.) They may target individuals or groups of individuals. Interventions targeting individuals may be provided at the individually or as a group.
7. Based on the criteria established for the inclusion of multicomponent interventions in each of the reviews (see point 8 in the general methods section above), this review also included interventions that comprised education/ information **with** reminders. (The evidence for reminders interventions alone is covered in evidence review C.)
8. For this review, and the main reminders interventions review C, the term 'reminders' is used to include both the initial call/ invitation to be vaccinated when a vaccination is due and the reminder/ recall contact when a vaccination is overdue unless the text states otherwise. Reminders could be delivered by telephone, letter, postcard, text message, automatic electronic telephone calls (autodialer), or within a secure online patient portal system. Reminders could also be delivered in person. For example, a care provider giving a face-to-face reminder during a home visit or a clinic visit. The reminders could vary with regards to the type, number and be combined with other types of reminders interventions (for example, letter and phone reminders). The reminders could include an invitation to schedule a vaccination appointment.
9. For this review, the committee agreed that there were sufficient RCTs and cluster RCTs such that we did not need to include other study types.
10. The Cochrane systematic review Kaufman 2018 was incorporated into this review. Its methodology was adopted in this review so that cluster RCTs could be incorporated into meta-analyses with 'standard' RCTs. Including cRCTs with RCTs in the same meta-

analysis involved using each cRCT's intracluster correlation coefficient (ICC) to adjust the outcomes for clustering. If a study did not provide an ICC, we used a proxy ICC of 0.05 because this is the value used in the Cochrane review and it is the same or similar to several ICCs of cRCTs included in this review. The forest plot footnotes allow these adjusted cluster RCTs to be identified.

11. In some cases, studies reported adjusted odds ratios and did not provide the information to allow conversion to a RR to enable calculation of the absolute risk. These studies are marked in the GRADE table by the absence of an absolute risk.
12. Studies of intervention versus control were included if the controls were the following:
    - No education intervention
    - Usual practice. Studies did not need to specify what was normal care was. Ideally, they would say that this did not include education. Studies were downgraded for risk of bias if they said the control arm could include education in some clinics.
    - A control intervention such as printed educational material on a non-vaccine related topic for a printed educational material intervention, or a control non-vaccine related face-to-face education for face-to-face education on vaccines.
    - Parts of the interventions cancelled each other out (such as 2 arms including education, or an active control such as education about another vaccination).
13. A mixed methods summary was made which combined the main education-related findings from the qualitative barriers and facilitators review (evidence review B) with the relevant quantitative results from this review. Findings relating to education, and education and reminders, were identified from review B and the ones that were considered to be most important were summarised in 1.1.6 Summary of the evidence. These findings spanned the age groups and life stages and were further summarised to produce a diagram with key barriers and facilitators to vaccine uptake that related to education. Where possible links were made between barriers and corresponding facilitators that had been raised in the findings themselves or that were logically linked. So, for example, if a barrier concerned literacy problems and there was quantitative evidence from a study using video information about vaccines then the results of this study were summarised and placed in a box linked to the relevant barrier or facilitator. At this point the quantitative evidence was mapped onto the qualitative evidence. If a study could not be linked to a barrier or facilitator then it was shown in separate box at the side of the diagram.

1.1.4 Effectiveness evidence

A series of searches were carried out to identify evidence to answer the overall review question about effective interventions to increase uptake. Firstly, a search for systematic reviews (SRs) of interventions to increase routine vaccine uptake was carried out. This search returned 2190 references.

Additional searches were carried out to identify primary studies for all the intervention types listed in the full review protocol (see Appendix A). These searches were pooled with the SR search results in a single eppi 5 database for sifting to enable deduplication of results because the search results for particular intervention groups also frequently returned references for other intervention groups. As a result, it is harder to assign individual references to particular search results than would normally be the case. The numbers provided below refer to the pooled searches unless stated otherwise.

In total 19254 studies were screened at title and abstract level against the review protocol and 738 were included for screening at full text. Of these 215 matched the inclusion criteria and were divided into SRs or separate intervention types (education, infrastructure, access, reminders, acceptability) or multicomponent to match the evidence reviews.

Of the SRs that met the inclusion criteria all but 4 were subsequently excluded (see methods for more details of this process; the numbers above have taken this process into account and only include the 4 SRs). The 4 SRs were sufficiently well matched to a particular review

question to be included as directly applicable evidence and were judged to be high-quality (following a ROBIS quality assessment). None were relevant for this review.

Of the included primary studies, 45 studies met the criteria for inclusion in the education and reminders review.

The systematic review search and the primary searches were rerun at the end of the guideline development process to identify any newly published references that were relevant for this and other reviews. Of the 1752 new references, 67 were ordered at full text to screen for inclusion in the intervention reviews. Of these, no SRs matched the inclusion criteria closely enough to be included in any of the reviews. 3 additional primary studies were included at this stage. 3 additional primary studies were identified that were relevant for this review. Therefore, this review consisted of 48 included studies.

Forty eight RCTs and cluster RCTs (cRCTs) met the criteria for inclusion in the education review and therefore the decision was made to limit this review to RCT and cRCT study designs only. Therefore 319 studies were excluded as they did not meet the review protocol or were non-RCT or cRCT studies that looked at reminders interventions. Fifty-one systematic reviews of RCTs matched the criteria specified in the review protocol and were included initially with most being excluded after being used as a source of references.

1..4.1 Included studies

Information/ education interventions
Thirty-four studies targeted individuals, parents or carers, and/or healthcare providers. They were a mix of RCTs and cRCTs. They looked at information/ education interventions versus controls (usual practice) or information/ education interventions (alone or in combination) compared to other interventions to increase vaccine uptake.
The studies were as follows:

- Twenty-eight studies (17 RCTs and 11 cluster RCTs) looked at information/ education interventions aimed at individuals, parents or carers compared to control. These studies looked at: video information; video and printed material; social media; website with or without social media; printed material information; face-to-face education; face-to-face and printed material information; face-to-face education, video and printed information; telephone conversation; an interactive app; and website and lesson.
- Ten studies (7 RCTs and 3 cluster RCTs) looked at information/ education interventions aimed at individuals, parents or carers compared to other education interventions. These included comparing easy to read printed information to standard printed information, a website with tailored information to a website with untailored information, website and social media to a website, tailored iPad information to untailored iPad information, interactive electronic education to printed educational material, Interactive electronic education to video education, video to written advice, prenatal face-to-face education to postpartum education, and face-to-face education with an immunisation specialist to a webinar with an immunisation specialist.
- Three cluster RCTs looked at information/ education interventions aimed at health care providers compared to control. These studies looked at: face-to-face education, printed educational material and interactive multimedia to show parents; fact sheet attached to all patient notes; face-to-face education with an immunisation specialist; and webinar with an immunisation specialist.
- Two cluster RCTs looked at information/ education interventions aimed at individuals, parents or carers, and health care providers compared to control. These studies looked at: face-to-face education for providers who were also given printed educational material, and for parents and individuals: printed educational material, a website, and disease images; and face-to-face education, printed educational material and interactive multimedia to show parents.

Note: The numbers of studies listed above is greater than the includes study numbers because there were eleven 3-arm studies.

Information/ education plus reminders interventions
Fifteen studies targeted individuals, parents or carers. They were a mix of RCTs and cRCTs. They looked at educational and reminder interventions versus controls (usual practice) or educational and reminder interventions (alone or in combination) compared to other interventions to increase vaccine uptake.
The studies were as follows:

- Eleven studies (10 RCTs and 1 cluster RCT) looked at educational and reminder interventions aimed at individuals, parents or carers compared to control.
- Three RCTs looked at educational and reminder interventions aimed at individuals, parents or carers compared to other interventions. These included comparing information and reminders interventions to information alone, educational text message reminder to plain text message reminder, and information plus multiple reminders to information and single reminder.
- Two studies (1 RCT and 1 cluster RCT) looked at educational and reminder interventions aimed at individuals, parents or carers, and health care providers compared to control. These studies looked at: education for patients by GPs plus 2 home visits by nurse plus at least 1 telephone reminders plus tailored information for patients and GPs, and group patient education or 2 home visits for patients plus a tailored reminder for patients and GPs.

Note: The numbers of studies listed above is greater than the includes study numbers because there were four 3-arm studies and one 4-arm study.

For the evidence study selection, please see Appendix C. The studies are summarised in section 1.1.5 below.

1.1.4.2 Excluded studies

The list of excluded studies with reasons for their exclusion are available in Appendix J.

1.1.5 Summary of studies included in the effectiveness evidence

Education and education plus reminders interventions

Systematic review

Short Title	Population	Interventions and comparators	Relevant outcomes
Kaufman 2018	• 7 RCTs. [Our review included 4 of the RCTs. because 3 of the RCTs did not match the criteria set out in our review protocol.][1] • The databases were searched from 2012 to 3 July 2017. This was an update of earlier review so this review included studies from earlier dates too. • Participants included children: infants (less than 1 year) or preschool-aged children (1 to 5 or 6 years). • Participants included parents, guardians, or others fulfilling the parental role, alone or in groups. They also included participants who were expectant parents, individuals or couples currently pregnant, considering adoption, or otherwise expecting to become guardians of a child.	• Face-to-face communication interventions directed to parents to inform or educate them about routine childhood vaccinations. • Interventions delivered by anyone, including physicians, nurses, midwives, health visitors, or other healthcare professionals; trained volunteers; lay health workers; members of the community; or peers.	• Vaccination status of child (in other words, vaccination status up-to-date, or receipt of one or more vaccines, as defined by study authors).

1. The included studies are listed in the detailed evidence table for this Cochrane review in Appendix D.

Primary studies

Table 2 Summary of the characteristics of the primary studies of educational interventions aimed at individuals, parents or carers.

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Barthu 2006	Australia	152	RCT	Community	Children aged 0 to 6 months	Face-to-face education by visiting nurse	Usual care	General for age range[2]	Vaccine uptake
Chodick 2021	Israel	21592	RCT	Community	Parents of adolescents aged 14 years	Facebook campaign for parents to increase HPV vaccine uptake	Control (no Facebook campaign)	HPV (Human papillomavirus)	Vaccine uptake
Dempsey 2019	USA	848	Cluster RCT	Community	Adolescents aged 9 to 17 years	**Intervention 1:** Tailored information on an iPad for adolescents **Intervention 2:** Untailored information on an iPad for adolescents	Usual care	HPV	Vaccine uptake
DiClemente 2015	USA	216	RCT	Health clinics	Adolescents aged 13 to 18 years	Interactive computer-delivered media presentation	Media presentation on physical activity and nutrition.	HPV	Vaccine uptake
Dixon 2019	USA	1596	Cluster RCT	Health centres	Adolescents aged 11 to 17 years	Video education for parents	Usual care	HPV	Vaccine uptake
Esposito 2018	Italy	917	Cluster RCT	Schools	Adolescents aged 11 to 18 years	**Intervention 1:** Website and lesson were aimed at adolescents. **Intervention 2:** Lesson were aimed at adolescents.	No intervention	HPV, MenACWY (Meningococcal A, C, W and Y), MenB (Meningococcal B), MenC	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
								(Meningococcal C), Tdap (Tetanus, diphtheria, pertussis), varicella, influenza[1]	
Glanz 2020	USA	824	RCT	Community	Children aged 0 to 1 year	**Intervention 1:** Website with tailored information aimed at parents. **Intervention 2:** Website with untailored information aimed at parents.	Usual care	HepB (Hepatitis B), rotavirus, DTap (Diphtheria, tetanus, pertussis), Hib (Haemophilus influenzae type b), pneumococcus, polio	Vaccine uptake
Glanz 2017	USA	1093	RCT	Community	Children aged 0 to 200 days old	**Intervention 1:** Website with information and social media **Intervention 2:** Website with information	Usual care	HepB, rotavirus, Tdap, Hib, pneumococcus, polio	Vaccine uptake
Grandahl 2016	Sweden	2883	Cluster RCT	Schools	Adolescents aged 16 to 17 years	Face-to-face education of adolescents by school nurse	Usual care	HPV	Vaccine uptake
Hannan 2013	USA	139	RCT	Community	Children aged 0 to 8 weeks	2 telephone calls from nurse with advice	Usual care	General for age range[2]	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Jackson 2011	USA	142	Cluster RCT	Primary healthcare centres and childcare centres	Children aged 6 months to 5 years	Face-to-face education with researcher (and leaflet)	Leaflet only (control)	MMR (Measles, mumps and rubella)	Vaccine uptake
Jacobson 1999	USA	433	RCT	Primary care clinic	People aged 65 years and over	Easy to read information leaflet on vaccines	Easy to read information leaflet on nutrition	Pneumococcal	Vaccine uptake
Joseph 2016	USA	200	RCT	Primary care clinic at a hospital	Adolescents aged 11 to 15 years	Face-to-face education of the parent by the provider	No intervention	HPV	Vaccine uptake
Kriss 2017	USA	106	RCT	Antenatal clinic waiting rooms	Pregnant women aged 18 to 50 years	**Intervention 1:** Interactive electronic book **Intervention 2:** Video education	Written advice from CDC about vaccines in general (not specific to relevant vaccines)	Pertussis (Tdap)	Vaccine uptake
Lee 2018	USA	19	RCT	Community	Adolescents aged 14 to 17 years whose parents were Khmer refugees	Educational video for both mothers and daughters	Written advice for both mothers and daughters	HPV	Vaccine uptake
O'Leary 2019	USA	1093	RCT	Community	Pregnant women aged over 18 years	**Intervention 1:** Website with vaccine information and interactive social media components.	Usual care	Pertussis (Tdap)	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
						Intervention 2: Website with vaccine information only.			
Payakachat 2016	USA	279	RCT	Women's clinics at medical centres	Pregnant women at least 18 years of age	Plain language information about pertussis vaccine.	Standard information about pertussis vaccine	Pertussis (Tdap)	Vaccine uptake
Porter-Jones 2009	UK	974	RCT	Parent and toddler group	Children 8 months of age	Teddy bear with details about how to get more information.	No teddy bear	MMR	Vaccine uptake
Pot 2017	Netherlands	8062	RCT	Community	Adolescents	Web-based tailored intervention aimed at mothers to promote HPV vaccination.	Usual care	HPV	Vaccine uptake
Saitoh 2017	Japan	188	Cluster RCT	Obstetric hospitals and clinics	Children aged 0 to 6 months	Face-to-face education with investigator.	Usual care	Hib, pneumococcus, Tdap, polio	Vaccine uptake
Saitoh 2013	Japan	119	RCT	Obstetric hospitals	Children aged 0 to 3 months	**Intervention 1:** Face-to-face prenatal education with investigator. **Intervention 2:** Postpartum education with investigator.	Usual care	Hib, HepB, pneumococcus	Vaccine uptake
Santa Maria 2021	USA	508	RCT	Health centre	Parents of adolescents aged 11 to 14 years	Parental and adolescent education by a nurse. Written information for parents.	Control (the 2 reminder telephone calls were in both arms)	HPV	Vaccine uptake
Scarinci 2020	USA	293	Cluster RCT	"Community-based intervention"	Adolescent aged 9 to 12 years whose parents were	Face-to-face education (with educator) in groups and one-to-one in migrants' language.	Usual care	HPV	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
					Latina immigrants				
Shourie 2013	UK	203	Cluster RCT	Participants were at home	Children aged 3 to 12 months	**Intervention 1:** interactive multimedia online decision aid. **Intervention 2:** educational leaflet.	Usual care (including an information leaflet)	MMR	Vaccine uptake
Thomas 2003	USA	558	RCT	Medical clinic	People aged 65 years and over	**Intervention 1:** videotape education and low-literacy brochure on vaccine. **Intervention 2:** videotape education and control brochure on nutrition.	Control brochure on nutrition	Pneumococcus	Vaccine uptake
Tiro 2015[a]	USA	875	RCT	Paediatric clinic	Adolescents aged 11 to 18 years	HPV-specific brochure for parents[3]	General vaccine information brochure for parents	HPV	Vaccine uptake
Underwood 2019	USA	2135	Cluster RCT	Schools and community	Parents of school children	**Intervention 1:** Educational brochure mailed to parents of school children. **Intervention 2:** Educational brochure mailed to parents of school children + classroom teaching for children.	Control (no intervention)	HPV	Vaccine uptake
Underwood 2015	USA	686	Cluster RCT	Schools	Adolescents aged 11 to 18 years	**Intervention 1:** educational literature for parents and classroom teaching for adolescents.	Usual care	HPV	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
						Intervention 2: classroom teaching for adolescents.			
Winer 2016	USA	97	Cluster RCT	Presentation in the community	Adolescents aged 9 to 12 years who had a mother who was part of the Hopi Tribe	Face-to-face education of mother about HPV vaccine at mother-daughter dinners.	Face-to-face education of mother about juvenile diabetes at mother-daughter dinners	HPV	Vaccine uptake
Zuniga 2003	USA	348	RCT	Perinatal clinics	Children aged 0 to 3 months	Educational video about vaccines plus vaccination calendar plus face-to-face advice about vaccines from perinatal educator	Educational video about sudden infant death syndrome (SIDS) plus face-to-face advice about SIDS from perinatal educator	Hib, DTP and polio	Vaccine uptake

1. The data for Tdap, MenB, varicella, and influenza vaccines was not included because they are not on the vaccination schedule for this age. Data for MenC was provided but not used because data for MenACWY was available: The latter vaccine more accurately reflects the UK vaccination schedule. Furthermore, fewer participants in the study were given MenC. Therefore, the data for MenACWY should be more precise.
2. The specific vaccines were not mentioned in the study.
3. Tiro 2015 also included data for the HPV vaccine-specific arm with data for uptake after subsequent reminders. This data is in the "education and reminders" sections.

a. Tiro is a 4-arm study: the HPV-specific brochure versus general vaccine information brochure comparison appears in the education review sections. The two HPV-specific brochure with reminders arms and the general vaccine information brochure arm are in the education plus reminders review sections.

For the full evidence tables, please see Appendix D.

Table 3 Summary of the characteristics of the primary studies of educational interventions aimed at heath care providers.

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Chamberlain 2015	USA	325	Cluster RCT	Obstetric practices	Pregnant women aged 18 to 50 years	Face-to-face peer education, printed educational material and interactive multimedia to show parents	Usual care	Influenza[1] and Tdap	Vaccine uptake
Cowan 1992	USA	62[a]	Cluster RCT	Primary care clinic	People aged 65 years and over	Fact sheets attached to all patient notes in a clinic regardless of indication	Usual care	Pneumonia and influenza vaccine[1]	Vaccine uptake
Gilkey 2014	USA	107443	Cluster RCT	Paediatric and family practice clinics	Adolescents aged 11 to 18 years	**Intervention 1:** face-to-face advice with an immunisation specialist. **Intervention 2:** interactive webinar with immunisation specialist[3]	Usual care	HPV, Tdap, MenACWY, pertussis, MMR, HepB, varicella[2]	Vaccine uptake

1. This study included data on influenza vaccine. The data on influenza was excluded in this review because influenza vaccination is not covered by this guideline.
2. The data for HPV and MenACWY vaccines were included in the analysis. However, the data for pertussis, MMR, Tdap, HepB and varicella vaccines were excluded because they are not on the routine vaccination schedule for 11-18 years olds in the UK.
3. This evidence review has the comparison 'face-to-face education, assessment and feedback versus webinar education, assessment and feedback'. Other comparisons are in the infrastructure evidence review.

a. This is the per protocol analysis number. The intention to treat number was not provided.

Table 4 Summary of the characteristics of the primary studies of educational interventions aimed at both heath care providers and individuals, parents or carers

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Dempsey 2018	USA	13767	Cluster RCT	Paediatric or family medicine practices	Adolescents aged 11 to 17 years	For providers: face-to-face education for providers, printed educational material. For parents:	Usual care	HPV, MenACWY, Tdap[1]	Vaccine uptake

						printed educational material, website, disease images			

1. The intervention was focused on increasing HPV vaccine uptake, therefore HPV uptake was used in the analysis. Data on MenACWY was recorded as incidental information and was therefore excluded from the analysis. Tdap is not on the routine schedule for this age group and was not extracted.

Table 5 Summary of the characteristics of the primary studies of educational and reminder interventions aimed at individuals, parents or carers.

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Dapp 2011	Germany	2580	Germany	General practices	Adults aged 60 years and older	Group education or 2 home visits by a nurse for patients + tailored reminder with information for patients and GPs.	Control (GPs received special training on preventative care in both arms)	Pneumococcal, influenza[1]	Vaccine uptake
Fiks 2013	USA	22,633	cRCT	Primary care practices	Adolescents aged 11 to 17 years	**Intervention 1:** Clinician intervention – vaccine alerts, education, audits and feedback [6] **Intervention 2:** Family intervention – reminder phone calls with information about vaccination [6] **Intervention 3:** Combined clinician and family intervention [6]	Usual care	HPV	Vaccine uptake
Freed 1999	USA	629	RCT	Community	Newborn babies	**Intervention 1:** Letter with immunisation schedule and health message	No mailings sent to parents	DTP, polio, Hib, HBV	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
						Intervention 2: Letter with immunisation schedule and law-based message			
Gutschi 1998	Canada	150	RCT	Heart Institute	Patients admitted to a cardiac surgery programme	**Intervention 1:** Information on risks and benefits of the vaccine. Follow-up letter and pharmacy care plan sent to community pharmacist **Intervention 2:** Information on risks and benefits of the vaccine. Follow-up letter and pharmacy care plan sent to community pharmacist and GP	Information on risks and benefits of vaccination but no follow-up	Influenza and pneumococcal[1]	Vaccine uptake
Harari 2008	UK	2006	RCT	GP practices	Patients aged 65+ years	**Intervention 1:** Individualised computer-generated feedback based on patient's questionnaire responses, with a letter to discuss feedback with their GP. A reminder card was sent 6 months later	No education during the trial	Pneumococcal[2]	Vaccine uptake
Henrikson 2018	USA	1805	RCT	Primary care clinics	Adolescents aged 10-12 years	**Intervention 1:** Vaccine information letter sent to parents. Reminder phone calls 8 weeks later for vaccine 1 **Intervention 2:** Vaccine information letter sent to parents. Reminder phone calls 8 weeks later for vaccine 1, and then for vaccines 2 and 3	Usual care: No letter or reminder phone call	HPV	Vaccine uptake[3]

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Hofstetter 2017	USA	295	RCT	Paediatric clinic	Adolescents aged 11 to 17 years	Educational text message reminder to parents	Plain text message reminder to parents	HPV	Vaccine uptake
Krieger 2000	USA	1246	RCT	Senior centres	People aged 65+ years	**Intervention 1:** Educational brochure with a reply card to track immunisation status and follow-up phone calls	Usual care: Usual immunisation promotion activities	Pneumococcal	Vaccine uptake
Mason 2000	UK	511	RCT	Health authority	Children aged 21 months who had not had MMR vaccine	**Intervention 1:** Personal reminder letter and MMR leaflet sent to parents. Letter copied to GP and health visitor	No reminder or information to parents, GP or health visitor	MMR	Vaccine uptake
O'Sullivan 1992	USA	243	RCT	Outpatient baby unit	Newborn babies	**Intervention 1:** Educational programme including one-to-one teaching, video tapes and slides. Reminder phone calls and letters after any missed visits	Routine care with no reminder calls or letters	Childhood vaccinations (specific vaccines not stated)	Vaccine uptake
Otsuka-Ono 2019	Japan	175	RCT	Outpatient clinic	Newborn babies	**Intervention 1:** Group-based guidance, individual education sessions followed by check-up including check on immunisation status	Control. No further details provided	Hepatitis B, Rotavirus, Hib B and pneumococcal	Vaccine uptake
Quinlivan 2003	Australia	136	RCT	Community	Newborn babies	**Intervention 1:** Home visits with education about vaccination and face-to-face reminders	Routine support and no reminder until	Diphtheria, tetanus, pertussis, MMR	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
							after data collection		
Richman 2019	USA	257	RCT	Community clinics	Adolescents aged 9-17 years	**Intervention 1:** Electronic HPV education messages and appointment reminders	Standard of care: paper card with information about when to return for 2nd and 3rd doses	HPV	Vaccine uptake
Stuck 2015	Switzerland	2284	RCT	General practices	People aged 65 years and over	Tailored information about each patient for both patients and GPs. Education by GP. 2 educational home visits and ≥1 telephone call by a nurse.	Usual care	Pneumococcal	Vaccine uptake
Tiro 2015[a]	USA	875	RCT	Paediatric clinics	Female patients aged 11-18 years	**Intervention 1:** Specific information and reminders for all 3 vaccinations **Intervention 2:** Specific information and reminder for vaccine 1. No additional information or reminders for vaccines 2 and 3	General vaccines information with no reminders	HPV	Vaccine uptake[4]

1. This study included data on influenza vaccine. The data on influenza was excluded in this review because influenza vaccination is reviewed in a separate guideline.
2. Pneumococcal vaccine uptake was reported for patients ever having had the vaccine, not just during the trial period.
3. Two results from the study reported for this review: 1. Vaccine uptake for information and reminders vs no information and reminders, 2. Vaccine uptake for information and reminder for vaccine 1 vs information and reminders for all 3 vaccines
4. Two outcomes used for this review: 1. Information - Specific information and reminder vs general information and no reminder (2 intervention groups pooled vs control). 2 Reminders (intervention arm 1 vs intervention arm 2)
5. For this review, data from 'no clinician intervention and no family intervention' and 'no clinician intervention but family intervention' was used to give a comparison for information and reminders vs no information or reminders
6. Comparisons between arm 2 and control are in this evidence review. Comparisons between arm 1 and control, arm 3 and control, arms 1 and 2, and arms 2 and 3 are included in the multicomponent review.

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
a. Tiro is a 4-arm study: the HPV-specific brochure for patients versus general vaccine information brochure comparison appears in the education review sections. The two specific brochure with reminders arms and the general vaccine information brochure arm are in the education plus reminders review sections.									

For the full evidence tables, please see Appendix D.

1.1.6 Summary of the evidence

See 1.1.3 Methods and process for an explanation of the interpretation column.

Quantitative evidence: education/ information

See appendix F for full GRADE tables

Information/education aimed at individuals or parents/carers compared to control

Table 6 Summary of effectiveness findings for Information/education interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information and/or education versus control (summary by age group) (subtotals but no total) (RR >1 favours intervention)							
Pregnant women							
2 (Kriss 2017, O'Leary 2019)	RCT	1199	RR 1.41 (0.58, 3.44)	13 per 100	18 per 100 (7, 44)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
0-5 year olds							
10[a]	RCT, cluster RCT	3994	RR 1.01 (0.97, 1.06)	80 per 100	81 per 100 (77, 85)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
11-18 year olds							
11[b]	RCT, cluster RCT	32174	RR 1.06 (0.99, 1.13)	61 per 100	64 per 100 (60, 69)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
65 years and older							
2 (Jacobson 1999,	RCT	994	RR 3.53 (1.72, 7.27)	5 per 100	18 per 100 (9, 37)	Increased with Information/education	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Thomas 2003)							
Information and/or education versus control (summary by age group) (total but no Glanz 2017 data) (RR >1 favours intervention)							
24[c]	RCT, cluster RCT	37268	RR 1.05 (1.00, 1.10)	51 per 100	54 per 100 (51, 56)	Increased with Information/education	Very low
Pregnant women							
2 (Kriss 2017, O'Leary 2019)	RCT	1199	RR 1.41 (0.58, 3.44)	13 per 100	18 per 100 (7, 44)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
0-5 year olds							
9[d]	RCT, cluster RCT	2077	RR 1.01 (0.96, 1.06)	81 per 100	82 per 100 (78, 86)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
11-18 year olds							
11[e]	RCT, cluster RCT	32174	RR 1.06 (0.99, 1.13)	61 per 100	64 per 100 (60, 69)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
65 years and older							
2 (Jacobson 1999, Thomas 2003)	RCT	994	RR 3.53 (1.72, 7.27)	5 per 100	18 per 100 (9, 37)	Increased with Information/education	Moderate
Education versus control (summary by age group) (Glanz 2017 separately) (RR >1 favours intervention)							
0-5 year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Glanz 2017)	RCT	1093	RR 1.04 (0.94, 1.15)	72 per 100	74 per 100 (67, 82)	The studies could not differentiate change in vaccine uptake between Information/education or control	Moderate
Information and/or education versus control (summary by delivery method) (subtotals but no total) (RR >1 favours intervention)							
Information: video information							
3 (Dixon 2019, Kris 2017, Thomas 2003)	RCT, cluster RCT	537	RR 1.41 (1.05, 1.90)	18 per 100	25 per 100 (18, 33)	Increased with Information/education	Moderate
Information: video and printed material							
1 (Thomas 2003)	RCT	371	RR 3.53 (1.93, 6.47)	7 per 100	23 per 100 (13, 43)	Increased with Information/education	High
Information: social media							
1 (Chodick 2021)	RCT	21592	RR 1.01 (0.98, 1.04)	55 per 100	56 per 100 (54, 57)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Information: website with or without social media							
5[f]	RCT, cluster RCT	11071	RR 1.00 (0.99, 1.02)	73 per 100	73 per 100 (73, 75)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Information: printed material information, such as leaflets							
4 (Jacobson 1999, Shourie 2013, Tiro 2015,	RCT, cluster RCT	1591	RR 1.32 (0.84, 2.07)	33 per 100	44 per 100 (28, 69)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Underwood 2019)							
Education: face-to-face							
8[g]	RCT, cluster RCT	1006	RR 1.25 (0.92, 1.69)	35 per 100	44 per 100 (32, 60)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Education: face-to-face and printed material information							
3 (Santa Maria 2021, Underwood 2019, Winer 2016)	cluster RCT	669	RR 1.15 (1.02, 1.30)	28 per 100	33 per 100 (12, 94)	Increased with information/education or control	High
Education: face-to-face, video and printed material information							
1 (Zuniga 2003)	RCT	348	RR 1.02 (0.96, 1.07)	93 per 100	95 per 100 (90, 100)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Education: telephone conversation							
1 (Hannan 2013)	RCT	139	RR 1.10 (0.98, 1.25)	84 per 100	93 per 100 (82, 105)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Education: interactive app							
2 (DiClemente 2015, Kriss 2017)	RCT	289	RR 1.72 (0.60, 4.95)	13 per 100	22 per 100 (8, 64)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information and/or education versus control (summary by whether intervention targets an individual/parent or a group) (subtotals but no total) (RR >1 favours intervention)							
Targets individuals or parents							
19[h]	RCT, cluster RCT	36588	RR 1.03 (0.99, 1.07)	61 per 100	62 per 100 (60, 65)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Targets groups of people who are together							
4 (Grandahl 2016, Jackson 2011, Underwood 2019, Winer 2016)	cluster RCT	421	RR 1.08 (0.92, 1.27)	47 per 100	51 per 100 (43, 60)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Targets both groups and individuals or parents							
2 (Scarinci 2020, Underwood 2019)	cluster RCT	403	RR 1.83 (0.56, 6.01)	20 per 100	36 per 100 (11, 119)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Information and/or education versus control (summary by tailored or generic interventions) (subtotals but no total) (RR >1 favours intervention)							
Tailored							
16[i]	RCT, cluster RCT	11641	RR 1.06 (1.00, 1.13)	67 per 100	71 per 100 (67, 76)	Increased with Information/education	Very low
Generic							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
13[j]	RCT, cluster RCT	26263	RR 1.02 (0.96, 1.09)	53 per 100	54 per 100 (51, 58)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Information and/or education versus control (summary by who provided the information or education) (subtotals but no total) (RR >1 favours intervention)							
Healthcare professionals							
10[k]	RCT, cluster RCT	23304	RR 1.03 (0.99, 1.07)	56 per 100	58 per 100(56, 60)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Government health authority organisation							
3 (Porter-Jones 2009, Pot 2017, Shourie 2013)	RCT, cluster RCT	9191	RR 0.98 (0.94, 1.03)	75 per 100	73 per 100 (70, 77)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Study personnel							
3 (Glanz 2020, Saitoh 2013, Underwood 2019)	RCT, cluster RCT	1071	RR 1.41 (0.69, 2.90)	71 per 100	100 per 100 (49, 205)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Study personnel and school teachers							
1 (Underwood 2019)	cluster RCT	128	RR 0.94 (0.52, 1.71)	26 per 100	25 per 100 (14, 45)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
School teachers							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Underwood 2019)	cluster RCT	144	RR 0.92 (0.53, 1.61)	27 per 100	25 per 100 (14, 43)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Lay educators							
1 (Scarinci 2020)	cluster RCT	203	RR 3.35 (2.05, 5.46)	15 per 100	52 per 100 (32, 84)	Increased with Information/education	Moderate
Unspecified personnel at a health clinic							
8[l]	RCT, cluster RCT	2955	RR 1.51 (1.00, 2.29)	25 per 100	38 per 100 (25, 58)	Increased with Information/education	Low
Unspecified personnel at a health clinic and panel of experts on social media							
1 (O'Leary 2019)	RCT	722	RR 0.90 (0.56, 1.44	12 per 100	11 per 100 (7, 17)	The studies could not differentiate change in vaccine uptake between Information/education or control	Moderate
Information versus control (summary) (RR >1 favours intervention)							
10[m]	RCT, cluster RCT	13447	RR 1.05 (0.97, 1.15)	65 per 100	68 per 100 (63, 74)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Immunisations for pregnant women							
2 (Kriss 2017, O'Leary 2019)	RCT	1199	RR 1.41 (0.58, 3.44)	13 per 100	18 per 100 (7, 44)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
0-5 year olds							
4 (Glanz 2017, Glanz 2020, Porter-	RCT, cluster RCT	2770	RR 0.99 (0.95, 1.03)	87 per 100	86 per 100 (83, 90)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Jones 2009, Shourie 2013)							
11-18 year olds							
5 (Chodick 2021, Dixon 2019, Pot 2017, Tiro 2015, Underwood 2019)	RCT, cluster RCT	30752	RR 1.01 (0.99, 1.03)	62 per 100	63 per 100 (61, 64)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
65 years and older							
2 (Jacobson 1999, Thomas 2003)	RCT	994	RR 3.53 (1.72, 7.27)	5 per 100	18 per 100 (9, 37)	Increased with Information/education	Moderate
Education versus control by age group/life stage (RR >1 favours intervention)							
15[m]	RCT, cluster RCT	3062	RR 1.08 (1.00, 1.18)	60 per 100	65 per 100 (60, 71)	Increased with Information/education	Very low
0-5 year olds							
8[n]	RCT, cluster RCT	1568	RR 1.03 (0.97, 1.09)	77 per 100	79 per 100 (75, 84)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
11-18 year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
7[o]	RCT, cluster RCT	1494	RR 1.21 (0.94, 1.56)	41 per 100	50 per 100 (39, 65)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Vaccinations for adolescents aged 11-18 years, Information/education versus control analysed by who the intervention was targeting (RR >1 favours intervention)							
11-18 year olds							
2 (Grandahl 2016, Underwood 2019)	cluster RCT	334	RR 0.96 (0.77, 1.20)	44 per 100	42 per 100 (34, 53)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Parents							
7[p]	RCT, cluster RCT	31093	RR 1.04 (0.97, 1.12)	61 per 100	64 per 100 (60, 69)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Both parents and 11-18 year olds							
3 (Dixon 2019, Santa Maria 2021, Underwood 2019)	cluster RCT	731	RR 1.17 (1.04, 1.32)	53 per 100	62 per 100 (55, 69)	Increased with Information/education	Moderate
Face-to-face education vs control (RR >1 favours intervention)							
8[q]	RCT, cluster RCT	1150	RR 1.25 (0.92, 1.69)	35 per 100	44 per 100 (32, 60)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
0-5 year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
4 (Bartu 2006, Jackson 2011, Saitoh 2013, Saitoh 2017)	RCT, cluster RCT	413	RR 1.20 (0.75, 1.93)	31 per 100	37 per 100 (23, 59)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
11-18 year olds							
4 (Grandahl 2016, Joseph 2016, Scarinci 2020, Underwood 2019)	RCT, cluster RCT	737	RR 1.31 (0.81, 2.11)	38 per 100	49 per 100 (31, 80)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Face-to-face education versus control (MenACWY data) (RR >1 favours intervention)							
11-18 year olds							
1 (Underwood 2019)	cluster RCT	144	RR 1.05 (0.68, 1.62)	35 per 100	37 per 100 (24, 57)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Face-to-face education versus control (HPV different doses) (RR >1 favours intervention)							
11-18 year olds, 1st dose							
3 (Joseph 2016, Scarinci 2020,	RCT, cluster RCT	547	RR 1.47 (0.69, 3.17)	32 per 100	47 per 100 (22, 100)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Underwood 2019)							
11-18 year olds, 2nd dose							
2 (Joseph 2016, Scarinci 2020)	RCT, cluster RCT	403	RR 2.56 (0.66, 9.89)	12 per 100	30 per 100 (8, 116)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
11-18 year olds, 3st dose							
2 (Joseph 2016, Scarinci 2020)	RCT, cluster RCT	403	RR 4.58 (0.35, 59.58)	4 per 100	20 per 100 (2, 263)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Face-to-face education versus control 11-18 year olds, 3 doses (OR >1 favours intervention)							
1 (Underwood 2015)	cluster RCT	686	aOR 1.09 (0.60, 1.97)	N/A[1]	N/A[1]	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Face-to-face postpartum and prenatal education versus control for children aged 0-5 years (RR >1 favours intervention)							
Postpartum education							
1 (Saitoh 2013)	RCT	82	RR 5.68 (1.76, 18.26)	7 per 100	38 per 100 (12, 122)	Increased with Information/education	Moderate
Prenatal education							
1 (Saitoh 2013)	RCT	82	RR 4.05 (1.20, 13.66)	7 per 100	27 per 100 (8, 91)	Increased with Information/education	Moderate
Face-to-face education and printed educational material versus control (RR >1 favours intervention)							
3 (Santa Maria 2021, Underwood 2019,	RCT, cluster RCT	669	RR 1.15 (1.02, 1.30)	52 per 100	60 per 100 (53, 67)	Increased with Information/education	High

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Winer 2016)							
Face-to-face education and printed educational material versus control (MenACWY data) (RR >1 favours intervention)							
1 (Underwood 2019)	cluster RCT	128	RR 0.96 (0.61, 1.50)	38 per 100	37 per 100 (23, 57)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Face-to-face education and printed educational material versus control (different HPV doses) (RR >1 favours intervention)							
11-18 year olds, 1st dose							
1 (Underwood 2015)	cluster RCT	686	OR 2.14 (1.33, 3.43)	N/A[1]	N/A[1]	Increased with Information/education	Very low
11-18 year olds, 3 doses							
1 (Underwood 2015)	cluster RCT	686	OR 1.13 (0.63, 2.03)	N/A[1]	N/A[1]	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Face-to-face education, video and vaccination calendar versus control (RR >1 favours intervention)							
0-5 year olds							
1 (Zuniga 2003)	RCT	348	RR 1.02 (0.96, 1.07)	93 per 100	95 per 100 (90, 100)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Educational telephone call versus control (RR >1 favours intervention)							
0-5 year olds							
1 (Hannan 2013)	RCT	139	RR 1.10 (0.98, 1.25)	84 per 100	93 per 100 (82, 105)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Printed educational material versus control (RR >1 favours intervention)							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
4 (Shourie 2013, Tiro 2015, Jacobson 1999, Underwood 2019)	RCT, cluster RCT	1591	RR 1.32 (0.84, 2.07)	33 per 100	44 per 100 (28, 69)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
0-5 year olds							
1 (Shourie 2013)	cluster RCT	155	RR 0.92 (0.85, 0.99)	99 per 100	91 per 100 (84, 98)	Increased with control	Moderate
11-18 years							
2 (Tiro 2015, Underwood 2019)	RCT	1003	RR 1.02 (0.87, 1.20)	36 per 100	37 per 100 (32, 44)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
65 years and older							
1 (Jacobson 1999)	RCT	433	RR 5.28 (2.54, 10.94)	4 per 100	20 per 100 (10, 41)	Increased with Information/education	High
Printed educational material versus control (MenACWY data) (RR >1 favours intervention)							
1 (Underwood 2019)	cluster RCT	128	RR 0.94 (0.60, 1.49)	38 per 100	35 per 100 (23, 56)	The studies could not differentiate change in vaccine uptake between information/education or control	Very low
Printed educational material and video education versus control (RR >1 favours intervention)							
65 years and older							
1 (Thomas 2003)	RCT	371	RR 3.53 (1.93, 6.47)	7 per 100	23 per 100 (13, 43)	Increased with Information/education	High
Social media versus control (RR >1 favours intervention)							
11-18 years							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Chodick 2021)	RCT	21592	RR 1.01 (0.98, 1.04)	55 per 100	56 per 100 (54, 57)	The studies could not differentiate change in vaccine uptake between information/education or control	Very low
Website and social media versus control (RR >1 favours intervention)							
Pregnant women							
1 (O'Leary 2019)	RCT	722	RR 0.90 (0.56, 1.44)	12 per 100	11 per 100 (7, 17)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
0-5 years							
1 (Glanz 2017)	RCT	722	RR 1.05 (0.95, 1.17)	72 per 100	75 per 100 (68, 84)	The studies could not differentiate change in vaccine uptake between Information/education or control	Moderate
Website versus control (subtotals but no total) (RR >1 favours intervention)							
Pregnant women							
1 (O'Leary 2019)	RCT	551	RR 0.99 (0.61, 1.62)	12 per 100	12 per 100 (7, 19)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Immunisations for 0-5 year olds							
3 (Glanz 2017, Glanz 2020, Shourie 2013)	RCT, cluster RCT	1493	RR 1.01 (0.96, 1.05)	86 per 100	87 per 100 (83, 90)	The studies could not differentiate change in vaccine uptake between Information/education or control	Moderate
11-18 years							
1 (Pot 2017)	RCT	8062	RR 1.01 (0.98, 1.03)	73 per 100	74 per 100 (71, 75)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Website versus control (total but no Glanz 2017 data) (RR >1 favours intervention)							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
4 (O'Leary 2019, Glanz 2020, Shourie 2013, Pot 2017)	RCT, cluster RCT	9555	RR 1.01 (0.98, 1.03)	72 per 100	73 per 100 (71, 74)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Pregnant women							
1 (O'Leary 2019)	RCT	551	RR 0.99 (0.61, 1.62)	12 per 100	12 per 10 (7, 19)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
0-5 year olds							
2 (Glanz 2020, Shourie 2013)	RCT, cluster RCT	942	RR 1.00 (0.96, 1.04)	94 per 100	94 per 100(90, 97)	The studies could not differentiate change in vaccine uptake between Information/education or control	Moderate
11-18 years							
1 (Pot 2017)	RCT	8062	RR 1.01 (0.98, 1.03)	73 per 100	74 per 100(71, 75)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Website versus control (Glanz 2017 separately) (RR >1 favours intervention)							
1 (Glanz 2017)	RCT	551	RR 1.02 (0.91, 1.14)	72 per 100	73 per 100 (65, 82)	The studies could not differentiate change in vaccine uptake between Information/education or control	Moderate
Tailored iPad information versus control (OR >1 favours intervention)							
1 (Dempsey 2019)	RCT	869	OR 1.05 (0.72, 1.54)	N/A[1]	N/A[1]	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Untailored iPad information versus control (OR >1 favours intervention)							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Dempsey 2019)	RCT	864	OR 1.10 (0.71, 1.71)	N/A[1]	N/A[1]	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Interactive app versus control (RR >1 favours intervention)							
2 (Kriss 2017, DiClemente 2015)	RCT	289	RR 1.72 (0.60, 4.95)	13 per 100	22 per 100 (8, 64)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
Pregnant women							
1 (Kriss 2017)	RCT	73	RR 2.04 (1.39, 6.23)	18 per 100	51 per 100 (24, 109)	Increased with Information/education	Moderate
11-18 year olds							
1 (DiClemente 2015)	RCT	216	RR 1.00 (0.47, 2.13)	11 per 100	11 per 100 (5, 24)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Interactive app versus control (HPV doses) (RR >1 favours intervention)							
1st HPV dose							
1 (DiClemente 2015)	RCT	216	RR 1.00 (0.47, 2.13)	11 per 100	11 per 100 (5, 24)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
2nd HPV dose							
1 (DiClemente 2015)	RCT	216	RR 2.67 (0.73, 9.78)	3 per 100	7 per 100 (2, 27)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
2nd and 3rd dose							
1 (DiClemente 2015)	RCT	216	RR 3.00 (0.62, 14.53)	2 per 100	6 per 100 (1, 27)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Video education versus control (RR >1 favours intervention)							
3 (Kriss 2017, Dixon 2019, Thomas 2003)	RCT, cluster RCT	537	RR 1.46 (1.06, 2.01)	18 per 100	26 per 100 (19, 35)	Increased with Information/education	Moderate
Pregnant women							
1 (Kriss 2017)	RCT	73	RR 1.73 (0.74, 4.05)	18 per 100	30 per 100 (13, 71)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
11-18 year olds							
1 (Dixon 2019)	cluster RCT	95	RR 1.33 (0.94, 1.90)	49 per 100	65 per 100 (46, 93)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
65 years and older							
1 (Thomas 2003)	cluster RCT	369	RR 1.54 (0.77, 3.08)	7 per 100	10 per 100 (5, 20)	The studies could not differentiate change in vaccine uptake between Information/education or control	Moderate
Teddy bear wearing information versus control (RR >1 favours intervention)							
0-5 year olds							
1 (Porter-Jones)	cluster RCT	974	RR 0.99 (0.95, 1.04)	88 per 100	87 per 100 (83, 92)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
UNADJUSTED cRCT: website and lesson versus control (HPV) (RR >1 favours intervention)							
11-18 year olds							
1 (Esposito 2018)[r]	cluster RCT	636	RR 1.17 (0.61, 2.23)	5 per 100	6 per 100 (3, 11)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
UNADJUSTED cRCT: website and lesson versus control (MenACWY) (RR >1 favours intervention)							
11-18 year olds							
1 (Esposito 2018)[r]	cluster RCT	636	RR 46.82 (15.06, 145.55)	1 per 100	42 per 100 (14, 100)	Increased with Information/education	Low
UNADJUSTED cRCT: website versus control (HPV) (RR >1 favours intervention)							
11-18 year olds							
1 (Esposito 2018)[r]	cluster RCT	615	RR 0.63 (0.28, 1.39)	5 per 100	3 per 100 (1, 7)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
UNADJUSTED cRCT: website versus control (MenACWY) (RR >1 favours intervention)							
11-18 year olds							
1 (Esposito 2018)[r]	cluster RCT	615	RR 20.60 (6.50, 65.26)	1 per 100	19 per 100 (6, 59)	Increased with Information/education	Low
UNADJUSTED cRCT: lesson versus control (HPV) (RR >1 favours intervention)							
11-18 year olds							
1 (Esposito 2018)[r]	cluster RCT	583	RR 1.86 (0.85, 4.07)	3 per 100	6 per 100 (3, 13)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
UNADJUSTED cRCT: lesson versus control (MenACWY) (RR >1 favours intervention)							
11-18 year olds							
1 (Esposito 2018)[r]	cluster RCT	583	RR 2.27 (1.72, 3.00)	19 per 100	42 per 100 (32, 56)	Increased with Information/education	Low
1. The data in the study was provided as an odds ratio and there was insufficient data to calculate the absolute risks via a relative risk because no raw data on uptake was provided for the control arm. a. Bartu 2006, Glanz 2017, Glanz 2020, Hannan 2013, Jackson 2011, Porter-Jones 2009, Saitoh 2013, Saitoh 2017, Shourie 2018, Zuniga 2003							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality

b. Codick 2021, DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Pot 2017, Santa Maria 2021, Scarini 2020, Tiro 2015, Underwood 2019, Winer 2016

c. Kriss 2017, O'Leary 2019, Bartu 2006, Glanz 2020, Hannan 2013, Jackson 2011, Porter-Jones 2009, Saitoh 2013, Saitoh 2017, Shourie 2018, Zuniga 2003, Chodick 2021, DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Pot 2017, Santa Maria 2021, Scarinci 2020, Tiro 2015, Underwood 2019, Winer 2016, Jacobson 1999, Thomas 2003

d. Bartu 2006, Glanz 2020, Hannan 2013, Jackson 2011, Porter-Jones 2009, Saitoh 2013, Saitoh 2017, Shourie 2018, Zuniga 2003

e. Chodick 2021, DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Pot 2017, Santa Maria 2021, Scarini 2020, Tiro 2015, Underwood 2019, Winer 2016

f. Glanz 2020, O'Leary 2019, Porter-Jones 2009, Pot 2017, Shourie 2013

g. Bartu 2006, Grandahl 2016, Jackson 2011, Joseph 2016, Saitoh 2013, Saitoh 2017, Scarinci 2020, Underwood 2019

h. Bartu 2006, Chodick 2021, DiClemente 2015, Dixon 2019, Glanz 2020, Hannan 2013, Jacobson 1999, Joseph 2016, Kriss 2017, O'Leary 2019, Porter-Jones 2009, Pot 2017, Saitoh 2013, Saitoh 2017, Santa Maria 2021, Shourie 2013, Thomas 2003, Tiro 2015

i. Bartu 2006, DiClemente 2015, Glanz 2020, Hannan 2013, Jackson 2011, Joseph 2016, Kriss 2017, O'Leary 2019, Pot 2017, Saitoh 2013, Santa Maria 2021, Scarinci 2020, Shourie 2013, Underwood 2019, Winer 2016, Zuniga 2003

j. Chodick 2021, Dixon 2019, Glanz 2020, Grandahl 2016, Jacobson 1999, Kriss 2017, O'Leary 2019, Porter-Jones 2009, Saitoh 2017, Shourie 2013, Thomas 2003, Tiro 2015, Underwood 2019.

k. Bartu 2006, Chodick 2021, Grandhal 2016, Hannan 2013, Jackson 2011, Joseph 2016, Saitoh 2017, Santa Maria 2021, Winer 2016, Zuniga 2003

l. DiClemente 2015, Dixon 2019, Jacobson 1999, Kriss 2017, O'Leary 2019, Shourie 2013, Thomas 2003, Tiro 2015

m. Bartu 2006, Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Shourie 2013, Zuniga 2003, DiClemente 2015, Grandahl 2016, Joseph 2016, Santa Maria 2021, Scarinci 2020, Underwood 2019, Winer 2016

n. Bartu 2006, Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Shourie 2013, Zuniga 2003

o. DiClemente 2015, Grandahl 2016, Joseph 2016, Santa Maria 2021, Scarinci 2020, Underwood 2019, Winer 2016

p. Chodick 2021, Joseph 2016, Pot 2017, Scarinci 2020, Tiro 2015, Underwood 2019, Winer 2016

q. Bartu 2006, Jackson 2011, Saitoh 2013, Saitoh 2017, Grandahl 2016, Joseph 2016, Scarinci 2020, Underwood 2019

r. Esposito 2018 was classified as a cluster RCT because participants were randomised by class and some classes had lesions as part of the intervention. The data could not be adjusted for clustering because there was no information provided in the study about the number of clusters.

Information/education aimed at individuals or parents/carers compared to other education interventions

Table 7 Summary of effectiveness findings for Information/education interventions compared to other education interventions

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Easy to read printed information versus standard printed information (RR >1 favours easy to read information)							
Pregnant women							
1 (Payakachat 2016)	RCT	279	RR 1.08 (0.84, 1.39)	45 per 100	49 per 100 (38, 63)	The studies could not differentiate change in vaccine uptake between easy to read printed information or standard printed information	Low
Website with tailored information versus website with untailored information (RR >1 favours tailored information)							
0-5 year olds							
1 (Glanz 2020)	RCT	450	RR 0.98 (0.93, 1.03)	93 per 100	91 per 100 (87, 96)	The studies could not differentiate change in vaccine uptake between a website with tailored information or a website with untailored information	Moderate
Website and social media versus website (RR >1 favours website and social media)							
Pregnant women							
1 (O'Leary 2019)	RCT	913	RR 0.91 (0.62, 1.32)	12 per 100	11 per 100 (7, 15)	The studies could not differentiate change in vaccine uptake between website and social media or website	Low
0-5 year olds							
1 (Glanz 2017)	RCT	913	RR 1.03 (0.95, 1.11)	73 per 100	75 per 100 (70, 81)	The studies could not differentiate change in vaccine uptake between website and social media or website	Moderate
Tailored iPad information versus untailored iPad information (RR >1 favours untailored information)							
11-18 year olds							
1 (Dempsey 2019)	RCT	855	OR 1.11 (0.82, 1.51)	N/A[2]	N/A[2]	The studies could not differentiate change in vaccine uptake between tailored iPad information or untailored iPad information	Low
Interactive electronic education versus printed educational material (RR >1 favours interactive electronic information)							

0-5 year olds							
1 (Shourie 2013)	cluster RCT	133	RR 1.10 (1.02, 1.18)	91 per 100	99 per 100 (92, 107)	Increased with interactive electronic information	Moderate
Interactive electronic education versus video education (RR >1 favours interactive electronic education)							
Pregnant women							
1 (Kriss 2017)	RCT	66	RR 1.70 (0.92, 3.14)	30 per 100	52 per 100 (28, 95)	The studies could not differentiate change in vaccine uptake between interactive electronic education or video education	Very low
Video versus written advice (RR >1 favours video)							
11-18 year olds							
1 (Lee 2018)	RCT	19	RR 0.90 (0.16, 5.13)	22 per 100	20 per 100 (4, 114)	The studies could not differentiate change in vaccine uptake between video or written advice	Very low
Prenatal face-to-face education versus postpartum education (RR >1 favours prenatal education)							
0-5 year olds							
1 (Saitoh 2013)	cluster RCT	74	RR 0.71 (0.36, 1.40)	38 per 100	27 per 100 (14, 53)	The studies could not differentiate change in vaccine uptake between prenatal face-to-face education or postpartum education	Very low
ADJUSTED cRCT: Face-to-face education with an immunisation specialist versus webinar with an immunisation specialist (11-12 year olds, meningococcal) (RR >1 favours face-to-face education)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	21784 [a]	RR 1.04 (0.95, 1.14)	60 per 100	62 per 100 (57, 68)	The studies could not differentiate change in vaccine uptake between face-to-face education with an immunisation specialist or webinar with an immunisation specialist	Very low
ADJUSTED cRCT: Face-to-face education with an immunisation specialist versus webinar with an immunisation specialist (13-18 year olds catch-up, meningococcal) (RR >1 favours face-to-face education)							
11-18 year olds							

1 (Gilkey 2014)	cluster RCT	49844 [b]	RR 1.1 (1.02, 1.19)	66 per 100	73 per 100 (67, 78)	Increased with face-to-face education with an immunisation specialist	Low
ADJUSTED cRCT: Face-to-face education with an immunisation specialist versus webinar with an immunisation specialist (11-12 year olds, HPV 1 dose or more) (RR >1 favours face-to-face education)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	21784 [a]	RR 0.93 (0.78, 1.11)	31 per 100	29 per 100 (24, 35)	The studies could not differentiate change in vaccine uptake between face-to-face education with an immunisation specialist or webinar with an immunisation specialist	Very low
ADJUSTED cRCT: Face-to-face education with an immunisation specialist versus webinar with an immunisation specialist (13-18 year olds catch-up, HPV 1 dose or more) (RR >1 favours face-to-face education)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	49844 [b]	RR 1.06 (0.96, 1.22)	39 per 100	41 per 100 (37, 47)	The studies could not differentiate change in vaccine uptake between face-to-face education with an immunisation specialist or webinar with an immunisation specialist	Very low
a. Gilkey 2014 does not say how many participants were in each arm but provides participant numbers per age group. Because participants were randomised, it is probable that roughly 10,892 participants were in each arm for the 11-12 years age group. The data has been analysed accordingly and adjusted for clustering using these numbers. b. Gilkey 2014 does not say how many participants were in each arm but provides participant numbers per age group. Because participants were randomised, it is probable that roughly 24,922 participants were in each arm for the 13-18 years age catch-up group. The data has been analysed accordingly and adjusted for clustering using these numbers.							

Information/education aimed at providers compared to control

Table 8 Summary of effectiveness findings for Information/education interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Fact sheet attached to all patient notes versus control (RR >1 favours intervention)							
65 years and older							
1 (Cowan 1992)	cluster RCT	49	RR 5.75 (0.31, 105.70)	Not calculable [2]	Not calculable[2]	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
ADJUSTED cRCT: face-to-face education with an immunisation specialist versus control (11-12 year olds, meningococcal) (RR >1 favours intervention)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	21784[a]	RR 1.15 (1.04, 1.27)	54 per 100	62 per 100 (56, 68)	Increased with face-to-face education with an immunisation specialist	Moderate
ADJUSTED cRCT: face-to-face education with an immunisation specialist versus control (13-18 year olds catch-up, meningococcal) (RR >1 favours intervention)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	49844[b]	RR 1.01 (0.94, 1.09)	71 per 100	72 per 100 (67, 78)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
ADJUSTED cRCT: face-to-face education with an immunisation specialist versus control (11-12 year olds, HPV 1 dose or more) (RR >1 favours intervention)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	21784[a]	RR 0.9 (0.75, 1.07)	32 per 100	29 per 100 (24, 35)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
ADJUSTED cRCT: face-to-face education with an immunisation specialist versus control (13-18 year olds catch-up, HPV 1 dose or more) (RR >1 favours intervention)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	49844[b]	RR 1.03 (0.94, 1.13)	60 per 100	62 per 100 (56, 68)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
ADJUSTED cRCT: webinar with an immunisation specialist versus control (11-12 year olds, meningococcal) (RR >1 favours intervention)							
11-18 year olds							

1 (Gilkey 2014)	cluster RCT	21784[a]	RR 1.11 (1.00, 1.22)	54 per 100	60 per 100 (54, 66)	Increased with webinar education with an immunisation specialist	Low
ADJUSTED cRCT: webinar with an immunisation specialist versus control (13-18 year olds catch-up, meningococcal) (RR >1 favours intervention)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	49844[b]	RR 0.92 (0.85, 1.00)	71 per 100	66 per 100 (61, 71)	Increased with control	Very low
ADJUSTED cRCT: webinar with an immunisation specialist versus control (11-12 year olds, HPV 1 dose or more) (RR >1 favours intervention)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	21784[a]	RR 0.96 (0.81, 1.14)	32 per 100	31 per 100 (26, 37)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low
ADJUSTED cRCT: webinar with an immunisation specialist versus control (13-18 year olds catch-up, HPV 1 dose or more) (RR >1 favours intervention)							
11-18 year olds							
1 (Gilkey 2014)	cluster RCT	49844[b]	RR 0.97 (0.88, 1.06)	60 per 100	58 per 100 (53, 63)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low

1. The data from the cluster RCT was unadjusted for clustering and provided as a percentage. The n-numbers were not provided. Therefore, this is the relative risk of the percentage uptakes.
2. Not calculable because there were 0 events in the control arm.

a. Gilkey 2014 does not say how many participants were in each arm but provides participant numbers per age group. Because participants were randomised, it is probable that roughly 10,892 participants were in each arm for the 11-12 years age group. The data has been analysed accordingly and adjusted for clustering using these numbers.

b. Gilkey 2014 does not say how many participants were in each arm but provides participant numbers per age group. Because participants were randomised, it is probable that roughly 24,922 participants were in each arm for the 13-18 years age catch-up group. The data has been analysed accordingly and adjusted for clustering using these numbers.

Information/education aimed at providers and individuals and parents compared to control

Table 9 Summary of effectiveness findings for education/intervention interventions compare to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality

Providers: face-to-face education for providers, printed educational material. Parents and individuals: printed educational material, website, disease images versus control, 11-18 year olds (RR >1 favours intervention)							
1 or more HPV doses							
1 (Dempsey 2018)	cluster RCT	153	RR 1.11 (0.76, 1.63)	39 per 100	43 per 100 (30, 63)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
3 or more HPV doses							
1 (Dempsey 2018)	cluster RCT	104	RR 1.05 (0.82, 1.35)	69 per 100	72 per 100 (56, 93)	The studies could not differentiate change in vaccine uptake between Information/education or control	Low
Face-to-face education, printed educational material and interactive multimedia to show parents versus control (RR >1 favours intervention)							
Pregnant women							
1 (Chamberlain 2015)	cluster RCT	60	RR 1.43 (0.35, 5.83)	10 per 100	14 per 100 (3, 56)	The studies could not differentiate change in vaccine uptake between Information/education or control	Very low

Sensitivity analyses: Information/education aimed at individuals or parents/carers compared to control

All of the subgroups and pooled totals where studies have been removed are presented here, but other subgroups within these analyses that are unchanged are not included in the table below.

Table 10 Summary of the effectiveness findings for Information/education interventions compared to control without studies at high risk of bias

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information/education and reminders versus control (RR >1 favours information or education)							
0-5 year olds							
7[a]	RCT cluster RCT	2044	RR 1.04 (0.98, 1.12)	79 per 100	83 per 100 (78, 89)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
11-18 year olds							
8[b]	RCT cluster RCT	9674	RR 1.16 (0.99, 1.36)	68 per 100	79 per 100 (67, 92)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Education versus control (total but no Glanz 2017 data) (summary by age group) (RR>1 favours information or education)							
0-5 year olds							
6[c]	RCT cluster RCT	1572	RR 1.05 (0.97, 1.14)	82 per 100	86 per 100 (79, 93)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
11-18 year olds							
8[d]	RCT cluster RCT	9674	RR 1.16 (0.99, 1.36)	68 per 100	79 per 100 (67, 92)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Pooled result							
18[e]	RCT cluster RCT	13439	RR 1.13 (1.05, 1.23)	63 per 100	72 per 100 (66, 78)	Increased with Information/education	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information and/or education versus control (subtotals but no total) (summary by delivery method) (RR>1 favours information or education)							
Information: website with or without social media							
3 (Glanz 2017, O'Leary 2019, Pot 2017)	RCT cluster RCT	9979	RR 1.00 (0.98, 1.03)	72 per 100	72 per 100 (70, 74)	The studies could not differentiate change in vaccine uptake between Information/education and control	Low
Information: printed material information, such as leaflets							
2 (Jacobson 1999, Underwood 2019)	RCT cluster RCT	561	RR 2.31 (0.44, 12.09)	9 per 100	21 per 100 (4, 112)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Education: face-to-face							
7[f]	RCT cluster RCT	998	RR 1.32 (0.96, 1.83)	38 per 100	50 per 100 (36, 69)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Information and/or education versus control (subtotals but no total) (summary by whether intervention targets an individual/parent or a group) (RR>1 favours information or education)							
Targets individuals or parents							
14[g]	RCT cluster RCT	12756	RR 1.09 (1.02, 1.18)	65 per 100	70 per 100 (66, 76)	Increased with Information/education	Very low
Targets groups of people who are together							
3 (Grandahl 2016, Jackson 2011, Underwood 2019)	cluster RCT	388	RR 1.07 (0.87, 1.33)	49 per 100	53 per 100 (43, 65)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information and/or education versus control (subtotals but no total) (summary by tailored or generic interventions) (RR>1 favours information or education)							
Tailored							
13[h]	RCT cluster RCT	11338	RR 1.09 (1.01, 1.18)	68 per 100	74 per 100 (68, 80)	Increased with Information/education	Very low
Generic							
9[i]	RCT cluster RCT	2667	RR 1.35 (0.98, 1.86)	36 per 100	49 per 100 (36, 68)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Information and/or education versus control (subtotals but no total) (summary by who provided the information or education) (RR>1 favours information or education)							
Healthcare professionals							
6[j]	RCT cluster RCT	1527	RR 1.07 (1.00, 1.14)	69 per 100	74 per 100 (69, 100)	The studies could not differentiate change in vaccine uptake between Information/education and control	Moderate
Government health authority organisation							
1 (Pot 2017)	RCT cluster RCT	8217	RR 1.01 (0.98, 1.03)	73 per 100	71 per 100 (64, 78)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Unspecified personnel at a health clinic							
6[k]	RCT cluster RCT	1962	RR 1.80 (1.11, 2.92)	12 per 100	21 per 100 (13, 34)	Increased with Information/education	Very low
Information versus control (summary) (RR>1 favours information or education)							
0-5 year olds							
2 (Glanz 2017, Glanz 2020)	RCT cluster RCT	1641	RR 1.01 (0.97, 1.06)	84 per 100	85 per 100 (82, 89)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
11-18 year olds							
3 (Dixon 2019, Pot 2017, Underwood)	RCT cluster RCT	8285	RR 1.04 (0.92, 1.18)	72 per 100	75 per 100 (66, 85)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Education versus control (summary) (RR>1 favours information or education)							
0-5 year olds							
6[l]	RCT cluster RCT	1298	RR 1.05 (0.96, 1.15)	82 per 100	86 per 100 (78, 94)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
11-18 year olds							
6[m]	RCT cluster RCT	1461	RR 1.22 (0.93, 1.59)	42 per 100	51 per 100 (39, 66)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Pooled result							
10 (see subgroups above)	RCT cluster RCT	2759	RR 1.12 (1.00, 1.25)	61 per 100	68 per 100 (61, 76)	Increased with information/education	Very low
Vaccinations for adolescents aged 11-18 years, education versus control, adolescents and parents as different subgroups (RR>1 favours information or education)							
Interventions aimed at parents							
4 (Joseph 2016, Pot 2017, Scarinici 2020, Underwood 2019)	RCT cluster RCT	8593	RR 1.33 (0.90, 1.96)	70 per 100	93 per 100 (63, 100)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Pooled result							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
7[n]	RCT cluster RCT	9658	RR 1.14 (0.99, 1.33)	68 per 100	78 per 100 (67, 91)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Face-to-face education versus control (RR>1 favours information or education)							
0-5 year olds							
3 (Jackson 2011, Saitoh 2013, Saitoh 2017)	1 RCT, 2 cRCTs	261	RR 1.42 (0.77, 2.63)	38 per 100	54 per 100 (29, 100)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Pooled result							
7o	RCT cluster RCT	998	RR 1.32 (0.96, 1.83)	38 per 100	50 per 100 (36, 69)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Face-to-face education and printed educational material versus control (RR>1 favours information or education)							
11-18 year olds							
2 (Santa Maria 2021, Underwood 2019)	RCT cluster RCT	636	RR 1.15 (1.02, 1.30)	53 per 100	61 per 100 (54, 69)	Increased with information/education	High
Printed educational material versus control (RR>1 favours information or education)							
11-18 year olds							
1 (Underwood 2019)	cluster RCT	128	RR 1.04 (0.58, 1.85)	26 per 100	27 per 100 (15, 48)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Pooled result							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
2 (Jacobson 1999, Underwood 2019)	RCT cluster RCT	561	RR 2.31 (0.44, 12.09)	9 per 100	21 per 100 (4, 100)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low
Education interventions aimed at providers compared to control							
Pregnant women							
1 (Chamberlain 2015)	cluster RCT	60	RR 1.43 (0.35, 5.83)	10 per 100	14 per 100 (3, 56)	The studies could not differentiate change in vaccine uptake between Information/education and control	Very low

a. Glanz 2017, Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Zuniga 2003
b. DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Pot 2017, Santa Maria 2021, Scarinici 2020, Underwood 2019
c. Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Zuniga 2003
d. DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Santa Maria 2021, Pot 2017, Scarinici 2020, Underwood 2019
e. See c and d. Also Kriss 2017, O'Leary 2019, Jacobson 1999, Thomas 2003
f. Grandahl 2016, Jackson 2011, Joseph 2016, Saitoh 2013, Saitoh 2017, Scarinici 2020, Underwood 2019
g. DiClemente 2015, Dixon 2019, Glanz 2020, Hannan 2013, Jacobsen 1999, Joseph 2016, Kriss 2017, O'Leary 2019, Pot 2017, Saitoh 2013, Saitoh 2017, Santa Maria 2021, Thomas 2003, Zuniga 2003
h. DiClemente 2015, Glanz 2020, Hannan 2013, Jackson 2011, Joseph 2016, Kriss 2017, O'Leary 2019, Pot 2017, Saitoh 2013, Santa Maria 2021, Underwood 2019, Scarinici 2020, Zuniga 2003
i. Dixon 2019, Glanz 2020, Gradahl 2016, Jacobsen 1999, Kriss 2017, O'Leary 2019, Saitoh 2017, Thomas 2003, Underwood 2019
j. Grandahl 2016, Hannan 2013, Jackson 2011, Joseph 2016, Saitoh 2017, Santa Maria 2021, Zuniga 2003
k. DiClemente 2015, Dixon 2018, Jacobson 1999, Kriss 2017, O'Leary 2019, Thomas 2003
l. Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Zuniga 2003
m. DiClemente 2015, Grandahl 2016, Joseph 2016, Santa Maria 2021, Scarinici 2020, Underwood
n. Grandahl 2016, Dixon 2019, Joseph 2016, Pot 2017, Scarinici 2020, Underwood 2019, Santa Maria 2021
o. Jackson 2011, Saitoh 2013, Saitoh 2017, Grandahl 2016, Joseph 2016, Scarinici 2020, Underwood 2019

Quantitative evidence: Information/education and reminders

Information/education and reminders aimed at individuals, parents/ carers compared to control

Table 11 GRADE table for Information/education and reminders compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information/education and reminders versus control (RR >1 favours intervention)							
0-5 year olds							
5 (Freed 1999, Mason 2000, O'Sullivan 1992, Otsuka-Ono 2019, Quinlivan 2003)	RCT	1891	RR 1.22 (0.95, 1.57)	40 per 100	49 per 100 (37, 65)	The studies could not differentiate change in vaccine uptake between Information/education and reminders or control	Very low
11-18 year olds							
3 (Fiks 2013, Henriksen 2018, Richman 2019)	RCT cluster RCT	13254	RR 1.15 (1.04, 1.28)	16 per 100	18 per 100 (16, 20)	Increased with information/education and reminder	Very low
65+ year olds							
3 (Gutschi 1998, Harari 2008, Krieger 2000)	RCT	2830	RR 1.30 (0.97, 1.73)	29 per 100	37 per 100 (28, 50)	The studies could not differentiate change in vaccine uptake between Information/education and reminders or control	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Pooled result (all studies combined)							
11[a]	RCT cluster RCT	17737	RR 1.23 (1.08, 1.40)	20 per 100	25 per 100 (22, 28)	Increased with Information/education and reminders	Very low
a. Freed 1999, Mason 2000, O'Sullivan 1992, Otsuka-Ono 2019, Quinlivan 2003, Fiks 2013, Henriksen 2018, Richman 2019, Gutschi 1998, Harari 2008, Krieger 2000							

Table 12 GRADE table for Information/education and reminder interventions compared to control, grouped by reminder type

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information/education and reminders versus control (RR >1 favours intervention)							
0-5 year olds							
Passive reminder							
3 (Freed 1999, Mason 2000, O'Sullivan 1992)	RCT	1346	RR 1.24 (0.79, 1.95)	36 per 100	44 per 100 (28, 70)	The studies could not differentiate change in vaccine uptake between Information/education and reminders or control	Very low
Active reminder							
2 (Otsuka-Ono 2019, Quinlivan 2003)	RCT	307	RR 1.22 (0.65, 2.31)	56 per 100	68 per 100 (36, 100)	The studies could not differentiate change in vaccine uptake between Information/education and reminders or control	Very low
11-18 year olds							
Passive reminder							
2 (Fiks 2013,	RCT cluster RCT	11630	RR 1.13 (1.04, 1.22)	50 per 100	52 per 100 (46, 60)	Increased with information/education and reminders	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Richman 2019)							
Active reminder							
1 (Henrikse n 2018)	RCT	1624	RR 1.53 (1.02, 2.28)	7 per 100	10 per 100 (7, 15)	Increased with information/education and reminders	Moderate
65+ year olds							
Passive reminder							
2 (Gutschi 1998, Harari 2008)	RCT	2140	RR 1.18 (1.04, 1.34)	28 per 100	33 per 100 (29, 37)	Increased with Information/education and reminders	Low
Active reminder							
1 (Krieger 2000)	RCT	690	RR 1.68 (1.40, 2.03)	31 per 100	52 per 100 (43, 63)	Increased with Information/education and reminders	Low
Reminder phone calls with information about vaccination versus control (RR >1 favours intervention)							
HPV dose 1							
1 (Fiks 2013)	cluster RCT	11368	RR 1.12 (1.04, 1.22)	16 per 100	18 per 100 (17, 20)	Increased with Information/education and reminders	Moderate
HPV dose 2							
1 (Fiks 2013)	cluster RCT	11368	RR 1.23 (1.11, 1.36)	10 per 100	13 per 100 (12, 14)	Increased with Information/education and reminders	Moderate
HPV dose 3							
1 (Fiks 2013)	cluster RCT	11368	RR 1.42 (1.25, 1.61)	7 per 100	9 per 100 (8, 11)	Increased with Information/education and reminders	Moderate

Education/ information and reminder interventions aimed at individuals, parents/ carers compared to other reminder and/ or education interventions

Table 13 GRADE table for education/ information and reminder interventions compared to other reminder and/ or education interventions

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information and reminders interventions compared to information alone							
11-18 year olds (RR >1 favours intervention)							
1 (Tiro 2015)	RCT	337	RR 1.84 (1.20, 2.80)	16 per 100	29 per 100 (19, 44)	Increased with Information/education and reminders	High
Educational text message reminder versus plain text message reminder							
0-5 year olds							
1 (Hofstetter 2017)	RCT	295	RR 0.84 (0.49, 1.43)	17 per 100	14 per 100 (8, 24)	The study could not differentiate change in vaccine uptake between informational reminders and plain reminders	Moderate
Information plus multiple reminders versus information and single reminder							
0-5 year olds (RR >1 favours intervention)							
1 (Henriksen 2018)	RCT	463	RR 1.17 (0.79, 1.74)	16 per 100	19 per 100 (13, 28)	The studies could not differentiate change in vaccine uptake between a single reminder or multiple reminders	Low

Education or information plus reminder interventions aimed at individuals or parents/carers and providers to increase vaccine uptake compared to other interventions

Table 14 GRADE table for information/education and reminder interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Education for patients by GPs plus 2 home visits by nurse plus ≥1 telephone reminders plus tailored information for patients and GPs (RR >1 favours intervention)							
65+ year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Stuck 2015)	RCT	2284	RR 1.57 (1.35, 1.82)	19 per 100	30 per 100 (25, 34)	Increased with information/education and reminders	Moderate
Group patient education or 2 home visits for patients plus tailored reminder for patients and GPs (OR >1 favours intervention)							
65+ year olds							
1 (Dapp 2011)	cluster RCT	1910	OR 2.80 (2.27, 3.45)	N/A[1]	N/A[1]	Increased with information/education and reminders	High

1. The data in the study was provided as an odds ratio and there was insufficient data to calculate the absolute risks. In other words, there was no prevalence uptake data provided.

See appendix F for full GRADE tables

Sensitivity analyses: Information/education and reminders aimed at individuals, parents/ carers compared to control

All of the subgroups and pooled totals where studies have been removed are presented here, but other subgroups within these analyses that are unchanged are not included in the table below.

Table 15 GRADE table for Information/education and reminders compared to control without studies at high risk of bias

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information/education and reminders versus control (RR >1 favours intervention)							
0-5 year olds							
4 (Freed 1999, O'Sullivan 1992, Otsuka-Ono 2019, Quinlivan 2003)	RCT	1160	RR 1.23 (0.90, 1.68)	57 per 100	70 per 100 (51, 99)	The studies could not differentiate change in vaccine uptake between Information/education and reminders or control	Very low
Pooled result (all studies combined)							
7 (Fiks 2013, Freed 1999, Henriksen 2018, O'Sullivan 1992, Otsuka-Ono 2019, Quinlivan 2003, Richman 2019)	RCT cluster RCT	14414	RR 1.19 (1.02, 1.39)	19 per 100	22 per 100 (19, 26)	Increased with information/education and reminders	Very low

Table 16 GRADE table for Information/education and reminder interventions compared to control, grouped by reminder type without studies at high risk of bias

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Information/education and reminders versus control (RR >1 favours intervention)							
0-5 year olds							
Passive reminder							
2 (Freed 1999, O'Sullivan 1992)	RCT	853	RR 1.29 (0.68, 2.45)	58 per 100	74 per 100 (39, 100)	The studies could not differentiate change in vaccine uptake between Information/education and reminders or control	Very low

Qualitative evidence

Education related barriers and facilitators or relevant barriers that could be tackled by education/ information.

The following tables do not include all relevant findings but have been limited to the key ones relating to education and information needs from evidence review B. Please see this document for more details and additional findings. In the following table Gypsy, Roma and Travellers have been abbreviated to GRT to make the finding less unwieldy, however these apply to all 3 groups unless otherwise specified.

Table 17 Summary of the key qualitative findings relating to vaccine safety, effectiveness, and assessment of risk

Population to be vaccinated	Finding	Confidence
Pregnant women		
	Vaccine safety, effectiveness, assessment of risk and discussions	
Pregnant women	Some pregnant women believe that vaccines could harm their unborn child. In addition, some staff had reservations about the safety of the dTaP/IPV vaccine. However, other women, maternity assistants, midwives, and neonatal care nurses trust that vaccines would not be offered to pregnant women unless they were safe.	High
Pregnant women	Some pregnant women, maternity assistants, midwives, paediatric nurses, obstetricians and gynaecologists think vaccines are effective and were concerned that if pregnant women did not get vaccinated, their unborn child might come to harm. Midwives, obstetricians and gynaecologists agree that vaccines are effective. Some pregnant women think that there is insufficient evidence for vaccine effectiveness. In addition, some pregnant women think that vaccines affect different populations of people differently.	High

Population to be vaccinated	Finding	Confidence
Pregnant women	Parents, obstetricians, gynaecologists, maternity assistants, midwives, and neonatal care nurses agree that pertussis infection is potentially lethal, but some physicians thought that the prevalence of pertussis was low within their communities and therefore did not warrant the same degree of attention as other vaccinations..	Low
Pregnant women	Midwives believe that discussing vaccines with pregnant women requires good knowledge and communication skills. They feel that they are not adequately trained with regards to the benefits and potential harms of vaccines and that communication skills training would be useful in helping them effectively communicate this information.	Low
65 years and over		
	Vaccine safety	
65 years and over	People aged 65 years and over trust that vaccines they are offered are safe.	Low
65 years and over	People aged 65 years and over believe that naturally occurring things are better for them. They do not trust manufactured drugs and think their body cannot cope with a vaccine in addition to all the medications they are taking.	Very low
	Assessment of risk and the benefits of vaccination	
65 years and over	People aged 65 years and over are in favour of getting vaccinated and receiving advice about them. However, there are differing opinions as to how beneficial they are.	Moderate
65 years and over	The more severe a disease is, the more likely people aged 65 years and over are to accept a vaccine – even if it is not completely effective. They are also more likely to accept a vaccine if they have seen the disease first-hand before or if there is an epidemic. This is because they are more aware of how severe it can be.	Low
65 years and over	People aged 65 years and over realise that many people die from pneumonia every year and know from experience how painful shingles can be. However, they believe that pneumonia is something that is likely to happen to other people but not them.	Low
65 years and over	People aged 65 years and over believe that vaccines may cause serious side effects, which outweigh potential benefits.	Moderate
65 years and over	Some people who are 65 years and older think that vaccines will cure existing infections rather than prevent them. Others believe that vaccines could make them less ill or reduce the amount of time they would be sick.	Low
65 years and over	Some people believe that pneumonia is another word for flu. Therefore, a vaccine against one protects against the other.	Low
65 years and over	People aged 65 years and over with anti-vaccine beliefs do not support vaccination despite knowledge of disease and its consequences.	Low
65 years and over	People aged 65 years and over who are in countries illegally believe that the vaccination documentation could be used to trace them, and they could be deported as a result.	Low

Population to be vaccinated	Finding	Confidence
65 years and over	GPs agree that the effects of pneumonia are severe enough that appropriate people should be vaccinated against it. However, GPS say that vaccines for pneumococcal disease do not seem very effective from their personal experience, although they are willing to change this view if shown evidence to the contrary. In addition, they do not see many patients with proven pneumococcal disease in their own practices. This is because the tests required to confirm this are difficult to do and highly inaccurate.	Low
65 years and over	Some GPs say that shingles is so chronically painful that it is worth vaccinating appropriate people against it. However, other say that because shingles is not life-threatening, they do not agree with prescribing a shingles vaccine to people aged 65 years and over. This is because they believe that vaccines should only be given for 'serious' illnesses.	Very low
	Vaccines are for other people	
65 years and over	People aged 65 years and over say that vaccines are not for them, they are either for children or for people older than they are. Also, if they agree to a vaccine, that is an admission of illness or old age. Therefore, they reject vaccines.	Moderate
65 years and over	People aged 65 years and over say that GP's can be openly against vaccines and that GPs never mention the pneumonia vaccine to them. They also report that nurses express their anti-vaccination beliefs to them. The GPs say they do not agree with vaccinating people who are aged 65 years and over because they do not have immune systems that will be able to cope with vaccines.	Moderate
65 years and over	GPs say that people who are aged 65 years and over do not request pneumococcal vaccines.	Low
65 years and over	Emergency department nurses say that they associate vaccines with children rather than with older people. Although it is routine to check whether children have had vaccines, it is not routine to check adults.	Low
0-5 year olds		
	Vaccine safety, effectiveness and assessment of risk	
0-5 year olds	Parents (including immigrants*, GRT and Jewish parents) demonstrated a spectrum of opinion with regards to concerns about short-term or mild side effects of vaccination. Some parents said that a short-term fever caused by vaccination would not affect their decision to have their child vaccinated. This is because a fever is less severe than the disease the vaccine aims to prevent. However, other parents were worried that their child might develop a fever because their children were infants, so they would not be able to give much paracetamol. Additionally, some parents were worried about the discomfort the needles might cause or about unexpected side effects, such as hair loss. * Immigrants include people who had lived in the Netherlands for at least 1 year (mostly people from Morocco, and Turkey, as well as some from Afghanistan, Somalia, Poland and Belgium), people born in India, China or Bhutan, who moved to Canada in the previous 8 years, and undocumented parents living in Sweden for less than 3 years (from Africa, South America, Asia, and the Middle East)	High

Population to be vaccinated	Finding	Confidence
0-5 year olds	Parents (including those with anthroposophical beliefs, immigrants*, GRT and Jewish parents) and GPs were worried that vaccines could cause long-term or serious adverse events and that they would feel guilty for consenting to something that had harmed their child. Some parents and GPs thought that vaccines contained substances that could aggravate allergies or sensitivities such as mercury, thimerosal and aluminium. Others were concerned that vaccines could permanently alter their child's personality, temperament and intelligence, or cause them to develop chronic conditions such as multiple sclerosis, autism or Parkinson's disease. Parents were also worried that their child's immune system might not be able to cope with vaccination, particularly if they had a medical condition, illness or were born prematurely. They believed that older children would be better able to cope, so they would prefer to postpone vaccination. * Immigrants include people born in India, China or Bhutan who moved to Canada in the previous 8 years and Somali immigrants living in Sweden	High
0-5 year olds	Some parents had concerns about the effectiveness of vaccines. They said that the need for vaccine boosters raises doubts about long-term effectiveness and that they knew of children who were vaccinated against a disease and yet later caught it. Some also believed that new disease strains could appear and then the vaccine would be ineffective.	Moderate
0-5 year olds	Some parents (including Jewish parents and those with anthroposophical beliefs) and midwives think that vaccines are unnecessary. The parents thought that breast feeding confers natural immunity or that maintaining general health would be sufficient protection. They were unafraid of the diseases, unaware of their severity and risks, and considered them to be easily treatable. They often felt that diseases were natural, and (along with midwives) felt that exposing children strengthens their immune system. They recalled having measles or mumps when they were young and being unharmed. Some midwives believed that improved living conditions and sanitation made vaccination less important.	High
0-5 year olds	Parents (including parents who have anthroposophical beliefs, are Jewish, GRT or immigrants) GPs, and health visitors believe that vaccination is the right thing to do if there is a greater risk of harm from the disease compared to the risk of side effects from vaccines. Their decision-making included consideration of disease severity, the chance of catching the disease and occurrences that would increase this, such as a local outbreak or socialising with unimmunised children. Parents were particularly concerned about disease severity if they had a child with a medical condition that might make them more vulnerable. In addition, parents said that if their child became ill, they would feel guilty if they had not agreed to the vaccination.	High
0-5 year olds	Assessment of disease impact and risk is affected by experience and may make some parents (including parents with anthroposophical beliefs and parents who are immigrants or GRT) more accepting of vaccines or more likely to reject them. Experience of mild disease may make some parents more likely to reject vaccines. In contrast, immigrants who have first-hand experience of disease are more likely to accept vaccines because they know how serious the diseases can be.	High
0-5 year olds	Parents would like to receive information before their immunisation appointment, and they would appreciate designated times for discussions about vaccination with healthcare practitioners	Moderate

Population to be vaccinated	Finding	Confidence
11 – 18 year olds		
11-18 year olds	Many parents (including immigrant parents* and Jewish parents) and adolescent girls expressed concerns about the safety of the HPV vaccine or vaccines in general, however others were unconcerned and trusted their school, health care providers and the government. The most common concerns were that there may be unknown side effects of HPV vaccination in the short term, and that we do not yet know its effects on a young, growing body or if the vaccine will cause health problems later in life such as reduced fertility. They felt that they needed to weigh these risks against the benefits of the vaccination. Several of the studies were conducted when the HPV vaccine was relatively new, so some parents were concerned that it may not have been fully tested at that point. Several of these said that they did not want their children to be used as 'guinea pigs' in the first few vaccination cohorts. Nurses and managers were aware of parents' views concerning this issue. In contrast, other parents (including some school nurses) had little concern about side effects and agreed that the vaccine would not be available if there were serious concerns about its safety. * Immigrants included people living in the UK who were born in Bangladesh, Africa, Caribbean, Somalia, India or Pakistan and mothers from Somalia who had a migration date from 1990 or 2006 migration waves.	High
11-18 year olds	Some parents (including Jewish and African parents and those from other ethnic minorities) questioned whether the vaccine was necessary. Some parents felt that because HPV is transmitted through sexual activity it could be prevented through abstinence, contraception or by only having one partner. Others believed that good general health and alternative medicine provided sufficient protection. In addition, some parents noted that they had not been vaccinated when they were younger and had come to no harm. Other parents thought that vaccination was unnecessary because cervical cancer could be detected using normal screening methods and treated.	High
11-18 year olds	Parents (including immigrants* and Jewish parents) and adolescent girls often felt that the vaccine was not effective enough to be worth risking any side effects. The HPV vaccine does not prevent all forms of HPV and does not provide completely protection against cervical cancer; some parents and young people felt this was not sufficient protection. Others questioned how long the vaccine would remain effective. * Immigrants included people living in the UK who were born in Bangladesh, Africa, Caribbean, Somalia, India or Pakistan	High
11-18 year olds	Parents (including Jewish and immigrant parents* and parents of immunosuppressed children), adolescent girls and nurses were all worried about cervical cancer. Most participants described their fear of cervical cancer and related this to their own or their loved ones' experiences of cancer or their awareness of the death of Jade Goody from this form of cancer. They often expressed these views in conjunction with willingness and enthusiasm for the HPV vaccine. School nurses took pride in the programme as a way of providing long lasting protection against cervical cancer. However, other parents were less concerned because they believed that cervical cancer is slow growing and treatable. * UK-based African parents from Zambia, Zimbabwe, Nigeria, South Africa and Kenya	High
11-18 year olds	Many adolescent girls and parents (including Jewish parents and parents of immunosuppressed children) did not fully understand the link between HPV and cervical cancer. Some participants expressed confusion when they were presented	High

Population to be vaccinated	Finding	Confidence
	with information about HPV. Many did not know whether the vaccination was against HPV or cervical cancer. There was also a lack of understanding about how HPV is transmitted and causes cervical cancer and how the vaccine protects people against this. Some parents attributed HPV infection to having a high number of sexual partners. Some parents explained their lack of knowledge by the tendency to defer responsibility to trusted sources.	
11-18 year olds	Parents' (including African immigrant parents and parents of immunosuppressed children) and adolescent girls' perception of the risk of developing cervical cancer was mixed. Some parents believed the risk of cervical cancer was too low to be worth the risks of vaccination and it could be detected and treated if it did occur. Others felt that their child's specific risk was lower than most because they did not have a family history of this cancer or it was a disease seen in old women in their country of origin. Very few adolescent girls were aware that HPV was highly prevalent in the UK and they thought the threat was historical and/or low in the UK compared to developing countries. Some parents and adolescent girls however felt that any reduction in the risk of developing cancer was desirable.	High
11-18 year olds	Many parents (including immigrant* and Jewish parents and parents of immunosuppressed children) and adolescent girls lacked knowledge about how HPV vaccination protects against cervical cancer. They incorrectly believed that the vaccine was fully effective and did not realise that cervical smears are still required. In contrast, other parents (including some Jewish parents) and adolescent girls demonstrated knowledge and understanding of these issues. * Immigrants included people living in the UK who were born in Bangladesh, Africa, Caribbean, Somalia, India or Pakistan	High
11-18 year olds	Parents (including immigrant* and Jewish parents) often felt uncomfortable discussing sexuality with their child and questioned the age chosen for the HPV vaccine, although they disagreed about what would be a more appropriate age. They also underestimated the prevalence of HPV infection. Some parents felt that their children were too young and not sexually active, and that the vaccination should be given at an older age when parents could more easily discuss sexual health risks with their children. Others felt that it should be given at a younger age, so they could avoid any discussion of sex or because they were aware of younger girls having sex. Few understood the reason for the vaccination being given to the specific age group on the routine schedule. In addition, some parents thought the vaccine was for older girls, who had already had sex, while other parents thought girls could not get the vaccine after becoming sexually active. School nurses thought that targeting girls as young as 12 was appropriate as some became sexually active at this age, but they were in favour of extending the upper age to the early twenties for young women who had not been vaccinated. * Immigrants included people living in the UK who were born in Bangladesh, Africa, Caribbean, Somalia, India or Pakistan	High
Studies spanning categories		
	Views on vaccine-safety, effectiveness and usefulness	
Studies spanning categories	Parents are uncertain about the importance of vaccinations for their children, but many were in favour, especially among Polish and Romanian parents and GRT parents.	HIgh

Population to be vaccinated	Finding	Confidence
	Most Polish and Romanian parents regarded vaccines as essential protection against disease, but some vaccines were considered unnecessary and refused or generated particular concern such as the MMR vaccine. However, vaccination was not a priority for some Romanian immigrants and Romanian Roma who were more concerned about surviving and feeding their children. In contrast, parents of homeschooled children (from a Protestant background) believed that their healthy lifestyle would protect them together with a reduced risk of exposure and vaccines were therefore unnecessary. Orthodox Protestant parents had mixed views: some thought they were necessary to protect against disease while others disagreed and placed their faith in God. Healthcare providers perceived GRT as having mainly positive views about vaccination. GRT agree that there has been a shift in beliefs and acceptance between generations, although they had more confidence in some vaccines than others (such as HPV and MMR). This increased confidence was linked to growing integration of GRT into society and greater contact with non-Travellers. However, a minority of completely rejected vaccinations as unnecessary and preferred to treat any resulting infections instead.	
Studies spanning categories	Parent's assessment of the risk posed by the vaccine preventable diseases varied but an appreciation of the potential consequences of not vaccinating was not sufficient to encourage some parents to vaccinate their children. Older members of GRT communities had personal experience of some of the diseases and remembered the caring for sick children, while outbreaks of measles in some GRT communities had increased uptake of the MMR as a result. Some GRT were positive about accepting the HPV vaccine to try to prevent cervical cancer in part because of family experiences of this cancer. In contrast, most Protestant homeschooling parents and orthodox Protestant parents thought that childhood infections were a natural way of strengthening the immune system and did not pose a great risk to their children. many reported that because they had survived the diseases as children meant that they were mild. Health care practitioners report explaining the severity of the diseases to these parents and some were aware that severe side effects and death were possibilities, but this did not necessarily lead to an increase in vaccination. Some Polish parents identified a greater risk of disease in multicultural cities in the UK than at home which emphasised the importance of vaccination to them. However, providers also reported similar sentiments to Protestant parents in Romanian and Romanian Roma communities concerning measles.	High
Studies spanning categories	Most GRT believed the protective benefits of vaccination outweighed the short term side effects and accepted vaccinations for themselves and their children as the normal thing to do. Others expressed reservations about the pain of injection and potential side effects although they usually went ahead with the vaccinations after thinking about the balance of benefits and harms. However, a minority of parents in GRT communities were concerned that vaccinating their daughters for HPV would lead to community censure as it could imply that they were promiscuous. In contrast some Romanian immigrants and Romanian Roma declined vaccination for their children because they were aware of people who had been vaccinated but still got measles and therefore believed the vaccines were ineffective. In	High

Population to be vaccinated	Finding	Confidence
	addition, they thought that the risk of serious side effects was high and outweighed the benefits. Some Ultra-Orthodox Jewish mothers also declined vaccination because of fears over side effects, even if this meant going against the advice of their Rabbi	
Studies spanning categories	Parents who are GRT, Polish and Romanian immigrants*, orthodox Protestant and Protestant homeschoolers shared concerns about the safety of vaccines with more concern being raised about certain vaccines (specifically MMR and HPV). These concerns were due to the perceived link between MMR vaccination and autism and in some cases were the result of being influenced by other people in their community who attributed their child's autism to the vaccination. Some Ultra-Orthodox Jewish parents also had concerns about vaccination based on experiences by others in the community However, Polish and Romanian immigrant parents were no more concerned than the general population about this issue. Parents were concerned about the lack of long-term safety data for new vaccines such as HPV, and worried about their children being 'guinea pigs' in medical research. In addition, HPV was considered problematic by some parents due to negative media stories about side effects. *Polish and Romanian immigrants living in the UK (average time living in the UK was 11 years for Polish people and 9 years for Romanians)	High
Studies spanning categories	Many GRT were concerned about the safety of the pertussis vaccine during pregnancy because the immune system was perceived to be weak at this time while older GRT believed that the vaccine could lead to brain damage and disability, therefore vaccination of the baby after birth was favoured.	Moderate

Table 18 Summary of the key qualitative findings relating to a lack of information and sources of information

Population to be vaccinated	Finding	Confidence
Pregnant women		
	Lack of information, timing and information overload	
Pregnant women	Some pregnant women are not aware that vaccines are part of routine healthcare during pregnancy	Moderate
Pregnant women	Some maternity assistants, midwives, and paediatric nurses say they lack knowledge about maternal vaccines including the diseases they prevent and side effects, and do not have access to easily understandable information to give to pregnant women. Some pregnant women also think that midwives do not know enough about vaccines in order to adequately discuss them or answer questions.	High
Pregnant women	Some obstetricians and gynaecologists, maternity assistants, midwives and paediatric nurses believe that there is not enough evidence to recommend vaccines to pregnant women and some pregnant women believe that the reason healthcare practitioners do not give information about vaccines is because there is not much information on vaccines to be had	Low

Population to be vaccinated	Finding	Confidence
Pregnant women	Some pregnant women say that information on vaccines should be given to them throughout pregnancy so they have time to read them and organise vaccinations, while others say that they are so busy that they often do not have time to look at information on vaccines that is given to them. Some midwives say that pregnant women are given a lot of information during pregnancy.	Low
	Sources of information: official sources	
Pregnant women	Midwives say that they direct pregnant women to evidence-based information on vaccines and that they would like an official website to be created that has appropriate information on vaccines for pregnant women. Some pregnant women say they trust official sources of information more than others.	Moderate
	Sources of information: the media and online, including social media and apps	
Pregnant women	Midwives and pregnant women agree that the TV and news reports can be a source of positive messages to encourage vaccination. However, some pregnant women say that other media stories suggest vaccines do harm and discourage vaccination.	Moderate
Pregnant women	Pregnant women say that they use Google to search for information about vaccines, but they do not trust advice on the internet that appears to be biased too heavily either in favour or against vaccines. They would prefer a balanced account.	Low
Pregnant women	Some midwives say that there is a lot of mis-information on vaccines that saturates social media, while others are unaware of this problem.	Very low
	Sources of information: printed materials, such as leaflets	
Pregnant women	Midwives say that being able to give leaflets about vaccines to pregnant women is useful and that they have they have leaflets and other materials. However, some midwives do not give these leaflets out because pregnant woman are given many other leaflets.	Moderate
Pregnant women	Not all pregnant women say that they read the leaflets they have been given and some would prefer the opportunity to discuss vaccines with healthcare practitioners rather than being given information.	Low
	Sources of information and influence: discussing vaccination with healthcare providers	
Pregnant women	Some midwives agree that discussing maternal vaccines are an important part of their role and are willing to spend time doing this, while others think this is a topic for doctors to deal with or that discussing vaccines with pregnant women made them appear less trustworthy. Pregnant women say that they would like the opportunity to discuss vaccines with a midwife.	Moderate
Pregnant women	Some obstetricians and gynaecologists do not routinely discuss vaccinations with pregnant women and say that vaccines are not on their list of top priorities or that they do not feel responsible for vaccinating pregnant women.	Low
Pregnant women	Pregnant women say that midwives and obstetricians do not discuss vaccines enough in hospitals.	Low
Pregnant women	Pregnant women say that healthcare practitioners do not initiate conversations about vaccines or discuss vaccines, including the pertussis vaccine, with them very much or at all.	High

Population to be vaccinated	Finding	Confidence
Pregnant women	Healthcare practitioners mention vaccines to pregnant women rather than discuss them but pregnant women who did not discuss vaccines with a healthcare practitioner were unlikely to be vaccinated.	Low
Pregnant women	Midwives say that they discuss vaccines many times throughout each woman's pregnancy and they also discuss childhood vaccines. However, they discuss vaccines for childhood less frequently because they feel that mothers will have further opportunities to discuss childhood vaccines.	Very low
Pregnant women	Pregnant women say that midwives can discourage them from being vaccinated by being too relaxed about the importance of being vaccinated.	Low
Pregnant women	Pregnant women who are young, single and/or unemployed sometimes report feeling judged by healthcare practitioners or feel that their concerns are dismissed. Others say they feel pressurised to accept the vaccines because midwives sometimes mention social workers. However, other pregnant women who are in precarious or marginalised situations want healthcare practitioners to make decisions on their behalf because they feel unable to do so themselves.	Low
	Sources of information and influence: friends and relatives	
Pregnant women	Pregnant women say that friends and relatives sometimes recommend vaccination, but in other cases they can influence them not to vaccinate. The reasons for this include the belief that pertussis is a harmless disease, the vaccines are untested or poorly tested and may do harm or cultural reasons.	Low
Pregnant women	Pregnant women sometimes say that they are unlikely to discuss vaccines with their male partner and that he is too busy to discuss vaccines with them.	Moderate
65 years and over		
	Lack of information	
65 years and over	People aged 65 years and over may not necessarily know what a vaccine is or do not realise that vaccines are available to them until someone discusses the topic with them. They say that there are no posters in GP waiting rooms that say they should ask for vaccines for people in their age group. GPs agree that people aged 65 years and over are not aware that vaccines are available for them and say that more information would be useful.	Moderate
65 years and over	Emergency department nurses say that their usual training does not include vaccines for people aged 65 years and over. As a result, they do not know enough about vaccines for people aged 65 years and over in order to advise them and administer vaccines. They also say that they do not have information to hand about the relevant vaccines for people aged 65 year and over.	Low
	Sources of information: official sources, posters, and the media	
65 years and over	GPs and people aged 65 years and over believe that campaigns to increase the vaccination rates of people aged 65 years and over are best conducted by official government organisations that have credibility. These sources of information should be easier to read than the Green Book.	Low

Population to be vaccinated	Finding	Confidence
65 years and over	GPs and people aged 65 years and over believe that multi-media campaigns increase vaccine uptake by raising awareness. However, the media do not provide enough coverage of the consequences of diseases that vaccines aim to prevent.	Moderate
65 years and over	In vaccine advertising campaigns, people are more receptive to positive messages compared to negative messages.	Very low
65 years and over	People aged 65 years and over say that placing literature such as posters in GP's waiting rooms should make people more aware that there are vaccines available.	Low
65 years and over	GPs say that they are more influenced by the opinions of colleagues than by evidence-based sources.	Low
	Sources of information and influence: discussing vaccination with healthcare providers	
65 years and over	GPs and people aged 65 years and over say that people aged 65 years and over trust their GP because they have developed a relationship with them.	Moderate
65 years and over	Some people aged 65 years and over will not be put off by a healthcare practitioner who has a negative opinion about them receiving a vaccine. However, others say that they will follow their GP's advice – even if they incorrectly advise against a vaccine – until a different healthcare practitioner discusses it with them later on.	Low
65 years and over	GPs say that when they discuss pneumococcal vaccination with people who are aged 65 years and over, they usually agree to having the vaccine.	Low
65 years and over	Emergency department nurses say that they are usually too busy with emergency work to discuss vaccines with people aged 65 years and over and they assume that these people will take responsibility for themselves and seek vaccination. However, emergency department nurses say that people aged 65 years and over would be vaccinated by them if that was on their routine.	Very low
	Sources of information and influence: friends and relatives	
65 years and over	People aged 65 years and over say they are encouraged to be vaccinated by friends and relatives. If friends or relatives advise them to not accept a vaccine, they do not necessarily take their advice. In addition, they say they talk to their friends and relatives to persuade them to be vaccinated.	Low
0-5 year olds		
	Information needs	
0-5 year olds	Parents (including those with anthroposophical beliefs, immigrants* and Jewish parents) and GPs said they would like balanced information about vaccines that address parental concerns about safety as well as effectiveness. Parents said that they felt well informed, but the information did not address their concerns fully because they lacked information about potential adverse events, the rationale for combination vaccines, how the vaccines were tested, where else they had been used, and the vaccine ingredients. They thought that the information they received was written to purposefully avoid these issues and did not present a balanced picture.	High

Population to be vaccinated	Finding	Confidence
	GPs agree that the information they provide to parents downplays the potential side effects to such a degree that they vaccines are presented as being 100% safe and that this can dissuade parents from having their children vaccinated. However, doctors and public health nurses said that most parents with concerns agree to vaccination after they have discussed the evidence with them. * Immigrants include people who had lived in the Netherlands for at least 1 year (mostly people from Morocco, and Turkey, as well as some from Afghanistan, Somalia, Poland and Belgium)	
0-5 year olds	Parents (including immigrant parents*) were concerned about the introduction of new vaccines, such as MMR or MenB, but were reassured if they were informed about vaccine safety and benefits and persuaded that it was aimed at protecting their child's health rather than cutting costs. They were also more trusting if they could be persuaded that enough research had been done to evaluate safety. * Immigrants include people who had lived in the Netherlands for at least 1 year (mostly people from Morocco, and Turkey, as well as some from Afghanistan, Somalia, Poland and Belgium)	High
	Sources of information and influence: family, other parents and the media	
0-5 year olds	Parents (including Jewish people, GRT, migrants and anthroposophic followers) use multiple sources of information in their decision making and can be influenced by family members, other parents, NHS websites and leaflets, online forums, healthcare practitioners perceived social pressure and the media. Some parents believe that the media is a valuable information provider. However, others believe that the media is irresponsible and unbalanced. Some GPs said that adverse publicity was a key factor in poor vaccine uptake (for example, decreased MMR uptake following the Wakefield incident). (The studies did not mention social media, possibly due to their age.) Other parents were also seen as a good source of advice because the parents developed relationships with each other at children's centres, and they viewed each other as impartial and trustworthy. Some parents said that their relatives had influenced their decision to vaccinate. In addition, parents said getting vaccinated was the perceived social norm and thought that there was social pressure to accept vaccination. They were concerned about being judged by others if they rejected vaccines such as the MMR. However, in some communities the social circle can influence people to decide against vaccinations. Nurses highlighted how, in the Somali community in Sweden, the opinions of friends and family result in a low uptake of the MMR vaccine because of their beliefs in its link with autism.	High
	Themes that are specific to immigrants: religious considerations	
0-5 year olds	Muslim immigrant parents* had different opinions on whether vaccinations were acceptable in Islam. Somali immigrant parents who vaccinated on time had confidence because they trusted God and believed that anything that happened to their child was according to the will of God. Some Turkish immigrant parents said that according to Islam, vaccination was considered beneficial because they must protect their health. However, others believed Allah determined whether their	High

Population to be vaccinated	Finding	Confidence
	child became sick, so vaccines did not prevent disease. In addition, some Somali migrants who were Muslim were anxious that the MMR vaccine contained gelatine, a pig-based product forbidden in Islam. However, others held the view that it was only an injection and not food eaten every day. * People who had lived in the Netherlands for at least 1 year (mostly people from Morocco, and Turkey, as well as some from Afghanistan, Somalia, Poland and Belgium), people living in the UK who were born in Somalia and Somali immigrants living in Sweden.	
11- 18 year olds		
	Information and influences	
11-18 year olds	Healthcare practitioners are willing to provide information and advice about vaccinations and this is taken up by some parents (including immigrant parents) and adolescent girls where it is available. School nurses noted that when they offered to discuss vaccinations few parents contacted them. They also thought that parent information sessions in schools would be ineffective because these would be attended by those least in need of information while the hard to reach parents would not attend.	High
11-18 year olds	Some parents did not trust or feel supported by the school nurse and wanted more information than they felt the nurse was competent to provide.	Low
11-18 year olds	Adolescent girls and their parents want and expect that information about HPV vaccination will be covered in school lessons. School staff and nurses described how they present information about HPV and the vaccine to adolescent girls through school assemblies and in health and sex education lessons. However, some teachers were not comfortable talking about the vaccine, promoting its use or able to answer students' questions. Some adolescent girls reported receiving information about HPV vaccination at school and finding it useful, but others did not feel that school lessons had been sufficiently informative, and the amount of information provided appears to be highly variable between schools.	High
11-18 year olds	Written information about HPV vaccination is often perceived to be inadequate by parents and adolescent girls (including immigrant* and Jewish parents). Some people found the written information provided for by schools and the NHS website useful, but many parents and adolescent girls criticised it for being uninformative, unengaging, or pro-vaccine biased and some thought it left them with more questions than answers. It was suggested that information should be provided in different formats, such as videos, podcasts and via social media. Some parents looked for more information elsewhere. Parents also complained that the information provided by the school was mainly concerned with logistics of the vaccination process rather than about the vaccine and why it was needed. * Immigrants included people living in the UK who were born in Zambia, Zimbabwe, Nigeria, South Africa and Kenya	High
11-18 year olds	Family, friends and the media can influence parents' decisions to vaccinate their children. Some parents (including immigrants* and Jewish parents) discussed the decision to vaccinate with the child's other parent, or their own parents and other family members or sought the opinions of other parents they knew, or friends in their community to guide them.	High

Population to be vaccinated	Finding	Confidence
	Adolescent girls reported that familial indifference was a barrier to vaccination. They also reported feeing social pressure to be vaccinated. The media was also influential, as there had been a lot of media coverage when the vaccine was introduced. School nurses, parents (including immigrant and Jewish parents) and adolescent girls made references to Jade Goody, a celebrity who died of cervical cancer in 2009. Parents also cited the death of a schoolgirl following HPV vaccination as influential in their decision making (her death was later shown to be unrelated to the vaccination). However, other parents recalled positive messages they had heard in the media. Some thought that although media coverage is often negative, it is now starting to become more positive. * Immigrants included people living in the UK who were born in Bangladesh, Africa, Caribbean, Somalia, India or Pakistan	
11-18 year olds	Teachers and schools can play an important role in communicating information about vaccinations to girls and parents, helping ensure consent forms are completed and that the girls wear suitable clothes to make vaccination easy on the day.	Low
	Religious and cultural differences	
11-18 year olds	Some parents (including immigrant* and Jewish parents) felt that people from their culture are at a lower risk from HPV. Some parents cited cultural practices or traditions as protective against HPV, or simply felt that the prevalence was lower in their ethnic group. In particular, several of these parents believed that their daughters or sons would be less likely to engage in risky or pre-martial sexual activity due to their culture being more sexually conservative than western culture. * Immigrants included people living in the UK who were born in Bangladesh, Africa, Caribbean, Somalia, India or Pakistan and mothers from Somalia who had a migration date from 1990 or 2006 migration waves.	High
11-18 year olds	A tailored approach to vaccination would benefit parents including Jewish and immigrant* parents. Some parents from religious or cultural backgrounds would prefer to receive information tailored to their community. They felt that guidance from people within their community would be better suited to address their specific concerns. * Immigrants included African parents living in the UK	High
11-18 year olds	Language and literacy can be a barrier to accessing written information and gaining informed consent. Immigrant parents* who spoke English as a second language stated that they were unable to understand the written information they were given about the vaccine. Some relied on their child to explain it while others sought information in their own language. Parents may also be unaware of the availability of information in languages other than English if this not publicised. * Immigrants were mothers from Somalia who had a migration date from 1990 or 2006 migration waves.	High
	Vaccinating boys	
11-18 year olds	Many parents were unaware that HPV vaccination could be given to boys. Similar to parents considering vaccination for girls, some were distrustful of pharmaceutical companies and wanted more information about the side effects and/or long-	Low

Population to be vaccinated	Finding	Confidence
	term effects having heard negative stories in the media. They also discussed a lack of need due to their son not being sexually active yet, refusal on religious or moral grounds and some general anti-vaccine sentiments.	
11-18 year olds	Some parents thought that vaccinating boys for HPV was unnecessary as they cannot have cervical cancer. Very few seemed aware that HPV could cause cancer in boys too and that they could transmit the virus to their sexual partners. However, some parents felt that vaccinating all young people would offer greater protection against cervical cancer in the population were aware that vaccinating both sexes would reduce HPV related disease such as throat and oral cancers, in boys.	Low
11-18 year olds	Boys had limited knowledge of HPV and the vaccine and stated that they wanted more information. They wanted the information to be from someone they trust, such as the school nurse and school health services. There were mixed views on the best way to present this information, whether it was face-to-face, in individual sessions or in writing. They thought that education about HPV should begin from an early age, starting in primary school.	Moderate
Studies spanning multiple age/ life stage categories		
	Sources of information and level of knowledge	
Studies spanning multiple age/ life stage categories	Healthcare practitioners are trusted sources of information for many parents and can influence decision making, but not all parents respond positively. Where the health care providers and parents have established a trusting relationship based on long-term positive interactions, this allows the healthcare staff to promote vaccinations. GRT overwhelmingly identified healthcare providers as the key trusted source of written and verbal information about childhood and adult vaccinations , while many home schooling Protestant parents also identified physicians as having a real positive influence on their decision to vaccinate based on trusting that doctors want the best for their kids. However other Protestant parents felt pressured to vaccinate and this damaged their relationship with the healthcare providers or reported that they were pressured not to vaccinate by nurses and other respected healthcare related individuals. Healthcare practitioners working with Orthodox Protestant parents who have religious objections to vaccination provide information to try to persuade the parents to change their minds, but very few parents respond to this approach, which can be frustrating for the healthcare providers.	High
Studies spanning multiple age/ life stage categories	Knowledge about and awareness of vaccinations was variable in GRT communities. In general, GRT were more aware of childhood vaccines including HPV, than those aimed at adults, although they were less familiar with some of the more recently introduced childhood vaccines (such as rotavirus). There was increased awareness of vaccines such as MMR due to controversies about their safety. Some Travellers (Romanian Roma) had limited understanding of specific vaccines, the diseases they protect against and the time at which they are routinely provided. However other Roma participants were more knowledgeable.	Moderate

Population to be vaccinated	Finding	Confidence
Studies spanning multiple age/ life stage categories	Health care providers identified the lack of knowledge or misinformation about vaccines as the main problem affecting vaccine uptake because this required a substantial amount of time to provide information and attempt to correct misinformation that could be better used to address other patient needs. They suggested a public education programme to provide the correct information needed for decision making and challenge misinformation.	Low
Studies spanning multiple categories	Providing credible, trustworthy and unbiased information to parents could help improve their decision making. Polish and Romanian immigrant parents* report challenges in identifying trustworthy sources of information amongst the unregulated information available on the internet. They find the NHS literature more credible but would like more information about vaccine side effects. Scottish Show people commented on the biased information provided by the media, specifically around the MMR vaccine. *Polish and Romanian immigrants living in the UK (average time living in the UK was 11 years for Polish people and 9 years for Romanians)	High
Studies spanning multiple age/ life stage categories	Schools can also be a useful source of information for GRT parents and girls. Some GRT parents and girls reported receiving information about vaccinations from schools in written format and in presentations in school assemblies. This was generally well received.	Moderate
Studies spanning multiple age/ life stage categories	The influence of family and community was felt by both GRT and Protestant parents but to different degrees. These influences were still strong in GRT communities but there was a shift to health practitioners as the primary source of information. In contrast some Orthodox Protestant parents reported discussing vaccinations with family and friends, but others did not do so deliberately because they feel pressured to make the same decision as their non-vaccinating community. Protestant home schooling parents also experienced pressure from family and friends not to vaccinate their children.	High
Studies spanning multiple age/ life stage categories	Parents reported looking at information in the media, social media and on the internet as part of their decision-making process, but this information was often conflicting and could be confusing. Polish and Romanian immigrant parents were aware of antivaccination groups and celebrities in their home countries promoting not vaccinating their children. GRT reported coming across biased, scaremongering information in the media (especially about MMR) and social media as well as accurate and balanced information. In contrast, some GRT had no access to the internet or had to rely on their children to use it for them. Protestant homeschooling parents reported feeling empowered by the research they did online, but this could also lead to confusion with the amount of conflicting information.	High
	Language and literacy barriers	
Studies spanning multiple age/ life stage categories	Language barriers can make communication between healthcare workers and parents who are from abroad difficult and this is compounded by the lack of availability of translators at consultations and information in languages other than English. Polish and Romanian immigrant parents* report difficulties in understanding medical terminology and would like information to be provided in their own language. Healthcare providers report that interpreting services are difficult to organise, can be impersonal and increase the time needed for a consultation, but agree that face to face communication using interpreters is preferable for certain groups who have low levels of literacy (such as Roma Romanian Traveller	HIgh

Population to be vaccinated	Finding	Confidence
	communities) and have a culture of oral communication. In addition, language difficulties can make it hard to obtain accurate vaccination histories for immigrants. *Polish and Romanian immigrants living in the UK (average time living in the UK was 11 years for Polish people and 9 years for Romanians in one study, 3 years or less in another study)	
Studies spanning multiple age/ life stage categories	Low levels of literacy act as a barrier preventing some GRT and immigrants* from understanding written information about vaccines and appointment letters. Romanian Roma and some Romanians have low literacy levels and may struggle to read information even when it is translated into their native language. Low levels of literacy may also be found in older members of other GRT communities, which may include the current generation of parents. As a result, GRT and providers agree that simple written information with pictures may prove useful but verbal information is preferable. *Romanian immigrants living in the UK for 3 years or less	Moderate
	Access	
Studies spanning multiple age/ life stage categories	Some parents who are Polish or Romanian immigrants and Roma Travellers are unfamiliar with the NHS and can find it difficult to navigate the UK health system to obtain healthcare. They reported difficulties in registering with GPs and this was linked to lack of appropriate documentation in some cases while Roma travellers were not necessarily aware that they needed to book appointments to be seen by a GP. In addition, pregnant Roma often arrive without having had any antenatal care and cannot access it in the UK until they are registered with a GP. These difficulties are overcome with the support of family members and friends and a growing understanding of how the system works. Once registered some Romanian and Polish parents report finding it easy to book appointments at GP practices. In contrast other Romanian and Romanian Roma parents still find it hard book GP appointments, and this may be due to language difficulties affecting communication or discrimination. Providers report that these parents are more likely to see help at A&E if they are unwell than to visit a GP, which may be linked to problems with booking appointments. However, providers also thought that these communities have a more reactive response to healthcare. This could negatively affect their uptake of vaccines.	High
	UK versus Poland and Romania's schedules and processes	
Studies spanning multiple age/ life stage categories	Some immigrant parents* are aware that there is an emphasis on informed consent and choice concerning vaccination in the UK. while others think they are mandatory. Polish parents were aware of differences in the rules around consent in the UK compared to Poland where vaccination was mandatory. In contrast, some Roma Travellers were unaware that vaccinations were not mandatory and believed that their children would not be allowed to attend school unless they had all their childhood vaccinations. The requirement for written consent in schools was seen by some healthcare providers as off putting for parents who may not be used to a formal approach to consent in Romania. *Polish and Romanian immigrants living in the UK (average time living in the UK was 11 years for Polish people and 9 years for Romanians)	High

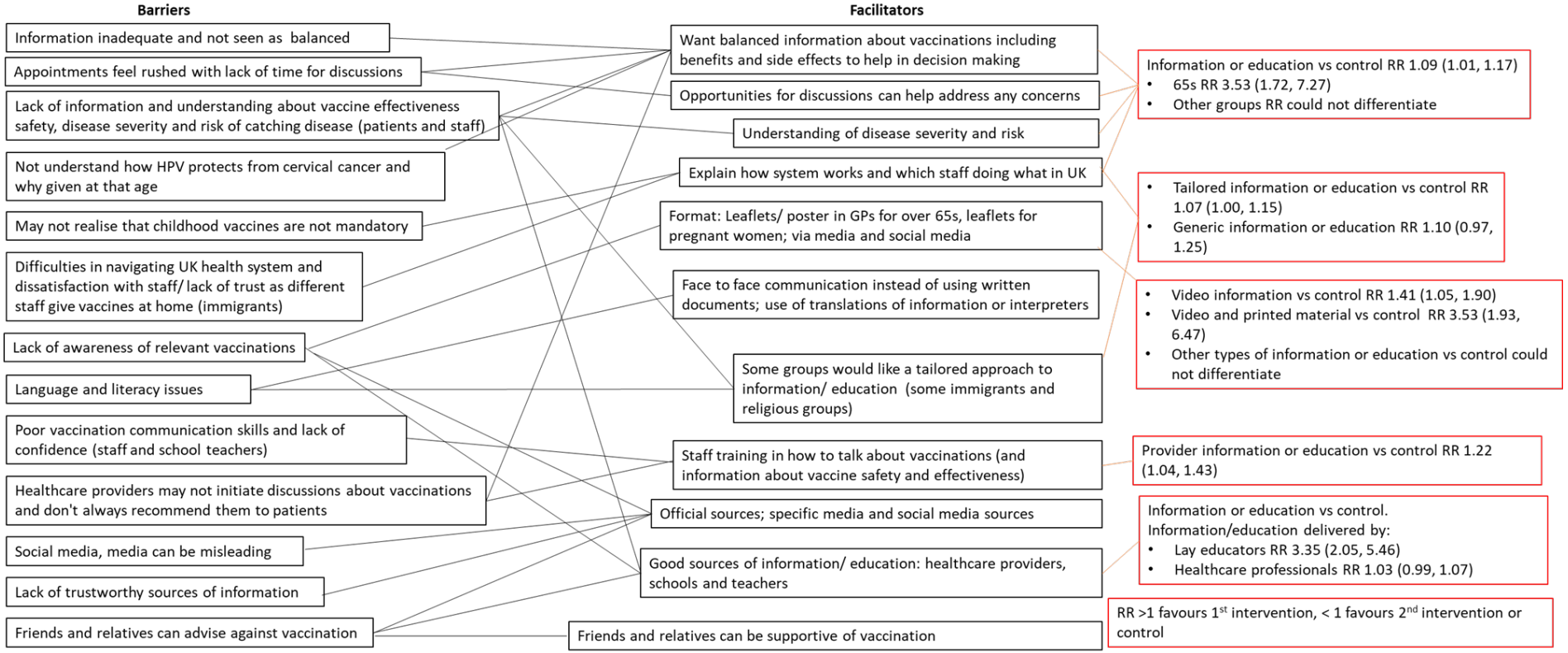
Population to be vaccinated	Finding	Confidence
Studies spanning multiple age/ life stage categories	Polish and Romanian parents* were aware of differences between the UK schedules and those of their home countries but while this could lead to uncertainties it was not necessarily viewed as a problem by parents. Some followed the UK system as their children were born and living in the UK, while others report consulting their own doctor in Poland or continuing to use their native health services particularly if they were visiting just after birth. Healthcare providers noted that this could cause difficulties if the children returned to the UK with undocumented vaccine histories. *Polish and Romanian immigrants living in the UK (average time living in the UK was 11 years for Polish people and 9 years for Romanians)	Moderate
Studies spanning multiple age/ life stage categories	Levels of trust in the UK system were varied with many Polish and Romanian immigrant parents* being sceptical about the quality of the UK system and in particular the medical staff. There was a lack of trust in nurses giving vaccinations because these are carried out by doctors in Poland while some parents were concerned that GPs were generalists, while vaccination was considered a specialist service. Parents also viewed the expertise of health visitors negatively comparing them to paediatricians at home. Lack of trust in primary healthcare was a driving factor for people opting to access emergency services in England and for seeking care in Poland and Romania or private Polish doctors in England. In addition, parents were unhappy about a lack of continuity of care preferring to have a single member of staff who has a relationship with them and their child. Health care providers thought that it was important to explain the UK system to parents to improve trust. *Polish and Romanian immigrants living in the UK (average time living in the UK was 11 years for Polish people and 9 years for Romanians)	Moderate
	Religious beliefs- Orthodox Protestants	
Studies spanning multiple age/ life stage categories	Providing information is usually ineffective in persuading reluctant Orthodox Protestant parents to accept vaccination. All healthcare providers responded to religious objections from Orthodox Protestant parents to vaccination by providing information about the severity of the diseases concerned, benefits and side effects of vaccinations and how the vaccines work, however, this was rarely a successful approach and led to feelings of frustration amongst the staff.	Moderate
Studies spanning multiple age/ life stage categories	Providers try to engage Orthodox Protestant parents in discussions about vaccinations and a knowledge of Orthodox Protestantism or being Protestant themselves is beneficial. Providers who had knowledge about orthodox Protestantism or were Protestant themselves (although not necessarily Orthodox) were able to relate the parents more easily, could engage them in discussions about the religious and medical issues and support their decision making. Although they were clear that the parents had to make the final decision themselves. Discussions between healthcare providers and parents were dependent on the willingness of the parents to be engaged. The staff reported only discussing vaccinations for the first-	Moderate

Population to be vaccinated	Finding	Confidence
	born child. After this, they confirmed with the parents that the decision was the same for subsequent children: They were worried that the parents would stop attending the clinics if they were repeatedly challenged about their decisions.	

Mixed methods summary of the quantitative and qualitative evidence for education/ information interventions

The barriers and facilitators in the diagram are summarised versions of the findings that were considered to be the most important from the qualitative evidence relating to education/ information presented in Table 17 and Table 18. Possible links between barriers and corresponding facilitators are shown in the diagram, with the quantitative evidence mapped onto the related qualitative themes. See section 1.1.3 Methods and process for more details.

Figure 1 Diagrammatic summary of the barriers and facilitators to vaccine uptake with education/ information interventions mapped onto them.



1.1.7 Economic evidence

A single systematic review was conducted to identify economic evaluations relevant to any of the quantitative review questions in the guideline. The search returned 5,716 records which were sifted against the review protocol. Of these publications 5,669 were excluded based on title and abstract. On full paper inspection 43 studies did not meet the initial inclusion criteria. Inclusion was restricted to cost-utility analyses from OECD countries comparing interventions to increase vaccine uptake for vaccines in the UK immunisation schedule as described in the green book. Four published economic analyses were included in the evidence synthesis.

Due to a lack of cost-utility evidence in children, an additional inclusion set was used to identify studies in children and adolescents (0-18 years), where outcomes were not restricted to QALYs only (and therefore cost-effectiveness studies were also included). An additional six studies from the search were included on this basis to provide evidence in the younger population..

The search was rerun in April 2021 to identify any newly published papers and returned 544 publications, of which 541 were excluded based on title and abstract and two were excluded at the full text inspection. One published economic analysis from this search was included in the evidence synthesis.

1.1.7.1 Included studies

Of the 11 cost-utility and cost-effectiveness papers included across the guideline, 3 were judged to be most relevant to this question and are included in this review. A summary of the studies included in the cost-effectiveness review is given in 1.1.8 Summary of included economic evidence. Detailed information and quality checklists for these studies can be found in Appendix H, and the study selection is described in Appendix G.

All costs and monetary outcomes were uplifted and converted to 2021 GBP using the EPPI Centre cost converter (accessed 08/06/2021), using the IMF PPP dataset.

1.1.7.2 Excluded studies

A list of studies excluded at full text from the cost-effectiveness review can be found in Appendix J.

1.1.8 Summary of included economic evidence

1.1.8.1 Cost-utility studies

Five cost-utility studies (including one conducted in the UK from an NHS perspective) looked at strategies to increase the uptake of vaccines. All of these studies were in an adult or elderly population. Only one study was in an education and reminders intervention, and this was a community-based outreach initiative. This study was deemed partially applicable for this review question, but had minor methodological limitations, indicating that the evidence has some value to inform recommendations.

Education and reminders

Study	Comparators	Incremental cost	Incremental QALYs	ICER	Uncertainty	Applicability	Limitations
Weaver 2001 US Societal perspective Community based outreach initiative (educational brochure, reply card and follow-up phone call) People aged 65+ years	No program All participants (intervention and control) were exposed to other vaccine promotion activities including a volunteer nurse providing vaccines on site	As implemented (combined outreach) $22,780 (£25,363.95, 2021 GBP) As implemented (pneumococcal only) $24,724 (£27,528.46, 2021 GBP) Targeted (combined outreach) $17,267 (£19,225.61, 2021 GBP) Targeted (pneumococcal only) $24,583 (£27,371.47, 2021 GBP)	As implemented (combined outreach) 0.64 As implemented (pneumococcal only) 0.46 Targeted (combined outreach) 1.47 Targeted (pneumococcal only) 0.65	As implemented (combined outreach) $35,486 (£39,511, 2021 GBP) As implemented (pneumococcal only) $53,547 (£59,621, 2021 GBP) Targeted (combined outreach) $11,771 (£13,106, 2021 GBP) Targeted (pneumococcal only) $38,030 (£42,344, 2021 GBP)	Major sources of uncertainty in the model were the effectiveness of the intervention, and of the vaccines. To address this, partial stochastic CEAs were performed, in which quasi-confidence intervals were calculated. A one-way sensitivity analysis was performed, in which parameter values were changed within reasonable bounds. Variables such as the cost of vaccines, frequency of influenza epidemic years and probability of a bed-disability day from influenza and	Partially applicable	Minor limitations

Study	Comparators	Incremental cost	Incremental QALYs	ICER	Uncertainty	Applicability	Limitations
					pneumonia did not change the cost-effectiveness ratio by more than $1,000. Variables that did substantially change the cost-effectiveness ratio include the discount rate, the cost of intervention and the incidence and mortality rate from bacteraemia.		

1.1.8.2 Non-QALY outcome studies

Since no relevant cost-utility studies were identified in the children/adolescent population, we expanded the inclusion criteria to include non-QALY outcomes in non-adult populations and identified six studies. Of the six studies in children/adolescents, two looked at education interventions. All studies were rated as only partially applicable, and had potentially serious limitations, so may be of limited value in informing recommendations.

The Tubeuf study is likely to be somewhat more applicable as it was conducted in the UK from an NHS perspective, whereas the other was a US study.

Education

Study	Comparators	Incremental cost	Incremental outcomes	Cost-effectiveness	Uncertainty	Applicability	Limitations
Tubeuf 2014 England and Wales NHS perspective (and societal perspective) MMR decision aid + usual practice, or MMR leaflet + usual practice First time parents whose first child was aged 3-12 months.	Usual practice	Incremental cost of decision aid versus: Leaflet: -£7.17 (-£8.83 2021 GBP) Usual practice: -£9.20 (-£11.32 2021 GBP)	Incremental uptake (proportion) of MMR for decision aid versus: Leaflet: 0.10 Usual practice: 0.02	Decision aids were dominant: the decision aids were a cost-saving intervention compared with both the leaflet and usual practice. Uptake was higher in the decision	There were different numbers of patients with low (<2) and high (≥2) baseline decisional conflict in each arm so patients within each arm	Partially applicable	Potentially serious limitations

Study	Comparators	Incremental cost	Incremental outcomes	Cost-effectiveness	Uncertainty	Applicability	Limitations
				aids group than in both other groups. Leaflets cost less than usual practice but had a lower vaccine uptake proportion.	were randomly selected to achieve the same mix in each arm. To account for potential sampling bias, this random selection was repeated 10 000 times to build up distributions for mean incremental costs and vaccine uptake. Cost-effectiveness acceptability curves were used to express the likelihood that each of the three arms was the most cost-effective option across varying thresholds of monetary value of additional vaccination.		
Zhou 2003 US Societal perspective	No uptake intervention (a separate geographic	Total cost of the media intervention including	Years of life saved in the base-case (60% infection rate):	Cost per LY saved (3% discount rate, 60% infection rate):	Sensitivity analyses were conducted to explore the	Partially applicable	Potentially serious limitations

Study	Comparators	Incremental cost	Incremental outcomes	Cost-effectiveness	Uncertainty	Applicability	Limitations
Two interventions to increase hepatitis B vaccine uptake: A media intervention campaign, and Community mobilization interventions Vietnamese-American children born between 1984-1993	area to those areas in each intervention)	(excluding) vaccination costs: $313,904 ($153,323) [£327,598 (£160,012) 2021 GBP] Total cost of the community mobilization intervention including (excluding) vaccination costs: $169,561 ($106,276) [£176,958 (£110,912) 2021 GBP]	Media intervention: 131 Community mobilization intervention: 60	Media intervention: $9,954 (£10,388 2021 GBP) Community mobilization intervention: $11,759 (£12,272 2021 GBP) Benefit-cost ratio (3% discount rate, 60% infection rate: Media intervention: 5.26 Community mobilization intervention: 4.47	effect of the assumptions for discount rate and infection rate. Benefit-cost ratios and incremental cost-effectiveness were calculated for all combinations of 3% and 5% discount rates and 30% to 75% rates of infection, at increments of 15%. The broad range of infection rates was used to account for the potential variability resulting from differences in baseline vaccination levels, risk levels, and different ages at immigration.		

1.1.9 Economic model

Original health economic modelling was not prioritised for this review question.

1.1.10 Unit costs

The fees payable to GP providers for delivery each of the vaccines relevant to this guideline are given below.

Resource	Unit costs	Source
Vaccine fee for service (excluding pneumococcal PCV and MMR catch-up)	£10.06	British Medical Association: Vaccinations fees and arrangements
Vaccine fee for service (pneumococcal PCV)	£15.02	British Medical Association: Vaccinations fees and arrangements
Vaccine fee for service (MMR catch-up)	£5	British Medical Association: Vaccinations fees and arrangements

1.1.11 Economic evidence statements

- One cost-utility analysis found that in people aged 65 years and older, a community-based outreach initiative targeted at people who had not been vaccinated was cost-effective with an ICER of £13,106 compared with no outreach program when the intervention focused on both pneumococcal and flu vaccines. The outreach initiative had an ICER of £42,344 when only pneumococcal vaccination was considered. This analysis was assessed as partially applicable with minor limitations.
- One cost-effectiveness analysis found that in children aged between 3 and 12 months who had been offered the first MMR vaccine, a decision aid plus usual practice was less costly and more effective at increasing vaccine uptake when compared to usual practice alone. This analysis was assessed as partially applicable with potentially serious limitations.
- One cost-effectiveness analysis found that in children in a specific Vietnamese-American population, the cost per life year saved when a media intervention campaign for vaccination was implemented was £20,778 when compared with no intervention at a 30% baseline infection rate. The cost per life year saved when a community mobilisation intervention campaign for vaccination was implemented was £24,545 when compared with no intervention at a 30% baseline infection rate. This analysis was assessed as partially applicable with potentially serious limitations.

1.1.12 The committee's discussion and interpretation of the evidence

This discussion includes consideration of the qualitative evidence that specifically covers reminders from evidence review B (summarised above) as well as the quantitative evidence presented in this review.

1.1.12.1 The outcomes that matter most

The protocol's primary outcome was vaccine uptake. The committee agreed that this outcome was the most important for individuals, their parents and carers (as appropriate), and healthcare practitioners because the aim of this guideline is to increase vaccine uptake. None of the included studies reported the protocol's secondary outcomes, which were the proportion of people offered vaccinations and the numbers of people who develop the diseases the vaccines are aimed at preventing. Offers of vaccination was not considered as important as uptake because an offer may not necessarily result in a vaccination.

1.1.12.2 The quality of the evidence

The committee's experience corresponded with the pooled finding that information or education increases vaccine uptake versus control. However, the quality of this evidence was very low because there was high heterogeneity between the studies, and many were at moderate or high risk of bias. This was due to a lack of information about the randomisation process, and a lack of information about assessor blinding and how the data was collected.

The committee thought that issues with study design might explain the small pooled effect sizes seen when the information and education interventions were compared to control. Importantly, when the studies at high risk of bias were excluded in a sensitivity analysis the improvement in vaccine uptake associated with information/ education was maintained and the magnitude increased. Issues with study design may also explain the results of Shourie 2013 which reported that control resulted in higher vaccine uptake than printed educational materials. However, people in the control arm of this study also received usual care, which was a different educational leaflet on vaccines. Therefore, the committee agreed this was actually a comparison of 2 types of very similar information interventions making it hard to determine the effect of the intervention, and this did not mean that information was less effective than no information. In addition, the intervention arm and control arm had very high levels of uptake (125/133, and 69/70 respectively) which makes it hard to be sure if there would have been an effect in areas with lower vaccine uptake. The paper also reported that there was a statistically significant difference in decisional conflict across the three arms and since the intervention arms (information leaflets or a interactive decision aid) involved decision making this could affect the study results.

When the interventions were broken down by type there was some moderate and high quality evidence that video information, video plus printed material and face to face education with printed materials were more effective than control. However, there was limited evidence for these comparisons. Evidence for other types of intervention was low or very low quality and could not differentiate from control.

There was no specific evidence on antenatal information or education as well as no quantitative evidence specifically for groups of people with protected characteristics or other definable characteristics. Therefore, for these groups the committee used a combination of the qualitative evidence and their experience to make recommendations for these groups. There was no quantitative evidence about what messages any information or education interventions should contain. Evidence from the qualitative evidence review was therefore used when recommendations about this was considered. There was also no quantitative evidence about the timings at which people should have their awareness of vaccines raised (for example, in the form of media campaigns) and when they should receive information or education with invitations and reminders.

1.1.12.3 Advantages and disadvantages

Information/ education for individuals, their family members or carers (as appropriate)

The meta-analysis of the pooled education/ information interventions compared to control supported the use of information/ education to increase vaccine uptake for individuals, their family members or carers (as appropriate). However, with the exception of people aged 65 years and over, the committee noted that most of the individual studies and pooled summary results for different ages could not differentiate between education/ information interventions and control in increasing vaccine uptake. The committee were surprised by these results because, in their experience, the provision of education/ information interventions tended to increase vaccine uptake. However, they thought that the non-statistically significant results from some of the studies with small participant numbers could reflect the trial being underpowered and therefore unable to detect any effects, rather than a lack of effectiveness in comparison to control.

Although there was limited quantitative evidence to support of the use of information/ education in increasing the uptake of routine vaccinations, the committee agreed with the qualitative evidence that there were a number of issues that could be addressed using these types of interventions. The relevant qualitative evidence (see Table 17 and Figure 1 for a summary of the relevant qualitative findings, and evidence review B for all qualitative findings) fell into several main groups of findings: those covering a lack of information/ understanding about safety, effectiveness and disease risk; difficulties navigating the health system and language and literacy issues and misleading/ untrustworthy sources of information. The committee agreed that these barriers could be addressed by providing information or education to individuals, parents and carers (as appropriate), but there was little quantitative evidence to suggest how this could be provided most effectively.

The results could not differentiate between types of information/ education interventions in the majority of cases. The exception was the three-arm trial by Shourie (2013) which showed that an interactive multimedia online decision aid was more effective than printed education materials. However, the study could not differentiate the effect of the multimedia online decision aid from control making it difficult to determine how effective this intervention would actually be. In addition, this study was at high risk of bias and the decision aid was no longer available online for the committee to view and make a judgement on how useful it might be. Kriss 2017 showed that an interactive electronic book was more effective at increasing pertussis vaccine uptake in pregnant women than control, while in DiClemente 2015 a computer-based media presentation could not be differentiated from control for HPV vaccine uptake for young people aged 11-18 years. The committee noted that interactive forms of information and education could be helpful in facilitating informed decision making, but that current evidence was limited and had variable results. They also took into account the qualitative evidence in review J that looked at the acceptability of the Shourie 2013 intervention. This highlighted that parents felt that the decision aid helped them make an informed choice on MMR vaccination and reduced their need to ask further questions to healthcare practitioners. Due to the mixed results for the use of interactive decision aids the committee did not include a separate recommendation for them to be available as part of the decision-making process. However, they were included in a recommendation which lists the information that should be included with a vaccine invitation if they are available from trusted sources of information such as the WHO (see below for more details).

The committee also noted that while the evidence compared different formats of providing information or education, none compared different ways of phrasing this information, such as positive phrasing (“gaining immunity to a disease) compared to negative phrasing (“avoiding catching a disease”). This could be an important comparison, as a small change to the wording of information could potentially make a difference to vaccination uptake. This also applies to the framing of the invitation and any subsequent reminders. In the reminders review (evidence review C), there was limited evidence about the wording of these communications and the evidence identified (Hawe 1998) was considered to be flawed by the committee because the content as well as the framing of the information was different between the interventions making it hard to assign any improvements in vaccine uptake to the use of a health belief model over a neutrally worded postcard. The committee therefore made a recommendation for future research to compare these different methods of phrasing the invitation and accompanying information to help understand whether certain methods of framing of information would be more effective at encouraging vaccine uptake than others (for example, gaining immunity to disease versus avoiding catching a disease). (Appendix L).

The evidence indicated that video information was better than control at increasing vaccine uptake and that video and printed materials were also effective compared to control. It was unclear whether healthcare practitioners would be the most effective at delivering the education or information as the results could not differentiate education/ information interventions delivered by these people compared to control. Lay educators were effective at increasing vaccine uptake but there was only evidence available for this from a single study.

Due to the absence of strong evidence in favour of specific education interventions and the associated cost of delivering them in comparison to providing information, the committee agreed to recommend providing information over more labour-intensive educational interventions. They discussed when this information could be given and agreed that it was helpful to provide information at the same time as the initial invitation and with subsequent reminders. They therefore included information as part of the suggested contents for invitations. The committee made the recommendations for the contents of the invitations based on the limited quantitative evidence, their expertise and the requirements for information/ education that were raised in the qualitative review of barriers and facilitators to vaccine uptake (see evidence review B for details, summarised in the qualitative evidence in section 1.1.6 and mixed methods diagram above).

The committee agreed that invitations and reminders should be written in a user-friendly way with simple, clear language that is easy to understand, it should not use abbreviations and other jargon and the name of the vaccine should be written out in full. The committee agreed that it is good practice to use clear and informative language in general, but this is especially important in this case because the recipient might be short of time, have poor levels of literacy or not have English as a first language. They also agreed that invitations and recalls should briefly say what disease(s) the vaccine(s) aim to prevent to provide motivation for the recipient to seek vaccination. For example, “The meningococcal vaccine aims to prevent meningitis and blood poisoning”.

The committee agreed that the invitation or reminder should also contain the following:

- A statement that the NHS and your provider (with the provider’s name inserted) recommends the vaccination. The committee agreed that people were more likely to accept vaccination from a known health care provider that they have a relationship with, such as their midwife. This was supported by the qualitative evidence (see evidence reviews B and F for more details). The committee also thought that it is important that people are aware that vaccination is recommended by the NHS and that this may help some people decide to accept vaccination

- Details of how to contact a healthcare practitioner to discuss vaccination should the recipient have any questions. This could include a discussion about possible contraindications and allergies, which can make people unsure whether they can safely have a particular vaccination. The committee agreed that this is important because some people may not attend for vaccination if they have not had their questions answered in advance. Providing contact details should make arranging this discussion easier.

- An invitation for recipients to book appointments for vaccination and information about how to book the appointment (with a hyperlink to online booking system if this is available) to make it easier for them to make the booking. If drop-in clinics are also available, it is important to let people know about them as this might reduce difficulties with access (see Evidence Review D for more discussion about interventions to increase uptake by improving access).

- A reminder to bring any relevant patient-held records for updating because the qualitative evidence from the identification of eligibility review (evidence review A) highlighted that people wanted to have accurate records for their vaccinations or for their children or people they were responsible for (where appropriate). In addition, accurate patient-held records could be used to facilitate opportunistic identification and vaccination of eligible people.

The committee agreed that ideally, the vaccination invitation would contain additional information (see below), but they recognised that this might not be possible if the invitation was made using a postcard or another format with limited space. In these cases, the person could be directed to other sources of information using a short sentence.

Where space allows the committee agreed that the invitations should contain the following:

- Information about disease severity because from the qualitative evidence some people underestimated the impact of the diseases being discussed (such as measles and shingles) and increased understanding could remove this barrier to uptake.

- Information about the benefits and risks of the vaccine(s) being offered. The qualitative evidence showed that many individuals or parents were worried about the types and severity of side effects and thought that these were being understated or hidden from them. Clearly communicating the risk and severity of side effects compared to the benefits could prove helpful in the individual deciding in favour of vaccination. The committee also noted that benefits of vaccination can extend beyond the individual to the community as population/herd immunity. This benefit of vaccination was only raised by one study in the qualitative evidence and did not appear to play a large part in decision making by individuals, parents, or carers, but this may be due to a lack of awareness and understanding of this concept. The committee thought that people may be more willing to be vaccinated in some under vaccinated communities if they thought that they were protecting their neighbours and people who were unable to be vaccinated for medical reasons. The qualitative evidence relating vaccination of pregnant women (see evidence review B for more details) and the review of interventions to increase vaccine uptake in pregnant women (evidence review F) also highlighted that some people were concerned about the effects of pertussis vaccination on the developing baby and did not understand the benefits to the baby. They therefore included a statement to highlight this issue in the recommendation under individual benefits.

- Where the vaccination is part of a course of vaccinations, an explanation of why it is important to accept all of the doses to ensure complete protection from the target disease. The committee agreed that this was important because many people do not finish the vaccination course and do not understand why boosters are necessary.

- Information about vaccinations that are given at specific ages, where relevant. This was particularly important for the HPV vaccination because the qualitative evidence showed that people did not understand why it was being given to adolescent girls and there was resistance in some cases to vaccinating them based on their age.

- References to further information from trusted sources, such as the National Institute for Health Protection, Oxford University's Vaccine Knowledge Project, NHS England or the World Health Organisation to help provide answers to any questions the recipient may have about the vaccines or vaccination process. The trusted sources should ideally have information available in a variety of languages. The committee included videos as a source of information because the evidence showed that this intervention was better than control at increasing vaccine uptake. They also included reference to interactive information, where available from trusted sources, because there was some evidence that these were effective at increasing vaccine uptake (see above for more discussion about this point). Hyperlinks or QR codes could be useful for some people, but the committee recognised that not everyone has access to a smart-phone or can afford data to use them. The committee therefore agreed that having a variety of options would be best because in their experience, different people prefer and are able to access different forms of information/education. The committee also noted that the provision of high-quality sources of information that is accessible agrees with the recommendations in the NICE shared decision-making guideline about putting shared decision making into practice.

Using appointments/ consultations to discuss vaccinations

The committee did not recommend vaccination education because this was not supported by the quantitative evidence, would be costly, time consuming and could be unnecessary for the

majority of people who are provided with relevant information. However, they did include an invitation to discuss vaccination for people who had questions to help ensure that these people had the chance to reach an informed decision. Making people aware of the opportunity to discuss vaccinations is important as it will give people who have concerns about vaccination the chance to address those concerns and make an informed decision. However, the committee discussed that, in their experience, the time allocated to vaccination appointments can be relatively short despite the number of tasks that need to be completed during an appointment. As the committee could not recommend a specific length of time for vaccination appointments, they decided to include a recommendation for providers which states that sufficient time should be provided to complete all of the necessary steps during a vaccination appointment. This includes discussing any concerns about vaccination as well as gaining consent, administering vaccines and completing documentation. The importance of this recommendation was further supported by the qualitative evidence (see evidence review B), where nurses, individuals and parents reported that they felt there was not enough time in vaccination appointments to discuss vaccinations, and that the appointments often felt rushed. Additional qualitative evidence related to vaccinations for babies and children during the COVID-19 pandemic highlighted that nurses had to phone parents to encourage them to attend vaccination appointments. Nurses reported that a benefit of these phone calls was the additional time they had to discuss any concerns that parents had about vaccinations. Providing more time for discussions like this within vaccination appointments will allow people to make informed decisions, not feel pressured into making a rushed decision, and potentially increase the number of people who consent to vaccination.

Tailored education/information was marginally more effective at increasing vaccine uptake than control whilst generic education/information could not be differentiated from control. This evidence was very low quality and the committee decided that this information was not sufficient for them to recommend tailored information over generic information, especially because tailored Information/education could be more difficult and more expensive to implement. However, they were aware of the importance of ensuring that there is suitable literature to support the discussions that take place within appointments to help people to make informed decisions. The choice of literature should be based on people's individual needs, such as whether it is needed in a different language or whether easy read materials are required.

Training and education for health and social care practitioners

Evidence for education/information for providers was very low quality and could not differentiate vaccine uptake from control. However, the committee noted from the qualitative evidence that healthcare providers raised poor vaccination communication skills and a lack of confidence as barriers to vaccine uptake that could be overcome by training in how to discuss vaccinations and information about safety and effectiveness. Although there was limited quantitative evidence in this review to support of the need for staff education and training, one intervention from the multicomponent review (Fiks 2013 - see evidence review H) highlighted how a provider-based intervention that included staff education resulted in greater vaccine uptake than control. This supported the findings from the qualitative evidence about the importance of staff education to help staff feel confident when discussing vaccination with people, and when delivering vaccines.

The committee discussed the importance of education not only for the people directly involved in giving vaccinations, but also for other people who are in contact with those eligible for vaccination, such as staff in GP surgeries and those who work in social care. Although the evidence focused on people who give vaccinations rather than other staff, the committee thought, based on their clinical knowledge and experience, that education for both groups is important. Three recommendations were therefore made in relation to provider and staff education. The first is designed to identify healthcare practitioners who are not directly involved in vaccine delivery but who come into contact with eligible people to ensure that they have access to education about vaccinations. The committee agreed that these could

include secondary care staff and staff working in primary care settings, including GP surgeries, optometry, NHS dentists and community pharmacies. Social care practitioners may also be important because they come into contact with eligible people during home visits, individual needs assessments and carers' assessments. The committee then made a recommendation to cover what information they thought these people should be provided with including a basic knowledge of immunisation practices including the benefits of vaccination, barriers to vaccination and the routine schedule so that they can feel more confident when discussing vaccination. It also includes where to signpost people if they want more detailed information about vaccination. However, they noted that people in certain roles, such as GP receptionists, would need very different amounts and levels of complexity of information compared to people who are healthcare practitioners but not involved in administering vaccinations. They therefore agreed that the content and depth of information provided to people should vary depending on their specific role, and that this need to tailor the education to the individual's role should be considered when training is planned.

The third recommendation is to ensure that people who deliver immunisations are fully trained, aware of the main issues associated with vaccination, and feel confident when giving vaccinations. The committee were aware of the UKHSA (formally Public Health England's)) national minimum standards and core curriculum for immunisation training for registered healthcare practitioners and they therefore did not need to specify the details of what this training should cover. They noted that this training is mandatory for staff delivering vaccinations and included a bullet point to highlight that this training should also be part of a continuing professional development plan. The committee noted that although training is available there may be problems with finding time to complete it and they agreed that it is important that staff are provided with time, resources and support to undertake training. From the qualitative evidence staff reported that they would like training in communicating information about vaccinations to individuals and their parents (as appropriate) and that they were not necessarily trained in how to correctly administer the vaccinations. These topics are covered by the PHE training standards, but the committee included the requirement to be able to offer and administer vaccinations as a separate bullet point because they thought that this point was worth highlighting.

The committee also highlighted the need for providers to be able to tailor the information they provide to the needs of the individual and to be able to ask for any questions and concerns people may have about vaccination and respond to them appropriately. However, the committee recognised that there would be times when the provider would be unable to answer every question and that in these cases, they should refer the person to an appropriate source of information. This could be another provider in the same location or another location or online sources of information, for example the Oxford University's Vaccine Knowledge Project.

In addition, the committee recognised the importance of providers being able to have effective and sensitive vaccination conversations. Effective conversations include the ability to adapt what content to discuss, or how to deliver and discuss the content, to be most effective at addressing people's concerns. At times during conversations providers may need to be particularly sensitive to people's feelings of stigma that can act as a barrier to vaccination, such as those that may be associated with having HIV.

The committee agreed that it is important for health care practitioners who administer vaccines understanding when a vaccine is contraindicated or when it can still be delivered. This is particularly important as there can be times when a person may think they have an allergy or condition that means they cannot be vaccinated, when they actually could be given a vaccine. They should also be aware that they can consult the Green book for more information about this topic and know when and how to seek expert help, such as from an allergy specialist. (See review A for more information about the committee's discussions concerning allergies and contraindications).

The committee also thought that it was important that people are made aware of how to overcome some specific individual barriers to vaccination, as this will help to improve access to vaccination for a range of people. Such barriers could include those experienced by people with learning difficulties who may need easy read materials or alternative formats of vaccination if they are available; people with needle phobia and people who have sensory impairments and may need additional assistance to access vaccinations.

These recommendations are aimed at increasing staff confidence in the processes and issues relating to vaccination, and at making every contact count to increase the opportunities for people to discuss vaccination with healthcare staff, both of which were highlighted as potential facilitators for vaccination in the qualitative evidence review (see evidence review B).

1.1.12.4 Cost effectiveness and resource use

The committee agreed that none of the included cost-effectiveness studies were robust enough to form the basis of recommendations by themselves. Whilst the Tubeuf study was testing a relevant intervention (a decision aid) in the UK, the small sample size, reliance on expected future contacts with healthcare services rather than actual contacts for some of the costing data, and the high levels of vaccine uptake in the control arm, means they could not be confident the study demonstrated a benefit from the use of a decision aid, and therefore did not feel it was possible to make a recommendation for this.

The results of the Zhou study were agreed not to be generalisable to the UK. The lowest hepatitis B prevalence considered for the target population in that study was 30%, and the committee agreed this was higher than any comparable population in the UK, and therefore it would be inappropriate to extrapolate the results. Finally, the Weaver study results were agreed not to be directly applicable, as they came from the US, which has very different systems for vaccination than the UK. However, they did agree the finding that a programme is more cost-effective when it combines interventions for flu and pneumococcal vaccinations than when they are done separately (because the same benefits can be achieved, but with lower administrative costs) would also be true here. They agreed this provided support for the recommendation to combine vaccination services wherever possible.

The evidence was agreed to be insufficient to support making specific recommendations for additional education interventions for individuals requiring vaccination. The committee agreed though that people did need to be provided with enough information to be able to make informed decisions. In the absence of evidence on how or when this should be provided, the committee agreed the most efficient method was to provide this information alongside other contact that was already being made with the individual (for example, alongside initial invitations or reminders to attend appointments). This information could take the forms of links to already available information sources, and therefore there should be no additional costs associated with providing this information.

The committee discussed training and education about vaccination for health and social care staff in contact with those eligible for vaccination, and made recommendations for different levels of training and education based on the role of the staff member in the vaccination process. The committee recommended that those who are not directly involved in vaccine delivery should receive education to understand who is eligible for routine vaccination, where to signpost people for information and for vaccination, who to contact for further information, and the benefits of vaccination. Although this education would likely require some additional resources in terms of compiling the information, the content is generally available, and the costs associated with delivering the information could be contained by providing materials (e.g. a booklet or accessible webpage) rather than delivering education in person.

For health and social care staff who are delivering immunisations the committee recommended that time, resources and support be provided to those staff to allow them to: complete mandatory vaccination training, complete vaccination training as part of their

continuing professional development plan, be able to provide tailored information on risks and benefits of vaccination, and be able to offer and administer vaccination. Some of the staff delivering vaccinations would be the immunisation leads described in the section on service organisation, who would already be required to complete the mandatory training, and this recommendation would not require additional resources. Additionally, having these immunisation leads is likely to reduce the number of staff required to deliver vaccinations, therefore minimising the number of staff requiring additional training and resources.

The committee recommended that providers should ensure there is sufficient time in vaccination appointments to discuss and address any concerns, gain informed consent, administer vaccines, and complete documentation. This recommendation is not expected to have a substantial resource impact because although additional staff time can be costly, it is expected that only a relatively small proportion of people eligible for vaccination will need a longer appointment for the purposes of addressing specific concerns. Additionally, the activities that should be carried out during a vaccination appointment are already current practice, so it is not likely that the recommendation will result in longer appointments.

1.1.12.5 Other factors the committee took into account

The qualitative evidence highlighted that some people (including some immigrants and Gypsy, Roma and Travellers) experience language barriers which can prevent them from accessing information about the importance of vaccination. The committee therefore agreed that the information and reminder should be provided in an appropriate language for the recipient, where possible. In addition, they recognised that some people were either illiterate or had low levels of literacy and that it is important that this is taken into account to ensure that they receive the invitation and information in a format that they can access. This could include providing verbal rather than written information.

The NHS has a legal obligation to provide information in an accessible format. The committee made a recommendation to highlight this important point and provide links to the NHS Accessible Information Standard and the NICE guidelines on patient experience in adult NHS services and shared decision making to help ensure that people are able to access the information provided and make informed decisions about vaccination.

The committee discussed other barriers to vaccine uptake faced by some new migrants and asylum seekers. They noted that these people may have started vaccinations outside of the UK but not completed the course or they may be eligible for other vaccinations. In the qualitative evidence these people reported difficulties in navigating the UK health system (see evidence review B). The committee therefore recommended that information about UK vaccination schedules should be provided for these people. The committee also recognised that information alone might be insufficient and that these people might need further help in understanding the information and accessing healthcare. Based on the qualitative evidence related to the acceptability review (evidence review I), the committee also decided to add a statement to this recommendation to highlight that the expectations of these people about who delivers vaccines can vary depending on their cultural background. This will help to raise awareness of why some people might be more hesitant about vaccinations.

The committee also discussed the problems of obtaining vaccination histories from people who have come from abroad. This was raised in the qualitative evidence (see evidence review B). The committee noted that there is PHE guidance about the vaccination of individuals with uncertain or incomplete immunisation status) and that according to this, unless there is a documented or reliable, verbal vaccine history individuals should be assumed to be unimmunised and a full course of immunisations planned. The committee agreed that where uncertainty remained about vaccination status it is appropriate to take this approach because duplicating vaccinations is not harmful but remaining unvaccinated could leave people open to infection.

The committee were aware of the importance of ensuring that the parents or carers of babies who are in the neonatal unit receive all the necessary information about their baby's vaccinations. While these babies will still be eligible for routine vaccinations, they may be given them in the hospital, rather than with the GP. It is therefore important that their parents or carers receive the same information about the safety and effectiveness of the vaccinations as other parents and carers, but with information about when and where the vaccinations will take place that is tailored to their circumstances.

The committee discussed the economic evidence for education/ information and reminders interventions and noted that bundling influenza and pneumococcal vaccination reminders and education together was more cost effective than targeting pneumococcal vaccination separately (see Weaver 2001 in the economic evidence section for more details). They agreed that in some cases, such as this one, bundling different vaccination invitations and reminders together could be an effective way of increasing uptake of vaccinations and could reduce the number of reminders and vaccination appointments required. They therefore recommended that this approach should be considered.

Future proofing the recommendations

In the evidence reviews we looked for evidence regarding routine vaccinations for people aged 65 and over because this was the age limit for vaccinations for older people on the NHS routine schedule at the time the work was carried out. Since there was limited evidence for this age group, we also included data from relevant studies including people aged 50 and over, where the majority of participants were in our target age group, or the mean age was 65 or over with committee agreement taken on a review-by-review basis. These studies were downgraded for applicability where the committee deemed it appropriate.

According to the Joint Committee on Vaccination and Immunisation minutes from the meeting on 22 June 2021, shingles vaccination eligibility is changing to include people aged 60 and over and this will be introduced in a phased manner down from the current age of 70 years. It is unclear when this change will be initiated or completed. In order to future proof the guideline recommendations we have therefore changed those mentioning people aged 65 and over to refer to older people instead and defined them as follows: adults who are eligible for routine vaccination on the UK schedule, excluding pregnancy-related vaccinations. We also suggest that people consult the green book for information about current age limits and vaccinations for older people. The content of the recommendations has not been changed otherwise as this was not deemed necessary. The majority of recommendations that apply to older people are also more generally applicable and have not been altered because they do not mention groups of people by age. The committee discussions of the evidence have also been retained in their original form, with the addition of the information about the use of the term older people where the relevant recommendations that specifically mentioned people aged 65 and over are discussed.

1.1.13 Recommendations supported by this evidence review

This evidence review supports recommendations 1.1.19- 1.1.21, 1.2.13, 1.3.2- 1.3.5, 1.3.11- 1.3.14 and the research recommendation on different types of content in a vaccination invitation. Other evidence supporting these recommendations can be found in the evidence reviews on the barriers to and facilitators for vaccine uptake (evidence review B), the acceptability and effectiveness of specific interventions (review J), interventions to increase vaccine uptake in pregnant women (evidence review F), multicomponent interventions to increase vaccine uptake (evidence review H) and interventions to increase uptake by increasing acceptability (evidence review I).

1.1.14 References – included studies

1.1.14.1 Effectiveness

Education interventions

Systematic review

Kaufman J, RyanR, Walsh L, Horey D, Leask J, Robinson P, Hill S. Face-to-face interventions for informing or educating parents about early childhood vaccination. Cochrane Database of Systematic Reviews 2018, Issue 5. Art. No.: CD010038.

Randomised controlled trials and cluster randomised controlled trials

Bartu A, Sharp J, Ludlow J et al. (2006) Postnatal home visiting for illicit drug-using mothers and their infants: a randomised controlled trial. The Australian & New Zealand journal of obstetrics & gynaecology 46(5): 419-426

Chamberlain, A T, Seib, K, Ault, K A et al. (2015) Improving influenza and Tdap vaccination during pregnancy: A cluster-randomized trial of a multi-component antenatal vaccine promotion package in late influenza season. Vaccine 33(30): 3571-9

Chodick, G.; Teper, G.R.; Levi, S.; Kopel, H.; Kleinbort, A.; Khen, E.; Schejter, E.; Shalev, V.; Stein, M.; Lewis, N.; The impact of a Facebook campaign among mothers on HPV vaccine uptake among their daughters: A randomized field study; Gynecologic Oncology; 2021; vol. 160 (no. 1); 106-111

Cowan, J A; Heckerling, P S; Parker, J B (1992) Effect of a fact sheet reminder on performance of the periodic health examination: a randomized controlled trial. American journal of preventive medicine 8(2): 104-9

Dempsey, Amanda F, Maertens, Julie, Sevick, Carter et al. (2019) A randomized, controlled, pragmatic trial of an iPad-based, tailored messaging intervention to increase human papillomavirus vaccination among Latinos. Human vaccines & immunotherapeutics 15(78): 1577-1584

Dempsey, Amanda F, Pyrznawoski, Jennifer, Lockhart, Steven et al. (2018) Effect of a Health Care Professional Communication Training Intervention on Adolescent Human Papillomavirus Vaccination: A Cluster Randomized Clinical Trial. JAMA pediatrics 172(5): e180016

DiClemente, Ralph J, Murray, Colleen Crittenden, Graham, Tracie et al. (2015) Overcoming barriers to HPV vaccination: A randomized clinical trial of a culturally-tailored, media intervention among African American girls. Human vaccines & immunotherapeutics 11(12): 2883-94

Dixon, Brian E, Zimet, Gregory D, Xiao, Shan et al. (2019) An Educational Intervention to Improve HPV Vaccination: A Cluster Randomized Trial. Pediatrics 143(1)

Esposito, Susanna, Bianchini, Sonia, Tagliabue, Claudia et al. (2018) Impact of a website based educational program for increasing vaccination coverage among adolescents. Human vaccines & immunotherapeutics 14(4): 961-968

Gilkey, MB, Dayton, AM, Moss, JL et al. (2014) Increasing provision of adolescent vaccines in primary care: a randomized controlled trial. Pediatrics 134(2): e346-53

Glanz, Jason M, Wagner, Nicole M, Narwaney, Komal J et al. (2017) Web-based Social Media Intervention to Increase Vaccine Acceptance: A Randomized Controlled Trial. Pediatrics 140(6)

Glanz, J.M.; Wagner, N.M.; Narwaney, K.J.; Pyrzanowski, J.; Kwan, B.M.; Sevick, C.; Resnicow, K.; Dempsey, A.F.; Web-Based Tailored Messaging to Increase Vaccination: A Randomized Clinical Trial; Pediatrics; 2020; vol. 146 (no. 5); e20200669

Grandahl, Maria, Rosenblad, Andreas, Stenhammar, Christina et al. (2016) School-based intervention for the prevention of HPV among adolescents: a cluster randomised controlled study. BMJ open 6(1): e009875

Hannan, Jean (2013) APN telephone follow up to low-income first time mothers. Journal of Clinical Nursing 22(12): 262-270

Hofstetter, Annika M, Barrett, Angela, Camargo, Stewin et al. (2017) Text message reminders for vaccination of adolescents with chronic medical conditions: A randomized clinical trial. Vaccine 35(35ptb): 4554-4560

Jackson, Cath, Cheater, Francine M, Harrison, Wendy et al. (2011) Randomised cluster trial to support informed parental decision-making for the MMR vaccine. BMC public health 11: 475

Jacobson, T A, Thomas, D M, Morton, F J et al. (1999) Use of a low-literacy patient education tool to enhance pneumococcal vaccination rates. A randomized controlled trial. JAMA 282(7): 646-50

Joseph, Natalie Pierre, Bernstein, Judith, Pelton, Steve et al. (2016) Brief Client-Centered Motivational and Behavioral Intervention to Promote HPV Vaccination in a Hard-to-Reach Population: A Pilot Randomized Controlled Trial. Clinical pediatrics 55(9): 851-9

Kriss, Jennifer L, Frew, Paula M, Cortes, Marielysse et al. (2017) Evaluation of two vaccine education interventions to improve pertussis vaccination among pregnant African American women: A randomized controlled trial. Vaccine 35(11): 1551-1558

Lee, Haeok, Kim, Minjin, Cooley, Mary E et al. (2018) Using narrative intervention for HPV vaccine behavior change among Khmer mothers and daughters: A pilot RCT to examine feasibility, acceptability, and preliminary effectiveness. Applied nursing research : ANR 40: 51-60

O'Leary, S.T., Narwaney, K.J., Wagner, N.M. et al. (2019) Efficacy of a Web-Based Intervention to Increase Uptake of Maternal Vaccines: An RCT. American Journal of Preventive Medicine 57(4): e125-e133

Payakachat, Nalin; Hadden, Kristie B; Ragland, Denise (2016) Promoting Tdap immunization in pregnancy: Associations between maternal perceptions and vaccination rates. Vaccine 34(1): 179-86

Porter-Jones, G, Williams, S, Powell, C et al. (2009) Impact of a novel way to communicate information about MMR on uptake of MMR vaccine: a randomized controlled trial. Public health 123(1): 78-80

Pot, Mirjam, Paulussen, Theo Gwm, Ruiter, Robert Ac et al. (2017) Effectiveness of a Web-Based Tailored Intervention With Virtual Assistants Promoting the Acceptability of HPV Vaccination Among Mothers of Invited Girls: Randomized Controlled Trial. Journal of medical Internet research 19(9): e312

Santa Maria, D.; Markham, C.; Misra, S.M.; Coleman, D.C.; Lyons, M.; Desormeaux, C.; Cron, S.; Guilamo-Ramos, V.; Effects of a randomized controlled trial of a brief, student-nurse led, parent-based sexual health intervention on parental protective factors and HPV vaccination uptake; BMC public health; 2021; vol. 21 (no. 1); 585

Saitoh, Aya, Saitoh, Akihiko, Sato, Isamu et al. (2017) Effect of stepwise perinatal immunization education: A cluster-randomized controlled trial. Vaccine 35(12): 1645-1651

Saitoh, Aya, Nagata, Satoko, Saitoh, Akihiko et al. (2013) Perinatal immunization education improves immunization rates and knowledge: A randomized controlled trial. Preventive Medicine 56(6): 398-405

Scarinci, I.C.; Hansen, B.; Kim, Y.-I. (2020) HPV vaccine uptake among daughters of Latinx immigrant mothers: Findings from a cluster randomized controlled trial of a community-based, culturally relevant intervention. Vaccine 38(25): 4125-4134

Shourie, S, Jackson, C, Cheater, F M et al. (2013) A cluster randomised controlled trial of a web based decision aid to support parents' decisions about their child's Measles Mumps and Rubella (MMR) vaccination. Vaccine 31(50): 6003-10

Thomas, Donna M, Ray, Susan M, Morton, Felicia J et al. (2003) Patient education strategies to improve pneumococcal vaccination rates: randomized trial. Journal of investigative medicine: the official publication of the American Federation for Clinical Research 51(3): 141-8

Tiro, Jasmin A, Sanders, Joanne M, Pruitt, Sandi L et al. (2015) Promoting HPV Vaccination in Safety-Net Clinics: A Randomized Trial. Pediatrics 136(5): 850-9

Underwood, Natasha L, Weiss, Paul, Gargano, Lisa M et al. (2015) Human papillomavirus vaccination among adolescents in Georgia. Human vaccines & immunotherapeutics 11(7): 1703-8

Winer, Rachel L, Gonzales, Angela A, Noonan, Carolyn J et al. (2016) A Cluster-Randomized Trial to Evaluate a Mother-Daughter Dyadic Educational Intervention for Increasing HPV Vaccination Coverage in American Indian Girls. Journal of community health 41(2): 274-81

Zuniga de Nuncio, Maria Luisa, Nader, Philip R, Sawyer, Mark H et al. (2003) A prenatal intervention study to improve timeliness of immunization initiation in Latino infants. Journal of community health 28(2): 151-65

Education and reminder interventions

Randomised controlled trials and cluster randomised controlled trials

Dapp U; Anders JA; von Renteln-Kruse W; Minder CE; Meier-Baumgartner HP; Swift CG; Gillmann G; Egger M; Beck JC; Stuck AE; ; A randomized trial of effects of health risk appraisal combined with group sessions or home visits on preventive behaviors in older adults.; The journals of gerontology. Series A, Biological sciences and medical sciences; 2011; vol. 66 (no. 5)

Fiks, Alexander G, Grundmeier, Robert W, Mayne, Stephanie et al. (2013) Effectiveness of decision support for families, clinicians, or both on HPV vaccine receipt. Pediatrics 131(6): 1114-24

Freed, G. L., Freeman, V. A., Mauskopf, A., & Jacobson RM (1999) Age-appropriate immunization laws: A randomized trial of information dissemination. Ambulatory Child Health 5(1): 43-51

Gutschi, L.M., Vaillancourt, R., Homes, M. et al. (1998) Effect of pharmacist interventions on pneumococcal and influenza vaccination rates: A seamless care approach. Canadian Pharmaceutical Journal 131(8): 32-38

Harari, Danielle, Iliffe, Steve, Kharicha, Kalpa et al. (2008) Promotion of health in older people: a randomised controlled trial of health risk appraisal in British general practice. Age and Ageing 37(5): 565-571

Henrikson NB, Zhu W, Baba L et al. (2018) Outreach and Reminders to Improve Human Papillomavirus Vaccination in an Integrated Primary Care System. Clinical pediatrics 57(13): 1523-1531

Krieger, J W, Castorina, J S, Walls, M L et al. (2000) Increasing influenza and pneumococcal immunization rates: a randomized controlled study of a senior center-based intervention. American journal of preventive medicine 18(2): 123-31

Mason, B W and Donnelly, P D (2000) Targeted mailing of information to improve uptake of measles, mumps, and rubella vaccine: a randomised controlled trial. Communicable disease and public health 3(1): 67-8

O'Sullivan AL and Jacobsen BS (1992) A randomized trial of a health care program for first-time adolescent mothers and their infants. Nursing research 41(4): 210-215

Otsuka-Ono H, Hori N, Ohta H et al. (2019) A childhood immunization education program for parents delivered during late pregnancy and one-month postpartum: a randomized controlled trial. BMC health services research 19(1): 798

Quinlivan, Julie A; Box, Helen; Evans, Sharon F (2003) Postnatal home visits in teenage mothers: a randomised controlled trial. The Lancet 361(9361): 893-900

Richman, A; Torres, E (2019) Text and Email Messaging for Increasing Human Papillomavirus Vaccine Completion among Uninsured or Medicaid-insured Adolescents in Rural Eastern North Carolina. Journal of health care for the poor and underserved 30(4): 1499-1517

Stuck AE; Moser A; Morf U; Wirz U; Wyser J; Gillmann G; Born S; Zwahlen M; Iliffe S; Harari D; Swift C; Beck JC; Egger M; Effect of health risk assessment and counselling on health behaviour and survival in older people: a pragmatic randomised trial.; PLoS medicine; 2015; vol. 12 (no. 10)

Tiro, Jasmin A, Sanders, Joanne M, Pruitt, Sandi L et al. (2015) Promoting HPV Vaccination in Safety-Net Clinics: A Randomized Trial. Pediatrics 136(5): 850-9

1.1.14.2 Economic

Tubeuf, Sandy, Edlin, Richard, Shourie, Swati et al. (2014) Cost effectiveness of a web-based decision aid for parents deciding about MMR vaccination: a three-arm cluster randomised controlled trial in primary care. The British journal of general practice : the journal of the Royal College of General Practitioners 64(625): e493-9

Weaver, M, Krieger, J, Castorina, J et al. (2001) Cost-effectiveness of combined outreach for the pneumococcal and influenza vaccines. Archives of internal medicine 161(1): 111-20

Zhou, Fangjun, Euler, Gary L, McPhee, Stephen J et al. (2003) Economic analysis of promotion of hepatitis B vaccinations among Vietnamese-American children and adolescents in Houston and Dallas. Pediatrics 111(6pt1): 1289-96

Appendices

Appendix A – Review protocols

Review protocol to identify effective interventions to improve uptake of routine vaccines

ID	Field	Content
0.	PROSPERO registration number	Not applicable
1.	Review title	Identifying effective interventions to improve uptake of routine vaccines.
2.	Review questions	What are the most effective interventions for increasing the uptake of routine vaccines?
3.	Objectives	To identify effective strategies to improve routine vaccine uptake.
4.	Searches	The following databases will be searched: • Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • Embase • MEDLINE • Medline in process • Medline epubs ahead of print • Emcare • Psycinfo • Sociological Abstracts • ASSIA • DARE • Econlit (economic searches) • NHS EED (economic searches) • HTA (economic searches) • Other subject specific databases as appropriate for the quantitative review Searches will be restricted by: • Studies published since 1990 • English language • Human studies • Qualitative, Systematic Review, RCT, OECD geographic filters as appropriate Other searches: • Reference searching where appropriate

		• Citation searching where appropriate • Inclusion lists of systematic reviews • Websites where appropriate The searches will be re-run 6 weeks before final submission of the review and further studies retrieved for inclusion. The full search strategies for MEDLINE database will be published in the final review.
5.	Condition being studied	Uptake of vaccines on the routine NHS schedule
6.	Population	Inclusion: • All people who are eligible for vaccines on the routine UK immunisation schedule and their families and carers (if appropriate). • Staff including, but not limited to, those providing advice about or administering vaccines and those people with relevant administrative or managerial responsibilities. Exclusion: None
7.	Interventions and factors of interest	Interventions including, but not confined to: 1. Information, education and methods of communicating them: Interventions to provide information including: • online campaigns including social media and apps • radio campaigns • letters by mail • printed materials (e.g. leaflets) • multi-media campaigns • TV and online advertising (including pop up adverts) • posters • online information exchange- fill in questionnaire and get information Educational interventions (delivery methods): • face-to-face sessions • telephone conversations • social media with responses • interactive multi-media interventions (e.g. case studies on GP websites; e-learning) • interactive community events (e.g. talks with question and answer sessions) • peer education (carried out by a community member who shares similar life experiences to the community they are working with)

		• lay education (carried out by community members working in a non- professional capacity)
		• multicomponent interventions targeting education
		• vaccine hotlines and special advisory clinics for health professionals
		
		Who provides the information and/or advice and how they do so, including:
		• Vaccine champions:
		  ○ Practitioners
		  ○ Peers
		  ○ Community leaders
		• Interventions to train staff and other people on how best to communicate the information/ run educational sessions.
		• Recommendations to vaccinate from people/groups including:
		  ○ Medical and other staff (for example, GPs, nurse, health visitors, midwives,)
		  ○ Social workers
		  ○ Community leaders
		  ○ Religious leaders
		  ○ Peers
		  ○ Teachers
		
		Information and education can be provided during home visits, during interactions with health and social care workers, at support group meetings for people using other services etc. This may involve providing a contact point for more information.
		
		Types of information include PHE bulletins and local bulletins for providers.
		
		2. Vaccination reminders aimed at providers or individuals including:
		
		Reminder and recall systems (aimed at provider)
		• clinical alerts and prompts
		• national alerts to local teams
		• local recall initiatives
		
		Personal invitation to be vaccinated from:
		• GP
		• community pharmacist
		• health or social care worker
		• from several professionals
		
		Reminders to individuals/ eligible groups by:
		• text messages
		• electronic invitations (via apps)

		• emails • letter • phone calls • posters • postcards 3. Interventions targeting acceptability: • Alternative forms of vaccinations (e.g. injections, formulations) • Alternative settings • Alternative vaccine providers (e.g. doctor administering vaccine instead of nurse) 4. Interventions to improve access including: Expanding access in healthcare, such as: • Reducing distance/time to access vaccinations • Out of hour or drop-in services • Delivering vaccines in clinical settings in which they were previously not provided Vaccination clinics in community settings: • community pharmacies • antenatal clinics • specialist clinics (e.g. drug and alcohol services, mental health services) • community venues (e.g. libraries, children's centres) Dedicated clinics for specific/ all routine vaccinations: • Mass vaccination clinics in community or other settings (e.g. schools) • Walk in or open access immunisation clinics Extended hours clinics • weekends evenings (after 6 pm) • early mornings (before 8 am) • 24-hour access Outreach interventions or mobile services: • home or domiciliary or day centre visits • support group meeting visits • residential or care home visits • special school visits • inpatient visits • custodial visits • immigration settings • mobile clinics (e.g. in community) Parallel clinics

		• Offer vaccination in parallel with regular appointments (e.g. with midwives, clinicians, inpatient and outpatient clinics, long stay wards, etc.) • coordinated timing of other programmes (such as child developmental checks) Opportunistic vaccinations: • visits to GP, practice nurse or consultant for other medical conditions including STI clinics, drug and alcohol programmes • having vaccinations provided in hospitals or accident and emergency departments • may involve a dedicated person to administer the vaccines. 5. Interventions to improve infrastructure (targeting processes, staffing and settings): Booking systems • dedicated vaccination lines or online systems Organisation of local provider-based systems: • Local area approaches • Systems and processes in place to work with the community • Practice level approaches • Assigned lead for a specific vaccination programme • Having staff who are competent to deliver vaccinations available in multiple settings • Having staff with responsibilities for training practitioners, answering complex questions, co-ordinating immunisations etc. Systems involved in the recording and identification of eligibility and status (covered in RQ1- see this review protocol for a list of potential interventions) Incentives based interventions: • Incentive (and disincentives for not vaccinating) schemes (for individuals) o voucher schemes (not to cover cost of vaccination or healthcare) o payment to cover travel costs o fines/ penalties for not vaccinating o entry to childcare settings/ schools blocked in the absence of proof of vaccination status • Mandatory vaccination • Incentive schemes (for providers) o targets

		○ quality and outcomes framework ○ voucher schemes Audit and feedback on uptake rates for providers • Weekly statistics • Content and delivery of feedback • Practical relevance (e.g. how many more people need to be vaccinated to achieve a target number) • Comparison data (e.g. between GP practices) 6. Multicomponent interventions: • Interventions which include more than one component and target multiple issues (for example the intervention could include an educational component and changes in the timing of clinics) will be analysed separately, but with other similar multicomponent interventions where possible. • Multicomponent interventions which include more than one component that is targeting a single issue will be included in the relevant category instead.
8.	Comparators	• Usual approaches to increase vaccine uptake • Other interventions to increase vaccine uptake ○ Other interventions targeting same issue/ theme (for example education) ○ Other interventions targeting different issues/ theme (for example education versus infrastructure)
9.	Types of study to be included	Systematic reviews of included study designs. Then as needed: • Randomised controlled trials • Non-randomised controlled trials • Controlled before-and-after studies • Interrupted time series • Cohort studies • Before and after studies • Mixed method study designs (quantitative evidence that matches the above study designs only) For the mixed methods synthesis, published mixed methods studies will also be included if the study does not present quantitative and qualitative evidence separately, but only if the individual study designs meet the inclusion criteria for both the qualitative and quantitative reviews as detailed above.
10.	Other exclusion criteria	Interventions to increase uptake of these vaccines/ conditions: • Selective immunisation programmes, as defined in the Green Book and additional vaccines for people with underlying medical conditions because they do not form part of the routine schedule.

		• Seasonal vaccinations because they are not part of the routine vaccination schedule, apart from Flu, which is covered by a separate NICE guideline and excluded for this reason (see section 14 for reasons underlying a possible deviation from this exclusion). • Travel vaccines- not on routine schedule • Areas covered by NICE's guideline on tuberculosis. • Catch-up campaigns alongside the introduction of a new vaccine Only papers published in the English language will be included. Where studies from the USA (or other countries with similar health insurance-based systems) are included in the qualitative reviews any barriers/ facilitators relating to financial incentives (such as payment for vaccines or affording health insurance) will not be recorded as these are not relevant for the UK. In addition, in countries where vaccines or health care are paid for by the user studies looking at any financial incentive-based interventions are excluded.
11.	Context	The Department of Health and Social Care in England has asked NICE to produce a guideline on vaccine uptake in the general population. In recent years, UK vaccination rates have declined, resulting in increases in vaccine preventable diseases, particularly measles. There were 991 confirmed cases in England in 2018 compared with 284 in 2017 and the World Health Organization no longer considers measles 'eliminated' in the UK. Reasons for low uptake include poor access to healthcare services; inaccurate claims about safety and effectiveness, which can lead to doubts about vaccines; and insufficient capacity within the healthcare system for providing vaccinations. In addition, problems with the recording of vaccination status and poor identification of people who are eligible to be vaccinated may have contributed to this problem.
12.	Primary outcomes (critical outcomes)	Changes in: • Vaccine uptake (overall for a specific vaccine or vaccines and for each dose where a vaccine is administered in multiple doses)
13.	Secondary outcomes (important outcomes)	Changes in: • the proportion of people offered vaccinations • the numbers of people who develop the disease the vaccination was aimed at preventing

14.	Data extraction (selection and coding)	All references identified by the searches and from other sources will be uploaded into EPPI reviewer and de-duplicated. 10% of the abstracts will be reviewed by two reviewers, with any disagreements resolved by discussion or, if necessary, a third independent reviewer. The quantitative systematic review search results will be sifted using the EPPI reviewer priority screening functionality, but the whole data base will still be screened in each case. However, when sifting for primary studies for specific sections of the quantitative review priority screening may be used to terminate screening before the end of the search is reached. In this case, at least 50% of the identified abstracts will be screened. After this point, screening will only be terminated if a pre-specified threshold of 500 references is met for a number of abstracts being screened without a single new include being identified. A random 10% sample of the studies remaining in the database when the threshold is met will be additionally screened, to check if a substantial number of relevant studies are not being correctly classified by the algorithm, with the full database being screened if concerns are identified. The full text of potentially eligible studies will be retrieved and will be assessed in line with the criteria outlined above. Data will be extracted from the included studies into a standardised form (see Developing NICE guidelines: the manual section 6.4) for assessment of study quality and evidence synthesis. Extracted information for the quantitative review will include: study type; study setting; study population and participant demographics and baseline characteristics; details of the intervention and comparator used; study methodology; inclusion and exclusion criteria; recruitment and study completion rates; outcomes and times of measurement and information for assessment of the risk of bias. If insufficient evidence is identified to make recommendations, we will consult the committee and consider a call for evidence (as detailed in the NICE manual) or include more indirect evidence from other relevant guidelines (for example, the NICE flu guideline).
15.	Risk of bias (quality) assessment	Risk of bias will be assessed using appropriate checklists as described in Developing NICE guidelines: the manual. Systematic reviews will be assessed using the ROBIS checklist. For the quantitative review, randomised controlled trials will be assessed using the Cochrane risk of bias v2.0 checklist. Non-randomised controlled trials and cohort studies will be assessed using the Cochrane ROBINS-I checklist. Controlled/ uncontrolled before and after

		studies, and interrupted time series will be assessed using the EPOC tool. Any mixed methods studies with quantitative data that can be extracted separately will be assessed using ROBINS-I, Cochrane risk of bias v2.0, or EPOC appropriate. Mixed methods studies where separate quantitative and qualitative data cannot be assessed separately will be assessed using the mixed methods appraisal tool (2018 version).
16.	Strategy for data synthesis	A mixed methods approach will be used to address this topic area. The quantitative and qualitative reviews (evidence review B) will be conducted separately (segregated study design) but at the same time. The evidence from the reviews will then be analysed in relation to each other (convergent synthesis of results). (See below for more details. The findings will **not** be integrated by transforming one type of evidence into the other (e.g. quantitative findings into qualitative findings). Where possible, meta-analyses of outcome data will be conducted for all comparators that are reported by more than one study, with reference to the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al. 2011). Data will be separated into the groups identified in section 17. Continuous outcomes will be analysed as mean differences, unless multiple scales are used to measure the same factor. In these cases, standardised mean differences will be used instead. Pooled relative risks will be calculated for dichotomous outcomes (using the Mantel–Haenszel method) reporting numbers of people having an event. Absolute risks will be presented where possible. Fixed- and random-effects models (der Simonian and Laird) will be fitted for all comparators, with the presented analysis dependent on the degree of heterogeneity in the assembled evidence. Fixed-effects models will be deemed to be inappropriate if one or both of the following conditions is met: • Significant between study heterogeneity in methodology, population, intervention or comparator was identified by the reviewer in advance of data analysis. • The presence of significant statistical heterogeneity in the meta-analysis, defined as $I^2 \geq 50\%$.

		In any meta-analyses where some (but not all) of the data comes from studies at high risk of bias, a sensitivity analysis will be conducted, excluding those studies from the analysis. Results from both the full and restricted meta-analyses will be reported. Similarly, in any meta-analyses where some (but not all) of the data comes from indirect studies, a sensitivity analysis will be conducted, excluding those studies from the analysis. GRADE will be used to assess the quality of the outcomes. Outcomes using evidence from RCTs, non-randomised trials and cohort studies will be rated as high quality initially and downgraded from this point. Controlled before and after studies and interrupted time series will be rated as low quality initially. Reasons for upgrading the certainty of the evidence will also be considered. Where 10 or more studies are included as part of a single meta-analysis, a funnel plot will be produced to graphically assess the potential for publication bias. Meta-analyses will be carried out separately for each study type per outcome, but the similarities and differences between the results obtained from the different study types will be noted. <u>Synthesising the findings of mixed method reviews.</u> Where mixed methods studies are identified that present data in a form that cannot be extracted and analysed separately as quantitative and qualitative data (in evidence review B), the results of the studies will be reported separately for each study. Any correlations or discrepancies between the findings of the mixed methods studies and the syntheses of the quantitative and qualitative findings of the above analyses will be noted. <u>Mixed method synthesis of findings from the quantitative and qualitative reviews</u> Where appropriate, a synthesis matrix will be produced to combine results from the different individual analysis methods. Findings from one analytical approach will be compared to findings from the second approach, and outcomes paired up if they provided relevant information on the same underlying topic. The agreement between the findings of the two approaches will be qualitatively assessed, with each paired set of findings put into one of the three categories relating to the strength of the identified correlation. The results may be presented as a concept diagram with quantitative findings mapped onto the qualitative ones if this is thought to be informative.

17.	Analysis of sub-groups	Results will be separated into the following for analysis: • Age/time when vaccine is due: o During pregnancy o 0-5 years o 11 to 18 years o 65 years and older • Population groups with potential equality issues: o Children excluded from mainstream education (including pupil referral units) and non-attenders. o Care home residents or people in long-term care o Looked after children o Religious groups or groups with special beliefs (e.g. anthroposophical views) o Travellers/ gypsies o Migrants and asylum seekers • Settings: o care homes (covered above for residents) o hospitals o community versus healthcare o educational settings • Mandatory versus partially mandatory, opt-outs allowed or completely optional vaccine schedules • Numbers of doses of vaccines • Study type: RCT, non-randomised studies (NRTs, CBA, ITS) • Interventions that are part of a catch-up campaign versus interventions that are not part of a catch-up campaign • System levels: o health system level (for example clinical commissioning group [CCG], local authority, regional and national level) o service provider level (for example GP practices, practitioners) o individual level (for example patients or service users including carers) o mixed levels • For interventions that use information/ education to increase uptake the results will also be presented for generic versus tailored interventions.
		☒ Intervention (multicomponent review)

<table>
<tr><td>18.</td><td>Type and method of review</td><td colspan="3">☐ Diagnostic
☐ Prognostic
☐ Qualitative
☐ Epidemiologic
☐ Service Delivery
☒ Mixed method (all other quantitative reviews)</td></tr>
<tr><td>19.</td><td>Language</td><td colspan="3">English</td></tr>
<tr><td>20.</td><td>Country</td><td colspan="3">England</td></tr>
<tr><td>21.</td><td>Anticipated or actual start date</td><td colspan="3">January 2020</td></tr>
<tr><td>22.</td><td>Anticipated completion date</td><td colspan="3">October 2021</td></tr>
<tr><td rowspan="7">23.</td><td rowspan="7">Stage of review at time of this submission</td><td>Review stage</td><td>Started</td><td>Completed</td></tr>
<tr><td>Preliminary searches</td><td>x</td><td>x</td></tr>
<tr><td>Piloting of the study selection process</td><td>x</td><td>x</td></tr>
<tr><td>Formal screening of search results against eligibility criteria</td><td>x</td><td></td></tr>
<tr><td>Data extraction</td><td></td><td></td></tr>
<tr><td>Risk of bias (quality) assessment</td><td></td><td></td></tr>
<tr><td>Data analysis</td><td></td><td></td></tr>
<tr><td>24.</td><td>Named contact</td><td colspan="3">5a. Named contact
Guideline Updates Team</td></tr>
</table>

		5b Named contact e-mail VaccineUptake@nice.org.uk **5e Organisational affiliation of the review** National Institute for Health and Care Excellence (NICE)
25.	Review team members	From the Guideline Updates Team: • Marie Harrisingh • Toby Mercer • Stephen Sharp • Hannah Lomax • Joshua Pink • Elizabeth Barrett
26.	Funding sources/sponsor	This systematic review is being completed by the Guideline Updates Team which receives funding from NICE.
27.	Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.
28.	Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the manual. Members of the guideline committee are available on the NICE website: https://www.nice.org.uk/guidance/indevelopment/gid-ng10139
29.	Other registration details	None
30.	Reference/URL for published protocol	None
31.	Dissemination plans	NICE may use a range of different methods to raise awareness of the guideline. These include standard approaches such as:

		• notifying registered stakeholders of publication • publicising the guideline through NICE's newsletter and alerts • issuing a press release or briefing as appropriate, posting news articles on the NICE website, using social media channels, and publicising the guideline within NICE.
32.	Keywords	Vaccine uptake, NHS routine vaccination schedule, interventions and barriers and facilitators.
33.	Details of existing review of same topic by same authors	None
34.	Current review status	☐ Ongoing ☐ Completed but not published ☒ Completed and published ☐ Completed, published and being updated ☐ Discontinued
35..	Additional information	None
36.	Details of final publication	www.nice.org.uk

Appendix B – Literature search strategies

Systematic review search

An initial search to find systematic reviews identifying effective interventions to improve uptake of routine vaccinations was run on 23rd and 24th March 2020. The following databases were searched: Medline, Medline in Process, Medline epubs ahead of print, Embase, Emcare and Psycinfo (all via the Ovid platform), Cochrane Database of Systematic Reviews (via the Wiley platform), Database of Abstracts of Reviews of Effects (DARE, via the Centre for Reviews and Dissemination platform), Applied Social Sciences Index and Abstracts (ASSIA), British Nursing Index, Sociological Abstracts and Educational Resources Information Center (ERIC, all via the Proquest platform). The Medline strategy is shown below. health-evidence.ca study design filters were applied where appropriate. The search was limited to studies published after 1990 in the English language.

1 exp Vaccination/
2 exp vaccines/
3 exp Immunization programs/
4 vaccin*.tw.
5 exp Immunization/
6 (immunis* or immuniz*).tw.
7 (immunologic* adj4 (sensitiz* or sensitis* or stimulation*)).tw.
8 (immunostimul* or variolation*).tw.
9 or/1-8
10 (uptake or ((increas* or improv* or rais* or higher) adj8 (rate* or immuni* or vaccin* or complian*))).tw.
11 9 and 10
12 (MEDLINE or pubmed).tw.
13 systematic review.tw.
14 systematic review.pt.
15 meta-analysis.pt.
16 intervention$.ti.
17 or/12-16
18 11 and 17
19 animals/ not humans/
20 18 not 19
21 limit 20 to english language
22 limit 21 to ed=19900101-20200323

Common terms for primary studies searches

Focussed searches were run to identify evidence on themed groups of interventions between June 2020 and February 2021 to supplement systematic reviews retrieved by the overarching systematic review search. These were rerun in April 2021.

The Medline version of the population terms used in all searches is shown below.

1 Diphtheria/
2 diphtheria*.tw.
3 Tetanus/
4 (tetanus or tetani).tw.
5 Whooping Cough/

6 (pertuss* or "whooping cough").tw.
7 Haemophilus influenzae type b/
8 ("Haemophilus influenza* type b" or "Hemophilus influenza* type b" or hib).tw.
9 Hepatitis B/
10 "hepatitis b".tw.
11 exp Poliomyelitis/
12 (Polio* or (infantile adj1 paralysis)).tw.
13 exp Pneumococcal Infections/
14 (Pneumococcal adj4 (disease* or infection*)).tw.
15 (streptococcus pneumoniae adj4 Infection*).tw.
16 exp Meningococcal Infections/
17 (Meningococcal adj4 (disease* or infection*)).tw.
18 Rotavirus Infections/ or Rotavirus/
19 rotavirus.tw.
20 Measles/
21 (measles or rubeola or mmr).tw.
22 Mumps/
23 (mumps or (epidemic adj2 (parotitides or parotitis))).tw.
24 Rubella/ or Rubella virus/
25 (rubella or ((german or "three day") adj2 measle*)).tw.
26 human papillomavirus 16/ or human papillomavirus 18/ or exp papillomavirus Infections/ or exp human papillomavirus 11/
27 (hpv or papillomavirus).tw.
28 Condylomata Acuminata/
29 (condyloma* adj1 acuminat*).tw.
30 ((genital or veneral) adj2 wart*).tw.
31 exp Herpes Zoster/
32 (shingles or herpes zoster or zona).tw.
33 or/1-32
34 exp Vaccination/
35 Vaccines/ or exp bacterial vaccines/ or cancer vaccines/ or exp toxoids/ or exp viral vaccines/
36 exp Immunization programs/
37 vaccin*.tw.
38 exp Immunization/
39 (immunis* or immuniz*).tw.
40 (immunologic* adj4 (sensitiz* or sensitis* or stimulation*)).tw.
41 (immunostimul* or variolation*).tw.
42 or/34-41
43 33 and 42
44 exp Diphtheria toxoid/ or exp tetanus toxoid/ or Haemophilus Vaccines/ or meningococcal Vaccines/ or exp Pertussis Vaccine/ or exp Streptococcal vaccines/ or exp Vaccines Combined/ or exp Measles vaccine/ or exp Mumps Vaccine/ or exp papillomavirus vaccines/ or exp Poliovirus Vaccines/ or Rotavirus Vaccines/ or exp Rubella Vaccine/ or Hepatitis B vaccines/ or Herpes Zoster Vaccine/ (65237)
45 43 or 44

A NICE in house geographic filter to limit studies to OECD countries was applied where appropriate. The Medline version is shown below

1. afghanistan/ or exp africa/ or albania/ or andorra/ or antarctic regions/ or argentina/ or exp asia, central/ or exp asia, northern/ or exp asia, southeastern/ or exp atlantic islands/ or bahrain/ or bangladesh/ or Bhutan/ or bolivia/ or borneo/ or "bosnia and herzegovina"/ or brazil/ or bulgaria/ or exp central america/ or exp china/ or "commonwealth of independent states"/ or croatia/ or "democratic people's republic of korea"/ or ecuador/ or gibraltar/ or guyana/ or exp india/ or indonesia/ or iran/ or iraq/ or jordan/ or kosovo/ or kuwait/ or

lebanon/ or liechtenstein/ or macau/ or "macedonia (republic)"/ or exp melanesia/ or moldova/ or monaco/ or mongolia/ or montenegro/ or nepal/ or netherlands antilles/ or new guinea/ or oman/ or pakistan/ or paraguay/ or peru/ or philippines/ or qatar/ or "republic of belarus"/ or romania/ or exp russia/ or saudi arabia/ or serbia/ or sri lanka/ or suriname/ or syria/ or taiwan/ or exp transcaucasia/ or ukraine/ or uruguay/ or united arab emirates/ or exp ussr/ or venezuela/ or yemen/
2. "organisation for economic co-operation and development"/
3. australasia/ or exp australia/ or austria/ or exp baltic states/ or belgium/ or exp canada/ or chile/ or czech republic/ or colombia/ or europe/ or exp france/ or exp germany/ or greece/ or hungary/ or ireland/ or israel/ or exp italy/ or exp japan/ or korea/ or luxembourg/ or mexico/ or netherlands/ or new zealand/ or north america/ or poland/ or portugal/ or exp "republic of korea"/ or exp "scandinavian and nordic countries"/ or slovakia/ or slovenia/ or spain/ or switzerland/ or turkey/ or exp united kingdom/ or exp united states/
4. european union/
5. developed countries/
6. or/2-5
7. 1 not 6

The following study designs were applied where appropriate. Medline versions are shown below.

Randomised controlled trials

McMaster balanced filter

1. randomized controlled trial.pt.
2. randomi?ed.mp.
3. placebo.mp.
4. or/1-3

Systematic reviews

health-evidence.ca filter

1. (MEDLINE or pubmed).tw.
2. systematic review.tw.
3. systematic review.pt.
4. meta-analysis.pt.
5. intervention$.ti.
6. or/1-5

Observational studies

Adapted from the NICE in house filter

1. Observational Studies as Topic/
2. Observational Study/
3. Epidemiologic Studies/
4. exp Cohort Studies/
5. Controlled Before-After Studies/
6. Interrupted Time Series Analysis/
7. Comparative Study.pt.
8. (cohort adj (study or studies)).tw.
9. cohort analy$.tw.
10. (follow up adj (study or studies)).tw.

11. (observational adj (study or studies)).tw.
12. longitudinal.tw.
13. prospective.tw.
14. retrospective.tw.
15. or/1-14

Searches were limited to studies published after 1990 in the English language.

Reminder interventions search

Searches were run on various dates between 26th June and 28th July 2020 and re run on 9th April in the following databases: Medline, Medline in Process, Medline epubs ahead of print, Embase, Emcare and Psycinfo (all via the Ovid platform), CENTRAL and the Cochrane Database of Systematic Reviews (via the Wiley platform), Database of Abstracts of Reviews of Effects (DARE, via the Centre for Reviews and Dissemination platform), Applied Social Sciences Index and Abstracts (ASSIA), British Nursing Index, and Sociological Abstracts (all via the Proquest platform). The Medline version of the intervention terms are shown below. Population terms, the OECD geographic filter, RCT, systematic review and observational study design filters as described above were used.

1. Reminder Systems/
2. (recall or remind* or prompt* or nudge).tw.
3. (electronic* adj4 invit*).tw.
4. Mobile Applications/
5. exp Internet/
6. exp Cell Phone/
7. exp Computers, Handheld/
8. (app or apps).ti,ab.
9. (online or web or internet or digital*).ti.
10. ((online or web or internet or digital*) adj3 (based or application* or intervention* or program* or therap*)).ab.
11. (phone* or telephone* or smartphone* or cellphone* or smartwatch*).ti.
12. ((phone* or telephone* or smartphone* or cellphone* or smartwatch*) adj3 (based or application* or intervention* or program* or therap*)).ab. (8053)
13. (mobile health or mhealth or m-health or ehealth or e-health or emental or e-mental).ti.
14. ((mobile health or mhealth or m-health or ehealth or e-health or emental or e-mental) adj3 (based or application* or intervention* or program* or therap*)).ab.
15. (mobile* adj3 (based or application* or intervention* or device* or technolog*)).ti,ab.
16. text messaging/
17. (text messag* or sms or short messag* service).tw.
18. electronic mail/
19. (email* or e-mail* or e mail* or electronic mail).tw.
20. Correspondence as Topic/
21. (letter* or correspondence or mail).tw.
22. (iphone* or mobile phone*).tw.
23. pamphlets/
24. (pamphlet* or leaflet* or brochure*).tw.
25. Posters as Topic/
26. poster*.tw.
27. (postcard* or post-card*).tw.
28. or/1-27

Access interventions search

Searches were run between 11 and 17th June 2020 and re run on 9th April 2021 in the following databases: Medline, Medline in Process, Medline epubs ahead of print, Embase, Emcare and Psycinfo (all via the Ovid platform), CENTRAL and the Cochrane Database of Systematic Reviews (via the Wiley platform), Database of Abstracts of Reviews of Effects (DARE, via the Centre for Reviews and Dissemination platform), Applied Social Sciences Index and Abstracts (ASSIA), British Nursing Index, and Sociological Abstracts (all via the Proquest platform). The Medline version of the intervention terms are shown below. Population terms, the OECD geographic filter, RCT, systematic review and observational study design filters as described above were used.

1. exp Health Services Accessibility/
2. (access* or available or availability or convenien* or opportuni*).tw.
3. ((out or extended) adj2 hour*).tw.
4. (drop adj2 in).tw.
5. Community health centers/
6. ((community or public or civic or communal or municipal) adj4 (setting* or venue* or locat* or building* or facilit* or clinic* or hall* or centre* or center* or space*)).tw.
7. Pharmacies/
8. ((community or retail) adj4 pharmac*).tw.
9. Prenatal Care/ or Perinatal care/ or Maternal Child Health centers/
10. ((prenatal or antenatal or pregnan*) adj4 (care or service* or clinic*)).tw.
11. ((drug or alcohol or specialist or dedicated or "substance abuse") adj4 (service* or clinic* or care)).tw.
12. exp Community Mental Health Services/ or Substance Abuse Treatment Centers/
13. Libraries/
14. (library or libraries).tw.
15. ((child or children* or leisure or resource or day) adj4 (centre* or center*)).tw.
16. schools/ or schools, nursery/
17. (school* or nursery or nurseries or kindergarten* or "pre school*" or "play group*").tw.
18. (walk adj1 in adj4 (centre* or center* or clinic* or service*)).tw.
19. ((extend* or weekend or early or evening or commuter) adj4 (clinic* or service* or appointment* or session*)).tw.
20. ("24 hour* " or "twenty four hour*" or "all day" or "seven day" or "7 day").tw.
21. exp Home Care Services/
22. adult day care centers/ or exp child day care centers/ or Senior Centers/
23. ((home or domiciliary or day) adj4 (care or visit*)).tw.
24. Self-Help Groups/
25. ((support or self-help) adj4 (group* or meeting*)).tw.
26. Homes for the Aged/
27. exp Nursing Homes/
28. ((residential or nursing or care) adj4 home*).tw.
29. exp Education, Special/
30. (special adj4 (education or school*)).tw.
31. Inpatients/
32. inpatient*.tw.
33. Prisons/ or Prisoners/
34. (prison* or jail).tw.
35. (young adj4 (Offender* or detention)).tw.
36. (youth adj4 (detention or custody)).tw.
37. (juvenile adj4 (offender* or hall or detention)).tw.
38. (HMYOI* or YOI* or STC* or "secure training centre*").tw.
39. ((secure or correction* or detention) adj4 (accommodation or care or home or centre* or center* or facilit*)).tw.

40. exp "Emigrants and Immigrants"/
41. ((immigration or immigrant*) adj4 (removal or detention or detain* or accomodat* or hous* or home* or rent*)).tw.
42. 87 Mobile Health Units/
43. 88 ((mobile or outreach) adj4 (clinic* or unit* or service*)).tw.
44. 89 ("making every contact count" or MECC).tw.
45. 90 or/1-45

Education interventions search

Searches were run on 29th October 2020 and re run on 9th April 2021 in the following databases: Medline, Medline in Process, Medline epubs ahead of print, Embase, Emcare and Psycinfo (all via the Ovid platform), CENTRAL and the Cochrane Database of Systematic Reviews (via the Wiley platform), Database of Abstracts of Reviews of Effects (DARE, via the Centre for Reviews and Dissemination platform), Applied Social Sciences Index and Abstracts (ASSIA), British Nursing Index, Sociological Abstracts and ERIC (Educational Resources Information Center) (all via the Proquest platform). The Medline version of the intervention terms are shown below. Population terms, the OECD geographic filter and RCT study design filter as described above were used.

1. exp Communication/
2. ((Vaccin* or immuni*) adj4 (Communic* or messag* or listen* or negotiat* or persua* or dialogu* or conversation* or question* or discuss*)).tw.
3. ((universal or population or national* or public health or nationwide* or statewide* or countrywide* or citywide* or national* or nation wide* or state wide* or country wide* or city wide* or government*) adj4 (promotion* or campaign* or intervention* or toolkit* or strateg*)).tw.
4. (rais* adj2 awareness adj4 (promotion* or campaign* or intervention* or toolkit* or strateg*)).tw.
5. exp Consumer Health Information/
6. Social Media/
7. electronic mail/
8. Mobile Applications/
9. exp Internet/
10. exp Cell Phone/
11. exp Computers, Handheld/
12. Medical Informatics Applications/
13. Therapy, Computer-Assisted/
14. (app or apps).ti,ab.
15. (online or web or internet or digital*).ti.
16. ((online or web or internet or digital*) adj3 (based or application* or intervention* or program* or therap*)).ab.
17. (phone* or telephone* or smartphone* or cellphone* or smartwatch* or tablet*).ti.
18. ((phone* or telephone* or smartphone* or cellphone* or smartwatch or tablet*) adj3 (based or application* or intervention* or program* or therap*)).ab.
19. (mobile health or mhealth or m-health or ehealth or e-health or emental or e-mental).ti.
20. ((mobile health or mhealth or m-health or ehealth or e-health or emental or e-mental) adj3 (based or application* or intervention* or program* or therap*)).ab.
21. (mobile* adj3 (based or application* or intervention* or device* or technolog*)).ti,ab.
22. (twitter or tweet* or blog* or pinterest or instagram or facebook or snapchat).tw.
23. ((text or multimedia) adj messag*).tw.
24. (sms or whatsapp* or email* or "e-mail*" or "electronic mail*" or "e mail*").tw.
25. exp Mass Media/

26. (media or radio* or television* or tv* or broadcast* or podcast* or newspaper* or magazine* or display* or presentation*).tw.
27. Correspondence as Topic/
28. (correspond* or letter* or mail).tw.
29. Pamphlets/
30. (leaflet* or pamphlet* or booklet* or flyer* or brochure* or handout* or newsletter* or factsheet* or postcard* or banner* or bulletin*).tw.
31. ((print* or written*) adj4 (media or material*)).tw.
32. Health Promotion/
33. ((health or media) adj4 (campaign* or promot*)).tw.
34. Health Knowledge, Attitudes, Practice/
35. Advertising/
36. advert*.tw.
37. Posters as Topic/
38. poster*.tw.
39. Government Publications as Topic/
40. exp Education/
41. ((vaccin* or immuni*) adj4 (educ* or teach* or instruct* or learn* or "e-learn*" or " e learn*" or coach* or train* or aware* or inform*)).tw.
42. ((train* or development*) adj4 (inservice or staff or professional)).tw.
43. exp Interpersonal Relations/
44. Hospital Patient Relations/
45. Community Institutional Relations/
46. Community Networks/
47. ((communit* or social) adj4 network*).tw.
48. peer influence/
49. ((peer* or family or families or friend* or professional* or GP* or doctor* or physician* or nurse* or "health visitor*" or midwife or midwives or "social worker*" or leader* or community or communities or teacher* or faith) adj4 (influence* or pressure* or recommend* or advice or advise* or led or support* or educ* or advocat*)).tw.
50. Mentors/
51. (mentor* or "role model*").tw.
52. hotlines/
53. (champion* or hotline*).tw.
54. House calls/
55. ((house or home) adj4 (call* or visit*)).tw.
56. Self-Help Groups/
57. (group* adj2 (support* or self-help*)).tw.
58. exp Treatment Refusal/
59. Choice Behavior/
60. (decision* adj4 (making or support or aid*)).tw.
61. exp Informed Consent/
62. (informed adj4 (consent or choice* or decision*)).tw.
63. ((vaccin* or immuni*) adj4 (hesitan* or refus* or trust* or distrust* or accept* or confiden* or reject* or doubt* or decline*)).tw.

Infrastructure interventions search

Searches were run on 28th September 2020 and re run on 9th April 2021 in the following databases: Medline, Medline in Process, Medline epubs ahead of print, Embase, Emcare ,Psycinfo and HMIC (Health Management and Policy Database) (all via the Ovid platform), CENTRAL and the Cochrane Database of Systematic Reviews (via the Wiley platform), Database of Abstracts of Reviews of Effects (DARE, via the Centre for Reviews and Dissemination platform), Applied Social Sciences Index and Abstracts (ASSIA), British Nursing Index, and Sociological Abstracts (all via the Proquest platform). The Medline

version of the intervention terms are shown below. Population terms, the OECD geographic filter and RCT study design filter as described above were used.

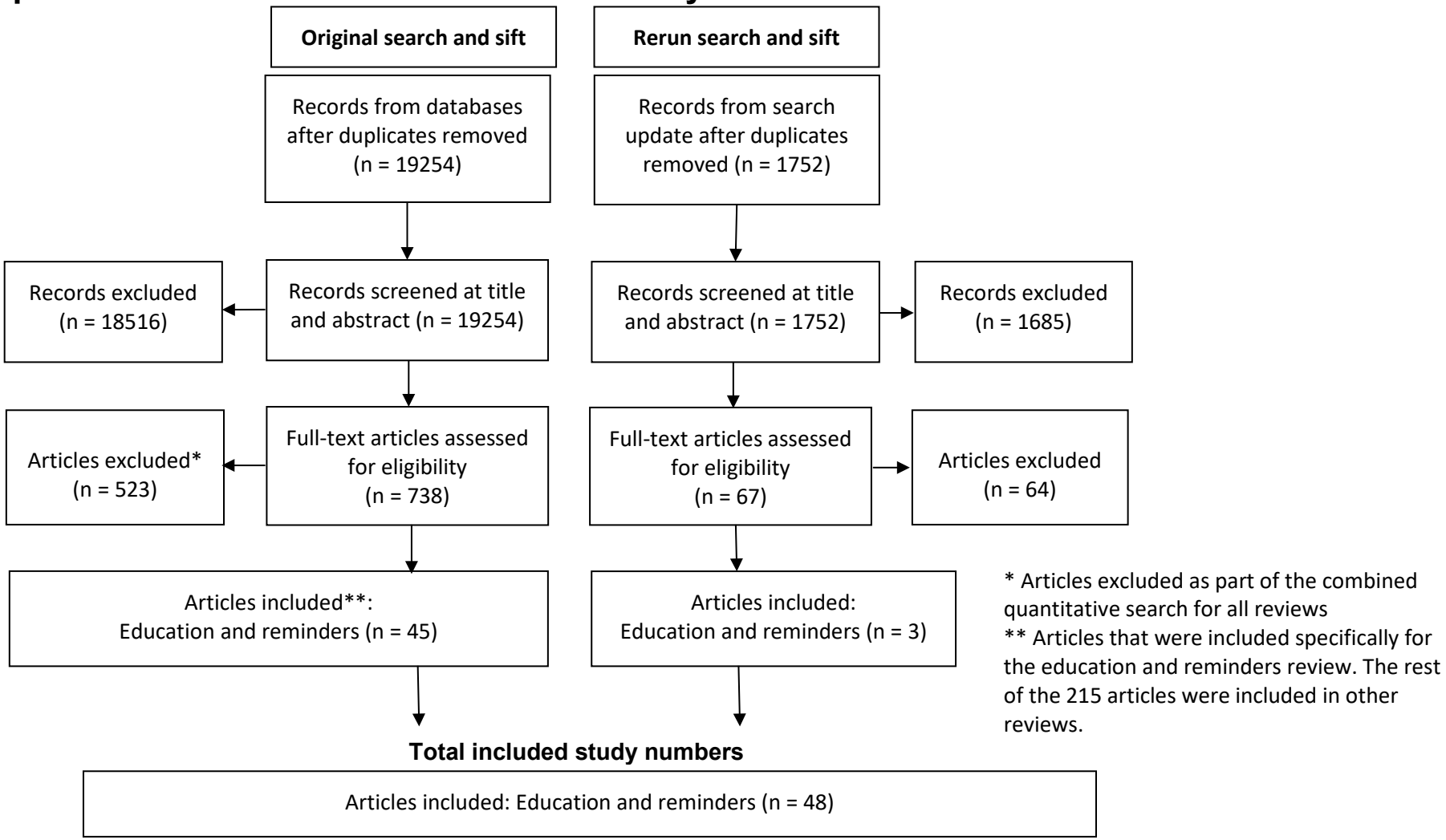
1. "Appointments and Schedules"/
2. (appointment* or schedul* or book* or rebook* or follow-up or follow up).tw.
3. "Organization and Administration"/
4. Health Planning/
5. "Delivery of Health Care"/og or "Delivery of Health Care"/st
6. Organizational Objectives/
7. Community Health Services/og or Community Health Services/st
8. ((service* or system* or team* or practice* or provider*) adj4 (administ* or organis* or organiz* or coordin* or co ordin* or co-ordin* or logistic* or plan* or structur*)).tw.
9. Statistics as Topic/
10. Data Collection/ or Datasets as Topic/ or Data Analysis/ or Data interpretation, Statistical/ or Data Management/ or Electronic Data Processing/
11. exp Clinical Audit/
12. Feedback/
13. (data* or audit* or statistic* or feedback or intelligence or dashboard* or analytics or analysis).tw.
14. Quality Indicators, Health Care/
15. Quality Improvement/og or Quality Improvement/st
16. Quality Assurance, Healthcare/og or Quality Assurance, Healthcare/st
17. (qof* or (quality adj4 (indicator* or outcome* or framework*))).tw.
18. "Facility Design and Construction"/
19. Built Environment/
20. Architecture/
21. ((building* or facilit* or premises or office* or room* or surger* or environment* or clinic or clinics or setting*) adj4 (design* or construct* or layout* or configur*)).tw.
22. "Treatment Adherence and Compliance"/ or Patient Compliance/
23. Motivation/
24. (incentive* or disincentive* or motivat*).tw.
25. Punishment/
26. (punish* or fine* or penal* or sanction* or deter* or discourage*).tw.
27. Reward/
28. (reward* or encourage* or attract* or reimburse* or pay or payment).tw.
29. Reimbursement, Incentive/ or Physician Incentive Plans/
30. Mandatory Programs/
31. (mandat* or compulsory or obligat*).tw.
32. infrastructure*.tw.

Acceptability interventions search

Searches were run on 4th and 5th February 2021 and re run on 12th April 2021 in the following databases: Medline, Medline in Process, Medline epubs ahead of print, Embase, Emcare and Psycinfo (all via the Ovid platform), CENTRAL and the Cochrane Database of Systematic Reviews (via the Wiley platform), Database of Abstracts of Reviews of Effects (DARE, via the Centre for Reviews and Dissemination platform), Applied Social Sciences Index and Abstracts (ASSIA), British Nursing Index, and Sociological Abstracts (all via the Proquest platform). The Medline version of the intervention terms are shown below. Population terms, the OECD geographic filter, RCT, systematic review and observational study design filters as described above were used

1. acceptab*.kw.
2. exp "Patient Acceptance of Health Care"/
3. exp Patient Satisfaction/
4. Choice Behavior/
5. (accept* or prefer* or option* or choice* or choose* or chose* or satisf* or tolera*).tw.
6. or/1-5
7. exp Drug Administration Routes/
8. ((subcutaneous* or cutaneous* or intravenous* or inhal* or nasal* or intranasal* or intramuscular* or topical* or oral* or infus* or intradermal*) adj4 (administ* or route* or appli* or dispens* or deliver* or method*)).tw.
9. (inject* or shot* or jab* or patch* or liquid* or drop* or spray* or needle* or syringe*).tw.
10. (dose* or dosage or formulation*).tw.
11. or/7-10
12. exp Physicians/
13. (doctor* or gp* or "general practitioner*" or physician*).tw.
14. exp Nurses/
15. (nurse* or midwife or midwives).tw.
16. Nursing Assistants/
17. ((nurse or nursing) adj2 (aide* or assistant*)).tw.
18. ((healthcare or "health care") adj2 assistant*).tw.
19. hca*.tw.
20. Pharmacists/ or Pharmacy Technicians/
21. (pharmacist* or (pharmacy adj2 technician*)).tw.
22. or/12-21
23. 11 or 22
24. (uptake or ((increas* or improv* or rais* or higher) adj8 (rate* or immuni* or vaccin* or complian*))).tw.
25. 23 and 24
26. 6 or 25

Appendix C – Effectiveness evidence study selection



* Articles excluded as part of the combined quantitative search for all reviews
** Articles that were included specifically for the education and reminders review. The rest of the 215 articles were included in other reviews.

Appendix D – Effectiveness evidence tables

Systematic reviews

Kaufman, 2018

Bibliographic Reference	Kaufman, Jessica; Ryan, Rebecca; Walsh, Louisa; Horey, Dell; Leask, Julie; Robinson, Priscilla; Hill, Sophie; Face-to-face interventions for informing or educating parents about early childhood vaccination.; The Cochrane database of systematic reviews; 2018; vol. 5; cd010038

Study Characteristics

Study design	Systematic review
Study details	Dates searched 2012 to 3 July 2017 (update of earlier review so included studies from earlier dates too) Databases searched Cochrane Central Register of Controlled Trials, MEDLINE Ovid, Embase Ovid, CINAHL EBSCO (Cumulative Index to Nursing and Allied Health Literature), PsycINFO Ovid, ClinicalTrials.gov, OpenGrey, and the ISI Web of Science. Sources of funding La Trobe University, National Health and Medical Research Council
Inclusion criteria	Randomised controlled trials (RCT) And cluster randomised controlled trials (cRCT) Children Infants (less than 1 year) or preschool-aged children (1 to 5 or 6 years). They only included RCTs with school-aged children if the main focus of the intervention was vaccines whose primary series began in infancy or preschool-aged children. Parents Parents, guardians, or others fulfilling the parental role, alone or in groups, targeted to receive face-to-face information or education, and who had at least one child due or overdue for childhood vaccinations. They also included participants who were expectant parents, individuals or couples currently pregnant, considering adoption, or otherwise expecting to become guardians of a child. The intervention could have been directed to parents individually or in groups. Vaccine programme organisers Face-to-face communication interventions Face-to-face communication interventions directed to parents to inform or educate them about routine childhood vaccinations. Interventions delivered by anyone, including physicians, nurses, midwives, health visitors, or other healthcare professionals; trained volunteers; lay health workers; members of the community; or peers. Routine vaccinations
Exclusion criteria	HPV vaccine Studies that mention relevant vaccines briefly or not at all
Outcome	Vaccine uptake Parental knowledge and understanding of vaccines Parental attitudes and beliefs about vaccination Intention to vaccinate Adverse events
Studies from the systematic review that are relevant for use in the current review	Jackson 2011 Saitoh 2013 Saitoh 2017 Quinlivan 2003
Studies from the	The remaining studies for the systematic review were not included because they did not have an outcome of interest, took place in non-OECD countries, or the

systematic review that are not relevant for use in the current review	intervention in the study was a better fit for the reminders evidence review (Wood 1998).

Section	Question	Answer
Study eligibility criteria	Concerns regarding specification of study eligibility criteria	Low
Identification and selection of studies	Concerns regarding methods used to identify and/or select studies	Low
Data collection and study appraisal	Concerns regarding methods used to collect data and appraise studies	Low
Synthesis and findings	Concerns regarding the synthesis and findings	Low
Overall study ratings	Overall risk of bias	Low
	Applicability as a source of data	Partially applicable *(This review covers part of the reminders interventions listed in our protocol, but does not include education that is not face-to-face. It also includes non-OECD countries and outcomes which are out of scope of this review.)*

Education interventions primary studies

To reduce duplication of effort, evidence tables for the studies that are also included in the Kaufman 2018 Cochrane review are not provided below. The entries refer readers to the tables in the Cochrane review where details about the studies can be found.

Bartu, 2006

Bibliographic Reference	Bartu A; Sharp J; Ludlow J; Doherty DA; Postnatal home visiting for illicit drug-using mothers and their infants: a randomised controlled trial.; The Australian & New Zealand journal of obstetrics & gynaecology; 2006; vol. 46 (no. 5)

Study details

Study type	Randomised controlled trial (RCT)
Study location	Australia
Study setting	Community
Study dates	2000 to 2003

Sources of funding	Healthways
Inclusion criteria	With a specified area or location Women were recruited at the Antenatal Chemical Dependency Clinic at the King Edward Memorial Hospital. Participants who spoke English Illicit drug users Pregnant women Approximately 35 to 40 weeks gestation.
Exclusion criteria	None
Intervention(s)	The home visiting arm received home visits by a research midwife at weeks one, two and four, then monthly until six months post-partum. Each visit lasted from 1 to 2 h. Any difficulties encountered by the mother were addressed at each visit. Week one: The first visit included an assessment of how the mother, baby and family were coping. The focus was infant feeding, the mother's physical and psychological well-being, family, drug use and adjustment to parenting. Breastfeeding and nipple care were discussed. Week two: The same as for week one. Any major problems detected were addressed or referred to relevant services. Stress management was introduced and self-nurturing activities were discussed. Week four: Relaxation, stress and crisis management techniques were reinforced. Any major issues were addressed or referred to appropriate agencies. Month two: Immunisation was discussed and information on Pap smears provided. Relaxation, stress and crisis management techniques were reinforced. Months three to five: As for previous months. Month six: Final assessment of mother, baby and family. The mother was provided with links to community resources for further support if necessary. The home visit arm received eight home visits. This intervention allowed the research midwife flexibility to address any areas of concern for individual mothers as they arose. The needs of the mother and baby took precedence over formal, structured sessions. After each visit the nurses recorded their assessments of the infant, mother and the home environment.
Comparator	The control arm had a telephone contact at two months and a home visit at six months. At the last contact, mothers in both groups received 20 Australian dollars for their time for each home visit. At recruitment they were unaware that they would be paid for this, hence it was not an inducement for involvement in the study.
Number of participants	152
Duration of follow-up	6 months
Loss to follow-up	None
Additional comments	Data for vaccine uptake was provided for children at 2, 4 and 6 months of age. Data used in the meta-analysis was uptake at 6 months of age because this is a later and more summative result.

Study arms

Home-visiting (N = 76)
Control (N = 76)

Characteristics

Arm-level characteristics

	Home-visiting (N = 76)	Control (N = 76)
Age *(years)* Median		
Nominal	27	25
Age *(years)*		
Range	17 to 39	18 to 41

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(The investigators telephoned participants in the control arm at 2 months. The nature of this telephone call was not described.)*
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	High *(No blinding of the investigators when they collected the data. The home visiting arm data was collected by the same nurses who did the visiting and educating.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Downgraded for lack of blinding at data collection and for contacting participants in the control arm in an unspecified way during the study.)*
	Overall Directness	Partially applicable *(Details of what immunisations were given was not provided.)*

Chamberlain, 2015

Bibliographic Reference Chamberlain, A T; Seib, K; Ault, K A; Rosenberg, E S; Frew, P M; Cortes, M; Whitney, E A S; Berkelman, R L; Orenstein, W A; Omer, S B; Improving influenza and Tdap vaccination during pregnancy: A cluster-randomized trial of a multi-component antenatal vaccine promotion package in late influenza season.; Vaccine; 2015; vol. 33 (no. 30); 3571-9

Study details

Study type	Cluster randomised controlled trial

Study location	Georgia, USA
Study setting	Obstetric practices
Study dates	August 2012 - November 2012
Sources of funding	Centers for Disease Control and Prevention
Inclusion criteria	Centre inclusion criteria: estimated influenza vaccination rate of <60% among pregnant patients during the previous 2011/2012 season Patient inclusion criteria: aged 18–50 years, able to read and write English, currently pregnant, and not received a 2012/2013 influenza vaccine or a Tdap vaccine during their current pregnancy
Exclusion criteria	Estimated influenza vaccination rate >60% among pregnant patients during the previous 2011/2012 season
Intervention(s)	3 types of education were delivered: 1. Practice level interventions (e.g. vaccine champions, posters and brochures); 2. Provider-level interventions (e.g. guidance on important talking points, nurse-led education session on the importance of giving antenatal vaccinations); 3. Patient-level education (e.g. iPad interactive tutorial, maps to local places that provide the vaccine if the practice did not provide them).
Comparator	No additional education materials provided. Practices asked to maintain their standard of care for vaccine promotion and administration.
Outcome measures	Vaccine uptake Vaccine receipt was assessed in 3 ways: obstetric chart review if the vaccine(s)were stocked by the patient's obstetric practice, patient recallduring a follow-up survey conducted 2–3 months post-partumand queries to the Georgia Registry for Immunization Transac-tions and Services (GRITS)
Number of participants	325
Duration of follow-up	Until 3 months post-partum
Additional comments	This study included data on influenza and pertussis vaccine. The data on influenza was excluded in this review because influenza vaccination is reviewed in a separate guideline.

Study arms

Vaccine education (N = 161)

6 clusters

Loss to follow-up	Influenza analysis: 6 Tdap analysis: 17

Control (N = 164)

5 clusters

Loss to follow-up	Influenza analysis: 12 Tdap analysis: 12

Characteristics

Arm-level characteristics

	Vaccine education (N = 161)	Control (N = 164)
Age *(Mean (SD))* Age at enrollment		
Mean/SD	26.9 (5.2)	27.5 (6)

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low *(Participants were recruited after cluster randomisation but eligibility was based on objective factors. Demographic information and beliefs about vaccines were only requested after randomisation)*
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(The outcome was objective where the practice stocked the vaccine, but was based on patient recall where the patient had to go elsewhere for the vaccine)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Where the practice did not stock the vaccine, the outcome was based on patient recall)*
	Overall Directness	Directly applicable

Chodick, 2021

Bibliographic Reference	Chodick, G.; Teper, G.R.; Levi, S.; Kopel, H.; Kleinbort, A.; Khen, E.; Schejter, E.; Shalev, V.; Stein, M.; Lewis, N.; The impact of a Facebook campaign among mothers on HPV vaccine uptake among their daughters: A randomized field study; Gynecologic Oncology; 2021; vol. 160 (no. 1); 106-111

Study details

Study type	Randomised controlled trial (RCT)
Study location	Israel
Study setting	Community
Study dates	2018
Sources of funding	Merck & Co

Inclusion criteria	Parents of adolescents: Adult female Maccabi Healthcare Services members who were mothers to 14 year-old daughters in the 2019 school year (who were born between 10/2004 and 12/2005).
Exclusion criteria	None
Intervention(s)	They investigated several different social marketing strategies to increase awareness and motivation with regard to HPV vaccination, using Medorion's artificial intelligence platform. The platform utilises digital communication channels to engage audiences for improved adherence and outcomes. In this study, they implemented the campaign through Facebook's social media channel. They used a Facebook Website Custom Audience (WCA) to control exposure across the study groups by allocating selected users in the intervention group to targeted ads. In order to maintain privacy, emails and cellphone numbers of study participants were extracted and hashed using the Secure Hash Algorithms (SHA)-256, a 'one-way' cryptographic function designed by the United States National Security Agency. After randomisation, hashed details of intervention group participants were uploaded and matched through Facebook's WCA using SHA-256. An overall match of 66% was achieved. This is a relatively high matching rate, given that approximately 77% of the one million women aged 35-54 in Israel use Facebook Campaign material had been prepared by gynecologists who are cervix specialists and clinical experts from the Israel Pediatric Infectious Disease Association. These were deployed to study population through their Facebook news feed during August to October of 2018 (the month when immunizations at schools typically start). Specific barriers to action were addressed in short videos and textual posts. The Facebook campaign was designed to gradually introduce members to content and to generate awareness of the MPH vaccination program. In addition, the campaign messages applied constructs from Inoculation theory to enhance the likelihood of persuasion. Specifically, messages provided audiences with a forewarning of counter-arguments – a threat component (in other words arguments against the HPV vaccination) followed by refutations of these counterarguments. Other campaign messages addressed additional issues and concerns regarding HPV vaccine hesitancy such as the importance of vaccination at early age, HPV prevalence, and safety issues. Facebook users exposed to the study campaign could progress through the campaign by watching over 50% of a video clips presented in their feed or by clicking on links in an ad.
Comparator	Control (no Facebook campaign)
Outcome measures	Vaccine uptake
Number of participants	21592
Duration of follow-up	Not provided
Loss to follow-up	None
Methods of analysis	
Additional comments	Vaccine uptake measured was for at least 1 dose of HPV vaccine.

Study arms

Facebook campaign to increase HPV vaccine uptake (N = 17271)

Control (no Facebook campaign) (N = 4321)

Characteristics

Arm-level characteristics

	Facebook campaign to increase HPV vaccine uptake (N = 17271)	Control (no Facebook campaign) (N = 4321)
Mean age (SD) of the mothers *(years)*		
Mean/SD	44.59 (5.2)	44.62 (5.14)

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	High *(The investigators wrote that data on uptake of HPV immunisations was provided by Israel Ministry of Health. Therefore, there is too little information. Furthermore, no follow-up time was provided.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(There are concerns with data collection.)*
	Overall Directness	Directly applicable

Cowan, 1992

Bibliographic Reference	Cowan, J A; Heckerling, P S; Parker, J B; Effect of a fact sheet reminder on performance of the periodic health examination: a randomized controlled trial.; American journal of preventive medicine; 1992; vol. 8 (no. 2); 104-9

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	General medical clinic (primary care)
Study dates	1985
Sources of funding	Not provided
Inclusion criteria	Individuals with a specified age (range) People over 65 years of age
Exclusion criteria	None
Intervention(s)	Fact sheet attached to every patient's records who attended the clinic. With regards to pneumonia, it said: ">65 years, pneumococcus (once)".
Comparator	No fact sheet (usual care).
Outcome measures	Vaccine uptake
Number of participants	62 (This is the per protocol analysis number - they did not say how many people over the age of 65 years who attended the clinic had already been vaccinated for pneumonia)
Duration of follow-up	Data was collected after the clinic.
Loss to follow-up	None
Additional comments	Data was also included for influenza vaccinaton. However, this was not relevant to this review. Data was provided per protocol analysis but not intention to treat. In other words, fact sheets were attached to every patients notes. However, data was only included for patients who met the criteria for vaccination (65 years and over for pneumonia). The data was not adjusted for clustering. Baseline characteristics were not provided.

Study arms

Fact sheet on patient notes for clinician (N = 29) 16 clusters
No fact sheet (N = 23) 13 clusters

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No details provided with regards to the*

Section	Question	Answer
		method of randomisation. No baseline characteristics are provided to check randomisation.)
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Some concerns *(Data is provided per protocol analysis, not intention to treat. For example, they do not provide the total number of participants who attended the clinic aged over 65 years (some may have already had the pneumonia vaccine).)*
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(There was no blinding at data collection. This could have influenced data collection.)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High
	Overall Directness	Directly applicable

Dempsey, 2019

Bibliographic Reference	Dempsey, Amanda F; Maertens, Julie; Sevick, Carter; Jimenez-Zambrano, Andrea; Juarez-Colunga, Elizabeth; A randomized, controlled, pragmatic trial of an iPad-based, tailored messaging intervention to increase human papillomavirus vaccination among Latinos.; Human vaccines & immunotherapeutics; 2019; vol. 15 (no. 78); 1577-1584

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Community
Study dates	2014 to 2016
Sources of funding	Patient Centered Outcomes Research Institute
Inclusion criteria	Individuals with a specified age (range) 9 to 17 years of age Parents Parents of the above adolescents

	Participants who spoke English or Spanish
Intervention(s)	Tailored intervention: Those in the tailored intervention received an iPad from a Research Assistant with the CHICOS (Combatting HPV Infections and CancerS) intervention programmed onto it. CHICOS was written at a 6th grade reading level and available in English or Spanish and provided in the clinics' waiting rooms. The intervention commenced with a short baseline survey that collected information about the participants'/participants' adolescent's name and birthday (to allow matching to vaccination records), attitudes and beliefs about HPV infection and vaccination, demographics, and self-reported/ parent-reported vaccination status. These data were then used to individually customize information in CHICOS that was provided directly on the iPad immediately following completion of the survey. Participants viewed the CHICOS information at their own pace for as long as they wished. Following this, they were asked by the Research Assistant to complete a short "post-intervention survey that reassessed their vaccination intentions for the visit. The Research Assistant was present throughout this process to help navigate the iPad or answer questions. Untailored intervention: Those in the untailored intervention also initiated the study with the same iPad-based baseline survey as in the CHICOS intervention. However, this information was not used to customize information. Instead, upon completion of the baseline survey the participant was provided with information from the Centers for Disease Control and Prevention's (CDC) HPV Vaccine Information Sheet that had been transcribed verbatim and shown over a series of seven webpages. The Supplemental Material provides screen shots of the untailored intervention. As with the CHICOS intervention, a Research Assistant was present throughout this process and a short post-intervention survey was provided.
Comparator	Usual care: Participants in this arm received care routinely provided by the clinician and did not interact with or have access to the iPad. Based on our pre-study informational interviews with study practices, usual care typically consisted of bringing up the need for vaccine during "routine physicals" (i.e. not illness visits) and providing a written version of the Vaccine Information Sheet for HPV at the time the vaccine was administered. However, these activities were completely at provider discretion and were not tracked as part of the study. The usual care arm did not receive a pre-intervention survey. The post-intervention survey was provided to participants by the Research Assistant immediately after the visit, in paper format.
Outcome measures	Vaccine uptake
Number of participants	848
Duration of follow-up	21 months after the study commenced.
Loss to follow-up	None
Additional comments	This study also included data for young adults aged 18 to 26 years. This data was excluded because this age range falls outside of the HPV routine vaccination schedule age range.

Study arms

Tailored information on an iPad (N = 287)
Untailored information on an iPad (N = 274)

Usual care (N = 287)

Characteristics

Arm-level characteristics

	Tailored information on an iPad (N = 287)	Untailored information on an iPad (N = 274)	Usual care (N = 287)
% Female *(%)*			
Nominal	49.8	48.5	48.4

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Clincians were not blinded. Therefore, the clincians in the usual care arm might have provided more advice than usual.)*
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Downgraded because the clinicians giving advice were not blinded.)*
	Overall Directness	Directly applicable

Dempsey, 2018

Bibliographic Reference	Dempsey, Amanda F; Pyrznawoski, Jennifer; Lockhart, Steven; Barnard, Juliana; Campagna, Elizabeth J; Garrett, Kathleen; Fisher, Allison; Dickinson, L Miriam; O'Leary, Sean T; Effect of a Health Care Professional Communication Training Intervention on Adolescent Human Papillomavirus Vaccination: A Cluster Randomized Clinical Trial.; JAMA pediatrics; 2018; vol. 172 (no. 5); e180016

Study details

Trial registration number and/or trial name	NCT02456077

Study type	Cluster randomised controlled trial
Study location	Denver, USA
Study setting	Paediatric or family medicine practices
Study dates	Baseline: September 2013 - August 2014 Intervention: February 2015 - January 2016
Sources of funding	Centers for Disease Control and Prevention
Inclusion criteria	Paediatrics or family medicine practice with at least 400 active adolescent patients (aged 11-17 years, seen within the last 2 years)
Exclusion criteria	None
Intervention(s)	5-component intervention that was designed based on the precaution adoption-process model including: (1) a fact sheet library that practices used to create practice-specific fact sheets about HPV infection and vaccination, (2) a parent education website called “iVac” that created individually customized information about HPV vaccination, (3) a series of disease images depicting diseases associated with HPV, (4) a decision aid for HPV vaccination, and (5) communication training to improve health care professionals’ vaccine recommendation practices. The communication training consisted of a self-guided, 30-minute webinar, plus 2 in-person, group training sessions that lasted 1 hour each.
Comparator	Usual care with no additional education. 8 practices with 16186 patients
Outcome measures	Vaccine uptake HPV vaccination - overall and by age group (11-12 years and 13-17 years) Meningococcal conjugate (MenACWY) vaccination - overall Tetanus-diphtheria-acellular pertussis (Tdap) vaccination - overall
Number of participants	8 practices with 13767 patients.
Duration of follow-up	2 years 4 months
Additional comments	8 practices with 13767 patients. Number of participants in each arm was not provided. Because the intervention was focused on increasing HPV vaccine uptake, only HPV uptake was used in the analysis. In this study, MenACWY was recorded as incidental information. Therefore, this data was excluded from the analysis because the intervention did not involve these vaccines. Data on Tdap was not included because it is not on the routine vaccination schedule for this age group.

Study arms

Vaccine communication education (N = 0)

8 clusters. The number of participants in each arm was not provided.

Loss to follow-up	0

Usual care (N = 0)

8 clusters. The number of participants in each arm was not provided.

Characteristics

Arm-level characteristics

	Vaccine communication education (N = 0)	Usual care (N = 0)
Age *(years)* Age at beginning of study period		
MedianIQR	12.5 (10.7 to 14.6)	12.6 (10.8 to 14.8)
% Female		
Custom value	50.8%	49.7%

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(States that study was randomised but no further information)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Low
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

DiClemente, 2015

Bibliographic Reference	DiClemente, Ralph J; Murray, Colleen Crittenden; Graham, Tracie; Still, Julia; Overcoming barriers to HPV vaccination: A randomized clinical trial of a culturally-tailored, media intervention among African American girls.; Human vaccines & immunotherapeutics; 2015; vol. 11 (no. 12); 2883-94

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Health clinics
Study dates	2010 to 2012
Sources of funding	Merk
Inclusion criteria	Individuals with a specified age (range) 13 to 18 years of age and self-identify as African American female. Unmarried Seeking reproductive or Sexually Transmitted Infection services

Exclusion criteria	Participants had already had the vaccine
Intervention(s)	Participants randomised into the Girls OnGuard intervention condition viewed a 12-minute interactive computer-delivered media presentation on HPV vaccination designed to enhance initial uptake and compliance of HPV4 and received a motivational keychain to store a vaccine reminder card (that was modelled in the video).
Comparator	Those randomised to the health comparison condition viewed a time-equivalent health promotion media presentation on physical activity and nutrition.
Number of participants	216
Duration of follow-up	7 months
Loss to follow-up	None

Study arms

Interactive computer-delivered media presentation (N = 108)
Control (N = 108)

Characteristics

Arm-level characteristics

	Interactive computer-delivered media presentation (N = 108)	**Control (N = 108)**
Age *(years)* Median		
Nominal	16.26 (1.54)	16.68 (1.44)

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(There is no mention of blinding at data collection. Data collection in this study required effort because it involved a review of patient records. Therefore, lack of blinding could have made data collection more rigorous in the intervention arm.)*

Section	Question	Answer
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Some concerns with data collection)*
	Overall Directness	Directly applicable

Dixon, 2019

Bibliographic Reference	Dixon, Brian E; Zimet, Gregory D; Xiao, Shan; Tu, Wanzhu; Lindsay, Brianna; Church, Abby; Downs, Stephen M; An Educational Intervention to Improve HPV Vaccination: A Cluster Randomized Trial.; Pediatrics; 2019; vol. 143 (no. 1)

Study details

Trial registration number and/or trial name	NCT02546752
Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Eskenazi Health (1 hospital and 9 community health centres)
Study dates	October 2015 - May 2016
Sources of funding	Merck–Regenstrief Program in Personalized Health Care Research and Innovation (project 20)
Inclusion criteria	Parents or guardians of adolescents aged 11 to 17 who were unvaccinated and partially vaccinated as of the date of visit during the study period Parents had a clear understanding of English or Spanish
Exclusion criteria	Children had received the full HPV vaccination series
Intervention(s)	Use of 'Theo' - a tablet-based interactive, patient-directed mobile health software. Theo screens for health risks at the point of care by using validated screening surveys, identifying specific patient risks, and delivering a standardized educational video in real time. Theo is used to measure pre- and postintervention patient knowledge, attitudes, readiness for change, and risk mitigation.
Comparator	No educational intervention.
Outcome measures	Vaccine uptake 2 weeks after clinic visit
Number of participants	1596
Duration of follow-up	2 weeks

Study arms

Tablet-based education (N = 537) 2 clusters	
Loss to follow-up	Not reported
Control (N = 1059) 3 clusters	
Loss to follow-up	Not reported

Characteristics

Arm-level characteristics

	Tablet-based education (N = 537)	Control (N = 1059)
Age (11-12 years) *(n (%))*		
Custom value	389 (72.4%)	524 (49.8%)
Age (13-14 years) *(n (%))*		
Custom value	89 (16.6%)	320 (30.2%)
Age (15-17) *(n (%))*		
Custom value	59 (11.0%)	212 (20.0%)
% Female		
Custom value	46.6%	44.7%

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Greater number of younger patients in the intervention arm than the control (49.8% in the 11-12 age group for the intervention compared to 72.4% in the control). Mean age was similar between the 2 groups)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Low *(Unclear if outcome assessors were aware of the intervention but outcomes*

Section	Question	Answer
		were objective, taken from a patient's health record)
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Some concerns over randomisation, with a greater number of younger patients in the intervention arm than the control arm)*
	Overall Directness	Directly applicable

Esposito, 2018

Bibliographic Reference	Esposito, Susanna; Bianchini, Sonia; Tagliabue, Claudia; Umbrello, Giulia; Madini, Barbara; Di Pietro, Giada; Principi, Nicola; Impact of a website based educational program for increasing vaccination coverage among adolescents.; Human vaccines & immunotherapeutics; 2018; vol. 14 (no. 4); 961-968

Study details

Study type	Cluster randomised controlled trial
Study location	Italy
Study setting	Schools
Study dates	2015 to 2016
Sources of funding	Pfizer
Inclusion criteria	Individuals with a specified age (range) 11 to 18 year olds at schools
Exclusion criteria	None
Intervention(s)	Arm 1: Presentation + website: Registration of vaccination coverage and attitudes toward vaccination at the beginning and at the end of the school year plus participation in a presentation and access to a specific website dedicated to vaccines and vaccination. Arm 2: Presentation + website + lecture: Same as the arm above plus participation in a lecture on vaccines and vaccination from medical experts in classrooms.
Comparator	Registration of vaccination coverage and attitudes toward vaccination at the beginning and at the end of the school year, but no intervention.
Outcome measures	Vaccine uptake
Number of participants	917
Duration of follow-up	The study started November 2015 and ended June 2016 (end of the school year). Therefore, follow-up was approximately 7 months maximum.
Loss to follow-up	None

Additional comments	This study also included data for Tdap (tetanus, diphtheria and pertussis), MenB, chickenpox, and influenza vaccines. However, this data was not included because they are not on the UK vaccination schedule for this age. Data for MenC vaccine was provided but not used because data for MenACWY was available: The latter vaccine more accurately reflects the UK vaccination schedule. Furthermore, fewer participants in the study were given MenC. Therefore, the data for MenACWY should be more precise. The data presented is unadjusted for clustering as the study authors did not adjust for this and there was no information provided in the study about the number of clusters, so we could not calculate it for this review.

Study arms

Presentation + website (N = 281) The number of clusters was not provided.
Presentation + website + lesson (N = 302) The number of clusters was not provided.
No intervention (N = 334) The number of clusters was not provided.

Characteristics

Arm-level characteristics

	Presentation + website (N = 281)	**Presentation + website + lesson (N = 302)**	**No intervention (N = 334)**
Age *(years)*			
Mean/SD	13.8 (2.3)	13.6 (2)	14.1 (2.3)
% Female *(%)*			
Nominal	53.4	64.2	55.1

Section	**Question**	**Answer**
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(The method of randomisation by classroom was not provided. The participants in the control arm were slightly older than the other arms.)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Some concerns *(There was no blinding. Children in one classroom could have discussed the presentations/website/lecture with other children and parents of a different classroom.)*

Section	Question	Answer
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(The data was collected from individual charts. Therefore, the lack of blinding could have influenced data collection.)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Method of randomisation is not provided. Children in the control arm were slightly older. Participants of one classroom could have discussed the intervention(s) with participants of other classrooms. Data was collected from individual charts by people who were not blinded.)*
	Overall Directness	Directly applicable

Gilkey, 2014

Bibliographic Reference	Gilkey, MB; Dayton, AM; Moss, JL; Sparks, AC; Grimshaw, AH; Bowling, JM; Brewer, NT; Increasing provision of adolescent vaccines in primary care: a randomized controlled trial; Pediatrics; 2014; vol. 134 (no. 2); e346-53

Study details

Trial registration number and/or trial name	NCT01544764 AFIX (Assessment, Feedback, Incentives, and eXchange) immunisation programme
Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Health care facilities in North Carolina's publicly funded vaccine programme
Study dates	April 2011 - August 2011 (intervention dates)
Sources of funding	Centers for Disease Control and Prevention
Inclusion criteria	Paediatric and family practice clinics with more than 200 patients aged 11 to 18 years with active records in the registry
Exclusion criteria	None reported
Intervention(s)	**Intervention 1:** Centre received an in-person consultation for the Centers for Disease Control and Prevention's AFIX (Assessment, Feedback, Incentives, and eXchange) immunisation programme (April 2011 - May 2011). AFIX involves an immunisation specialist who evaluates a clinic's vaccine coverage levels and works with providers to set goals for improvement. During the consultation, which consisted

	of a single 60- to 90-minute session, an immunization specialist met with the clinic's designated vaccine coordinator to evaluate vaccine coverage. In the "assessment and feedback" component, the immunization specialist presented coordinators with separate coverage estimates, specific to their clinic, for Tdap, meningococcal conjugate, 1 and 3 doses of HPV vaccine, 2 doses of measles-mumps-rubella (MMR), 3 doses of hepatitis B virus (HBV) and 2 doses of varicella. In the "exchange" component, the specialist helped coordinators gauge their progress by sharing information about average vaccine coverage for their clinic's county as well as coverage attained by other clinics within the county. In the "incentives" component, the specialist provided training in immunization best practices, such as how to maintain records in the immunization registry, how to generate reminders for patients, and how to decrease missed opportunities for concomitant vaccination. The vaccine coordinator selected several goals from a list of 20 prespecified immunization best practices on which to focus improvement efforts. At the 5-month follow-up, the specialist presented coordinators with updated vaccine coverage estimates so that they could assess their progress. **Intervention 2:** AFIX consultation delivered by webinar (May 2011-August 2011). Webinars used the same content and one-on-one approach as in-person consultations, but were delivered using an interactive conferencing system.
Comparator	No AFIX vaccine programme was delivered.
Outcome measures	Vaccine uptake At 5 month and 1 year follow up, separated by age (11 to 12 year olds and 13 to 18 year olds)
Number of participants	91 clinics Age 11 to 12 years: 32676 Age 13 to 18 years: 74767
Duration of follow-up	1 year
Loss to follow-up	None
Additional comments	Gilkey 2014 does not say how many participants were in each arm. Because participants were randomised, it is probable that roughly 10,892 participants were in each arm for the 11-12 years age group and roughly 24,922 participants were in the 13-18 years age catch-up group. The data has been synthesised accordingly (adjusted for clustering using an ICC of 0.05 as per this evidence review's methods section) and displayed separately. The data for HPV and MenACWY vaccines were included in the analysis. However, the data for pertussis, MMR, Tdap, HepB and varicella vaccines were excluded because they are not on the routine vaccination schedule for 11-18 years olds in the UK. The data for ≥1 HPV dose was included over the data for 3 doses of HPV because the former includes the data from the latter and some immunity is conferred by 1 dose. Data for the latest follow-up time point (1 year) was used in the analysis because this data is summative.

Study arms

In person vaccine programme (N = not stated) 30 clusters. The number of participants in each arm was not provided.
Webinar-based vaccine programme (N = not stated) 31 clusters. The number of participants in each arm was not provided.
Control (N = not stated) 30 clusters. The number of participants in each arm was not provided.

Characteristics

Arm-level characteristics

	In person vaccine programme (N = not stated)	Webinar-based vaccine programme (N = not stated)	Control (N = not stated)
% Female			
Custom value	46%	47%	48%

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(States that study was randomised but no further information)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	High *(The number of participants in each arm was not provided so we had to estimate the number in each arm)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(The number of participants in each arm was not provided)*
	Overall Directness	Directly applicable

Glanz, 2020

Bibliographic Reference	Glanz, J.M.; Wagner, N.M.; Narwaney, K.J.; Pyrzanowski, J.; Kwan, B.M.; Sevick, C.; Resnicow, K.; Dempsey, A.F.; Web-Based Tailored Messaging to Increase Vaccination: A Randomized Clinical Trial; Pediatrics; 2020; vol. 146 (no. 5); e20200669

Study details

Trial registration number and/or trial name	NCT02665013
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Community
Study dates	2016 to 2019
Sources of funding	National Institutes of Health
Inclusion criteria	Infants of women recruited during the last trimester of pregnancy. Potential participants were pregnant women, 18 years of age or over, identified by using a medical insurance company electronic health record (EHR). Participants who spoke English
Exclusion criteria	Pregnant women with a diagnosis of fetal death or congenital abnormality, or pregnant woman had a high risk medical condition.
Intervention(s)	**Intervention 1:** The Web-based tailored intervention was developed by using an iterative, user-driven approach that included surveys, one-on-one interviews, and usability testing. Informational content for the intervention was derived from peer-reviewed sources and online materials provided by the Centers for Disease Control and Prevention and the American Academy of Pediatrics. The messages conveying the information were tailored to each participants' intention to vaccinate, personal attitudes about vaccination, vaccination values, and the child's nickname, sex, and age. These data were collected from the preintervention survey, which activated an embedded algorithm to deliver the tailored messaging. After participants completed the preintervention survey, they were automatically directed to the website, which was personalized on the basis of their survey responses. Information on the website was arranged across 9 clickable tiles. The top 3 tiles were prominently labeled "Just for You" and contained the most highly tailored content that was based on the participants' vaccination values and top 3 vaccination concerns. The remaining content was lightly tailored on the basis of the participants' other, less pressing concerns identified by their survey responses. The lightly tailored content did not incorporate vaccination values. The intervention and surveys were administered again when the child was age 4 to 6, 10 to 12, and 13 to 15 months. The website was re-tailored and refreshed at each time point on the basis of the updated survey responses. Tailoring on attitudes was updated at all 3 follow-up time points, whereas tailoring on values was updated only at the 10- to 12-month time point. Participants in all 3 arms were administered the same surveys at the 4 intervention time points. **Intervention 2:** An untailored version of the website was created to isolate the effect of the tailoring. This version had the same design and factual information as the

	tailored website, but it was not personalised to the participants' survey responses, and the content did not change across the time points.
Comparator	Participants in all 3 study arms were eligible to receive standard pediatric preventive care. This consisted of scheduled 20-minute well-child visits at 2, 4, 6, and 12 months of age, with an option for a 9-month visit. Recommended childhood immunisations were administered at these health supervision visits, and it was standard practice to offer parents Vaccine Information Statements relevant to that visit. Participants in all 3 arms were administered the same surveys at the 4 intervention time points.
Outcome measures	Vaccine uptake
Number of participants	824
Duration of follow-up	At the first 200 days of age.
Loss to follow-up	None
Additional comments	Up to date status was recorded for the following vaccines: hepatitis B, rotavirus, diphtheria-tetanus, acellular pertussis, Haemophilus influenzae type b, pneumococcal conjugate, and inactivated poliovirus.

Study arms

Website with tailored information (N = 276)
Website with untailored information (N = 274)
Standard care (no website) (N = 274)

Characteristics

Arm-level characteristics

	Website with tailored information (N = 276)	**Website with untailored information (N = 274)**	**Standard care (no website) (N = 274)**
Parent's mean age (SD) *(years)*			
Mean/SD	31.96 (4.49)	32.2 (4.22)	31.81 (4.41)

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

Glanz, 2017

Bibliographic Reference	Glanz, Jason M; Wagner, Nicole M; Narwaney, Komal J; Kraus, Courtney R; Shoup, Jo Ann; Xu, Stanley; O'Leary, Sean T; Omer, Saad B; Gleason, Kathy S; Daley, Matthew F; Web-based Social Media Intervention to Increase Vaccine Acceptance: A Randomized Controlled Trial.; Pediatrics; 2017; vol. 140 (no. 6)

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Community
Study dates	2013 to 2015
Sources of funding	Agency for Healthcare Research and Quality
Inclusion criteria	Individuals with a specified age (range) Children from 0 to 200 days of age Participants who spoke English Pregnant women aged >18 years Pregnant women in the 3rd trimester of pregnancy were recruited and their children followed up from 0 to 200 days of age. Needed to have health insurance All participants were members of the Kaiser Permanente Colorado (KPCO) health plan, a nonprofit managed care organisation. Have internet access
Exclusion criteria	Pregnant women with a diagnosis of fetal death Or miscarriage or congenital abnormality
Intervention(s)	The theoretical basis for the website with vaccine information and interactive social media components intervention was the multidirectional communication model, a social marketing strategy with 3 components. Component 1 is a standard, top-down process in which website developers create and present content to users. Component 2 is a bottom-up process that allows users to create content and interact with Web site developers. Component 3 is a side-to-side process in which users can interact with each other and share information. This model is intended to empower users by allowing them to become active participants in the communication process, thereby eliciting positive health behavior changes. In contrast to this intervention, the website with vaccine information only VI intervention only included the topdown component of the model. The interventions were designed and pilot tested by using an adapted mental-models approach that included focus groups, individual interviews, surveys, and usability testing with parents and pregnant women. The study team first developed the factual vaccine content, guided by the Health Belief Model and Theory of Planned Behavior. They sought to present content that accurately represented the risks and benefits of vaccination, including

	information on vaccine-preventable diseases, vaccine safety, vaccine laws, the recommended immunisation schedule, vaccine ingredients, vaccine development, and basic immunology. Information was labeled and arranged into short, easy-to-read sections, guided by best practices in risk communication and Web site design. Sources of information were carefully referenced and hyperlinked to help convey transparency and credibility. The information was focused on encouraging parents to receive recommended vaccines on time. Participants in both intervention arms had access to the same base vaccine content. In addition to vaccine content, participants in the social media arm had access to social media technologies that included a blog, discussion forum, chat room, and "Ask a Question" portal through which participants could directly ask experts questions about vaccination. These technologies were designed to facilitate engagement and reinforce the factual content. Experts included a pediatrician, a vaccine safety researcher, and a risk communication specialist. Each month, the research team created 1 to 2 blog posts covering topics such as new vaccine safety research, vaccine-preventable disease outbreaks, changes in immunization policy, and the importance of adhering to the recommended immunization schedule. Posts were either text or audio (podcasts), and participants could contribute comments and ask questions. Each month, they hosted online chat sessions in which participants could engage in realtime conversations with experts. Participants were also encouraged to submit questions privately through e-mail; the team provided personalised responses within 2 business days. All participants in the social media arm received monthly newsletters to encourage website participation and highlight new website content. All interactive components were moderated to prevent bullying, disclosure of personal identifying health information, and abusive language. Responses to comments and questions adhered to a consistent communication framework designed to convey dedication, expertise, and honesty. Routine pediatric preventive care was available to participants in all study arms. Structured well-child visits were scheduled at 2 weeks and 2, 4, 6, and 12 months of age. Most immunizations were administered at these routinely scheduled, 20-minute health supervision visits. It was standard practice to provide a previsit informational sheet listing the vaccines recommended at that visit as well as Vaccine Information Statements.
Comparator	Routine pediatric preventive care was available to participants in all study arms. Structured well-child visits were scheduled at 2 weeks and 2, 4, 6, and 12 months of age. Most immunizations were administered at these routinely scheduled, 20-minute health supervision visits. It was standard practice to provide a previsit informational sheet listing the vaccines recommended at that visit as well as Vaccine Information Statements.
Number of participants	1093
Duration of follow-up	Up until age 200 days.
Loss to follow-up	In the website and social media arm, 100 were lost to follow-up. In the website arm, 74 were lost to follow-up. In the usual care arm, 31 were lost to follow-up. Reasons included fetal demise, child not enrolled in the insurance plan, child enrolled after 60 days, child disenrolled before study completion (this was the main reason for each of the 3 arms).

Study arms

Website with vaccine information + interactive social media components (N = 542)
Website with vaccine information (N = 371)
Control (N = 180)

Characteristics

Arm-level characteristics

	Website with vaccine information + interactive social media components (N = 542)	**Website with vaccine information (N = 371)**	**Control (N = 180)**
Mother's age *(years)*			
Mean/SD	31.4 (4.4)	31.5 (4.3)	31.4 (4.1)

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Some concerns *(The study does not say whether the clinicians managing the participants were blinded or not. (The study team may have been different from the clinical team.))*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(There was a relatively high dropout rate. However, this was similar for all 3 arms and similar reasons were given for each arm.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Although there was lack of blinding at data collection, vaccination status was obtained from an electronic health record.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

Grandahl, 2016

Bibliographic Reference	Grandahl, Maria; Rosenblad, Andreas; Stenhammar, Christina; Tyden, Tanja; Westerling, Ragnar; Larsson, Margareta; Oscarsson, Marie; Andrae, Bengt; Dalianis, Tina; Neveus, Tryggve; School-based intervention for the prevention of HPV among adolescents: a cluster randomised controlled study.; BMJ open; 2016; vol. 6 (no. 1); e009875

Study details

Trial registration number and/or trial name	NCT02280967
Study type	Cluster randomised controlled trial
Study location	Sweden
Study setting	First year upper secondary schools
Study dates	2014
Sources of funding	The Swedish Cancer Society, Uppsala-Örebro Regional Research Council, Uppsala County Council, the Swedish Government Funds for Clinical Research, Medical Faculty at Uppsala University.
Inclusion criteria	First year upper secondary school students (age 16 to 17 years) attending the regular health interview with the school nurse in the autumn semester of 2014
Exclusion criteria	Students who could not speak or write in Swedish Adolescents with severe learning disabilities and development disorders
Intervention(s)	Specific HPV education where the school nurse showed a specially designed flipchart with pictures and brief information to the students. They also handed out a specially designed leaflet. The intervention took about 30 min and included information on general facts about the virus, transmission, risk factors prevention and locations where students could get the vaccine.
Comparator	General information, including information about sexual health.
Outcome measures	Vaccine uptake
Number of participants	2883
Duration of follow-up	3 months

Study arms

HPV education group (N = 1587)

8 clusters

Loss to follow-up	4

Usual care (N = 1296)

10 clusters

Loss to follow-up	6

Characteristics

Arm-level characteristics

	HPV education group (N = 1587)	Usual care (N = 1296)
Age *(years)*		
Mean/SD	16.2 (16)	16.1 (16)
% Female		
Custom value	61.4%	41.6%

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Higher proportion of females in the intervention group and differences in number of children from an immigrant background. However, this was adjusted for in the analysis)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(Vaccine uptake outcome was participant-reported (based on participant's response to a questionnaire asking if they had the vaccine))*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Outcomes were based on participant-response rather than an objective outcome. Some differences in baseline characteristics, although these were adjusted for in the analysis)*
	Overall Directness	Directly applicable

Hannan, 2013

Bibliographic Reference	Hannan, Jean; APN telephone follow up to low-income first time mothers; Journal of Clinical Nursing; 2013; vol. 22 (no. 12); 262-270

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Nurses telephoned participants at home from the hospital.
Study dates	Not provided
Sources of funding	Not provided
Inclusion criteria	With a specified area or location Participants were recruited from the mother baby unit at Jackson Memorial Hospital in Miami. Pregnant women aged >18 years This was their first pregnancy. They were in good health. The pregnancy was singleton and the baby was a healthy, full-term infant. Participants were low income
Exclusion criteria	None
Intervention(s)	The intervention group received routine post discharge care plus follow up telephone calls by masters prepared paediatric advanced nurse practitioners on days 3, 7, 14, 21, 28 and week 8 post discharge. However, for this review, only the calls at 3 and 7 weeks are relevant because vaccination data was collected at approximately week 8. The advanced nurse practitioners were masters educated 'Pediatric Nurse Practitioners' with a minimum of 10 years experience as PNPs.
Comparator	The control group received routine post hospital discharge care.
Outcome measures	Vaccine uptake
Number of participants	139
Duration of follow-up	End of the second month post hospital discharge after giving birth.
Loss to follow-up	None
Additional comments	No baseline characteristics were provided for the two seperate arms. Vaccinations were age appropriate but not specified. For this review, only the calls at 3 and 7 weeks are relevant because vaccination data was collected at approximately week 8. The nurses provided advice about a range of things. For example, the comparison of outcomes included maternal health (stress, social support, physical health), infant health (immunisations as well as routine medical visits, weight gain), morbidity (urgent care visits, emergency room visits, re-hospitalisations), and health care charges (urgent care visits, emergency room visits, re-hospitalisations). However, only the immunisation data was relevant to this review.

Study arms

Telephone advice from an advanced nurse practitioner (N = 70)

No telephone advice (N = 69)

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Some concerns *(It is possible that the lack of blinding could have influenced clinicians' care in the control arm. However, there is insufficient information to make a judgement about this.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(There was no blinding and the method of data collection is not explained. This could have introduced bias.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Lack of blinding could have introduced bias with regards to data collection.)*
	Overall Directness	Directly applicable

Henriksen, 2018

Bibliographic Reference	Henrikson NB; Zhu W; Baba L; Nguyen M; Berthoud H; Gundersen G; Hofstetter AM; Outreach and Reminders to Improve Human Papillomavirus Vaccination in an Integrated Primary Care System.; Clinical pediatrics; 2018; vol. 57 (no. 13)

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	7 primary care clinics
Study dates	July 2015 - August 2016
Sources of funding	Group Health Foundation, Group Health Cooperative, Seattle, WA
Inclusion criteria	Patients aged 10-12 years who received care at one of the primary care clinics
Exclusion criteria	Patients who had received any doses of HPV vaccine

Intervention(s)	Mailed outreach letters with telephone/text reminder components. The mailed component was a one-off letter addressed to the parent of the child containing a statement that the child was due for the HPV vaccine, that the immunization team strongly recommended the vaccine, facts about the vaccine schedule and where patients could get the vaccine, and a statement that the parent would receive a follow-up reminder call. The mailout also included a single page trifold educational brochure with more information about vaccine safety and effectiveness. Reminder calls were sent out 8 weeks later and used interactive voice recognition with interactive prompts. For the dose 1 call, the script stated that the call was a follow-up to the letter sent previously, asked if the parent was intending to get their child vaccinated against HPV, and, if not, asked the parent to indicate barriers to HPV vaccination. It also restated the health system clinic locations where the HPV vaccine was available. At the end of the call, the parent was asked if they would like to receive future reminders by text message. If the parent could not be reached, an automated voice mail message asked for a return call to a toll-free number about their child's immunizations.
Comparator	Usual care - no outreach letter or reminder call
Outcome measures	Vaccine uptake During study period and within 210 days of the first dose
Number of participants	1805
Duration of follow-up	Duration of study period and within 210 days of first vaccine dose
Loss to follow-up	
Additional comments	Results in the review are reported for all 3 completed doses within the study period (1 year). Data was also reported for all 3 doses within 210 days of the 1st dose.

Study arms

Outreach letter and dose 1 reminder (N = 236)

Outreach letter and dose 1, 2 and 3 reminders (N = 227)

Control (no letter or reminders) (N = 451)

Characteristics

Characteristic	Outreach letter and dose 1 reminder (N = 236)	Outreach letter and dose 1, 2 and 3 reminders (N = 227)	Control (no letter or reminders) (N = 451)
% age 10 years at randomisation Custom value	46.8%	Intervention groups combined: 46.2%	*empty data*
% age 11 years at randomisation Custom value	31.3%	Intervention groups combined: 33.5%	*empty data*

Characteristic	Outreach letter and dose 1 reminder (N = 236)	Outreach letter and dose 1, 2 and 3 reminders (N = 227)	Control (no letter or reminders) (N = 451)
% age 12 years at randomisation Custom value	22.0%	20.3%	*empty data*
% Female Custom value	53.3%	Intervention groups combined: 51.1%	*empty data*

Risk of bias

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information about randomisation process or allocation concealment)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Limited information about analysis methods)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Limited information about randomisation, allocation concealment and analysis methods.)*
Overall bias and Directness	Overall Directness	Directly applicable

Jackson, 2011

Bibliographic Reference	Jackson, Cath; Cheater, Francine M; Harrison, Wendy; Peacock, Rose; Bekker, Hilary; West, Robert; Leese, Brenda; Randomised cluster trial to support informed parental decision-making for the MMR vaccine.; BMC public health; 2011; vol. 11; 475

Study details

Study type	Cluster randomised controlled trial
Study location	Leeds, UK
Study setting	Primary healthcare centres and childcare centres

Study dates	July 2006 - August 2006
Sources of funding	Department of Health Public Health Initiative Award
Inclusion criteria	Primary healthcare centres employing at least two medical practitioners Purposively selected based on their low income scheme index scores Childcare organisations in the same wards as included healthcare centres Selected on the basis of size, the largest first Parents who were English literate and had a child eligible for the first or second dose of the MMR vaccine At the time of the study the first dose was given at 13 months and the second dose between 4-5.5 years of age. The target age range for the study was 6 months to 5 years.
Exclusion criteria	None
Intervention(s)	Parents were sent an information leaflet about the MMR vaccine followed by a 2 hour meeting. The meeting included three components: provision of balanced information, a group discussion and a coaching exercise, all aimed at discussing the vaccine and answering any questions that the parents had about the vaccination.
Comparator	The control arm received the leaflet only.
Outcome measures	Vaccine uptake Based on parent questionnaire response
Number of participants	6 healthcare centres, 6 childcare organisations (142 parents)
Duration of follow-up	3 months

Study arms

Parent education (N = 71) 6 clusters	
Loss to follow-up	13
Control (N = 71) 6 clusters	
Loss to follow-up	7

Characteristics

Arm-level characteristics

	Parent education (N = 71)	**Control (N = 71)**
Mean parent age *(years)*		
Mean/SD	34.07 (5.43)	34.06 (5.52)
Mean age of youngest child eligible for vaccine *(Months)*		
Mean/SD	25.73 (14.66)	19.77 (11.69)
Mean age of second youngest child eligible for vaccine *(Months)*		
Mean/SD	50.56 (17.13)	49.32 (21.41)

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Some concerns *(Higher proportion of missing data for the intervention than control arm (23 of 71 parents did not recevie the intervention, All parents in the control arm received the control). The researchers took this into account in the analysis)*
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(Outcome was based on parent-reported questionnaire)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Outcome was subjective (based on parent-reported questionnaire). A substantial number of parents did not receive the intervention but all parents randomised to the control arm received the control, although the researchers took this into account in the analysis)*
	Overall Directness	Directly applicable

Jacobson, 1999

Bibliographic Reference	Jacobson, T A; Thomas, D M; Morton, F J; Offutt, G; Shevlin, J; Ray, S; Use of a low-literacy patient education tool to enhance pneumococcal vaccination rates. A randomized controlled trial.; JAMA; 1999; vol. 282 (no. 7); 646-50

Study details

Evidence table available in	The evidence table for this study can be found in the Kaufman 2018 Cochrane review.

an included systematic review	

Joseph, 2016

Bibliographic Reference	Joseph, Natalie Pierre; Bernstein, Judith; Pelton, Steve; Belizaire, Myrdell; Goff, Ginette; Horanieh, Nour; Freund, Karen M; Brief Client-Centered Motivational and Behavioral Intervention to Promote HPV Vaccination in a Hard-to-Reach Population: A Pilot Randomized Controlled Trial.; Clinical pediatrics; 2016; vol. 55 (no. 9); 851-9

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Primary care clinic at a hospital
Study dates	2011 to 2013
Sources of funding	American Cancer Society
Inclusion criteria	Individuals with a specified age (range) Age 11 to 15 years Parents Mother self-identified as African American or Haitian (US born or immigrants) Participants who spoke English Or Haitian Creole
Exclusion criteria	Participants who had already received the vaccine Female adolescent considered for vaccination was pregnant Or was a teen parent.
Intervention(s)	The 'Brief Negotiated Interviewing' intervention addressed mothers' beliefs, values, and concerns about HPV prevention and accounting for their priorities for health and well-being. Brief Negotiated Interviewing was administered to mothers over 10 to 20 minutes by a trained intervention provider and contained the following components: 1. Established rapport and discussed HPV by inviting mothers to discuss the impact of HPV. 2. Assessed advantages and disadvantages of vaccination to help resolve ambivalence while increasing self-efficacy about vaccine decisions, using reflective listening. 3. Helped mothers evaluate attitudes, misconceptions, and concerns about the HPV vaccine, and provided information on reducing the risk of HPV exposure. 4. Asked mothers to self-identify readiness to using a standard scale. Probed gaps between attitudes and self-ascribed reasons to vaccinate. 5. Negotiated, advised, and summarized by setting goals to identify next steps related to the HPV vaccine. Encouraged decision-making/alternative thoughts about benefits of the vaccine, summarizing, offering resources, writing down a prescriptive plan, and providing handouts. Encouraged women to ask provider for the vaccine if it was their intent to vaccinate their daughter. Research assistants received standardized training to conduct the Brief Negotiated Interviewing intervention. The codirector of the Brief Negotiated Interviewing Active Referral to Treatment Institute at Boston University School of Public Health and staff trained interventionists used a standardized curriculum for health educators approved by the National Registry

	of Evidence-Based Programs and Practices. This curriculum had been tested in RCTs and found to be effective for short-term outcomes. Training included didactic sessions, role-playing, and training in reflective listening, rolling with resistance, and resolving ambivalence. They provided weekly clinical supervision to research assistants using a standardized checklist and received feedback on difficulties and successes in intervention implementation. Recording a random sample of 20% of interventionist-parent interactions monitored intervention fidelity.
Comparator	Mothers assigned to the control group received the low literacy, standard-practice, HPV vaccine information sheet given to all patients prior to vaccination. Control mothers met once with the research assistant to collect demographic characteristics, HPV knowledge, and vaccine status of the daughter on the day of visit. No Brief Negotiated Interviewing counseling was provided.
Number of participants	200
Duration of follow-up	12 months
Loss to follow-up	None
Additional comments	Although the inclusion criteria includes immigrants, the study does not report how many of the participants were immigrants.

Study arms

Face-to-face education (N = 100)
Control (N = 100)

Characteristics

Arm-level characteristics

	Face-to-face education (N = 100)	**Control (N = 100)**
Mother's age *(years)*		
Mean/SD	40 (9)	41 (7)

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low *(Although there was no blinding, data was collected using a central electronic medical record system.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low

Section	Question	Answer
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

Kriss, 2017

Bibliographic Reference	Kriss, Jennifer L; Frew, Paula M; Cortes, Marielysse; Malik, Fauzia A; Chamberlain, Allison T; Seib, Katherine; Flowers, Lisa; Ault, Kevin A; Howards, Penelope P; Orenstein, Walter A; Omer, Saad B; Evaluation of two vaccine education interventions to improve pertussis vaccination among pregnant African American women: A randomized controlled trial.; Vaccine; 2017; vol. 35 (no. 11); 1551-1558

Study details

Study type	Randomised controlled trial
Study location	USA
Study setting	Antenatal clinic waiting rooms
Study dates	2013
Sources of funding	Not provided
Inclusion criteria	Pregnant women Aged 18 to 50 years and African American
Exclusion criteria	Participants who had already received the vaccine Already received an influenza or Tdap vaccine during current pregnancy
Intervention(s)	Intervention 1: An affective messaging video titled “Pregnant Pause,” or Intervention 2: A cognitive messaging iBook titled “Vaccines for a Healthy Pregnancy.” Both vaccine education interventions were completed on a handheld electronic tablet device and were designed to take no longer than 20 minutes, to enable patients to complete them while waiting for their prenatal appointments. The “Pregnant Pause” video was targeted specifically to pregnant women and showed physicians providing detailed information on Tdap and influenza vaccines, the severity of pertussis and influenza, how the vaccines protect pregnant women and newborns, safety information, and the current Advisory Committee on Immunization Practices (ACIP) recommendations. The interactive iBook was based on an educational tutorial developed for a previous study, but modified to exclude affective testimonial videos of parents whose infants contracted influenza and pertussis. This tutorial provided information through a question-and-answer format on the topics of antenatal Tdap and influenza vaccination, vaccine safety, pertussis and influenza among pregnant women and infants, and the current ACIP recommendations for vaccination during pregnancy. Women could choose the topic(s) that most interested them and complete each tutorial section separately. The video and iBook were given to the women in the waiting room, and if not completed before the woman was called back for her appointment, the woman was allowed to take the iPad to her examination room to complete.

Comparator	Women randomised to the control arm received the standard CDC Vaccine Information Statements (VIS) on Tdap and influenza vaccines. These statements are paper-based, text-only, non-interactive, and do not contain information specifically targeted for pregnant women.
Number of participants	106
Duration of follow-up	1 to 2 months after the expected delivery date.
Loss to follow-up	None
Additional comments	The interventions included information about influenza vaccine. Data for influenza vaccine was not collected by the investigators.

Study arms

Interactive electronic book (N = 33)
Video education (N = 33)
Written advice from the CDC about vaccines in general (not specifically about relevant vaccines) (N = 40)

Characteristics

Arm-level characteristics

	Interactive electronic book (N = 33)	**Video education (N = 33)**	**Written advice from the CDC about vaccines in general (not specifically about relevant vaccines) (N = 40)**
Maternal age *(years)*			
Mean/SD	27.4 (5.1)	25.8 (5.1)	25.3 (6)

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(There was no blinding in this study. However, there is nothing written to suggest that the clinicians knew what arm participants had been randomised to.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(There was no blinding in this study and the investigators do not describe how data was collected.)*

Section	Question	Answer
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(No blinding and no details on how uptake was measured.)*
	Overall Directness	Directly applicable *(Follow-up was at 1 to 2 months after birth. Therefore, some vaccinations may not have been administered during pregnancy. However, we have not downgraded because the follow-up time was reasonably timely.)*

Lee, 2018

Bibliographic Reference	Lee, Haeok; Kim, Minjin; Cooley, Mary E; Kiang, Peter Nien-Chu; Kim, Deogwoon; Tang, Shirley; Shi, Ling; Thiem, Linda; Kan, Penhsamnang; Peou, Sonith; Touch, Chhan; Chea, Phala; Allison, Jeroan; Using narrative intervention for HPV vaccine behavior change among Khmer mothers and daughters: A pilot RCT to examine feasibility, acceptability, and preliminary effectiveness.; Applied nursing research : ANR; 2018; vol. 40; 51-60

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	People who were Cambodian refugees from 1975 to 1979 living in Massachusetts, USA.
Study dates	Not provided
Sources of funding	University of Massachusetts Boston and Dana-Farber/Harvard Cancer Center.
Inclusion criteria	Individuals with a specified age (range) Girls aged 14 to 17 years of age. The ability to speak and read Khmer or English Parents Ability to speak and read Khmer or English, self-identification as a Khmer mother (or legal guardian) of a 14 to 17 year old girl.
Exclusion criteria	Participants had already had the vaccine
Intervention(s)	Bilingual data collectors introduced the storytelling DVD to the mothers in Khmer while Asian American college students did the same in English with the daughters in the intervention arm. The participants watched a 26-minute storytelling DVD, entitled “Save My Daughter from Cervical Cancer,” from the research assistant's laptop computer. The mothers watched the DVD of Khmer mothers' stories and the daughters watched daughters' stories in separate locations that include their homes, Khmer restaurants, Khmer community health centers or the researcher's cars. After watching the DVD, post-media interviews were conducted in a semi-structured format. The storytelling DVD including both the stories of mothers and daughters was then given to the mother-daughter dyads and they were encouraged to watch it together at home.
Comparator	All the conditions for the control group were the same as for the intervention group, except mothers and daughters in the control group received written non-narrative education materials. The written educational materials in both

	Khmer and English were provided for the Khmer mothers and in English only for the daughters. The data collectors stayed until the participants finished reading the educational materials. After the session, the materials were given to the mothers and daughters to take home to read together.
Number of participants	19
Duration of follow-up	3 weeks
Loss to follow-up	None
Additional comments	This study measured uptake as vaccine initiation. In other words, the first dose of HPV.

Study arms

Education using videos (N = 10)
Education using written information (N = 9)

Characteristics

Arm-level characteristics

	Education using videos (N = 10)	**Education using written information (N = 9)**
Age of the daughters *(years)*		
Mean/SD	15.2 (1.3)	15.4 (1.1)
Age of the mothers *(years)*		
Mean/SD	47 (10)	42.8 (6.7)

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Although they did not explain the randomisation procedure, the arms appeared to be balanced with regards to baseline characteristics.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low

Section	Question	Answer
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	High *(Uptake was measured by telephoning participants and/or their mothers and asking them if they had been vaccinated. Therefore, it is possible that data is innacurate because the study was aimed at increasing uptake. Therefore, participants might have felt pressure to say that they had been vaccinated when they had not. Particularly the video arm because effort had gone into it.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(There are some concerns with the way data had been collected.)*
	Overall Directness	Directly applicable

O'Leary, 2019

Bibliographic Reference	O'Leary, S.T.; Narwaney, K.J.; Wagner, N.M.; Kraus, C.R.; Omer, S.B.; Glanz, J.M.; Efficacy of a Web-Based Intervention to Increase Uptake of Maternal Vaccines: An RCT; American Journal of Preventive Medicine; 2019; vol. 57 (no. 4); e125-e133

Study details

Secondary publication of another included study- see primary study for details	This is a substudy of Glanz 2017. Glanz 2017 looked at uptake in the infants. O'Leary 2019 looked at uptake in the pregnant women before they gave birth to the infants.
Trial registration number and/or trial name	NCT01873040
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Community
Study dates	2013 to 2016
Sources of funding	Agency for Health care Research and Quality
Inclusion criteria	Participants who spoke English Pregnant women aged >18 years In the third trimester of pregnancy (6−13 weeks from delivery). Needed to have health insurance Kaiser Permanente Colorado health insurance. Have internet access

Exclusion criteria	Pregnant women with a diagnosis of fetal death Or miscarriage or congenital anomaly.
Intervention(s)	There were 2 different interventions/arms: 1) Website with vaccine information and interactive social media components. 2) Website with vaccine information only. Though most of the website was devoted to childhood immunizations, the website also contained information specifically related to maternal vaccinations and concerns. This information included national vaccine recommendations during pregnancy (Tdap and influenza), details on each recommended vaccine including safety information and ingredients, a description of the diseases the vaccines prevent (tetanus, diphtheria, pertussis, and influenza), and answers to common vaccine concerns during pregnancy. Information was arranged into short, easy-toread sections, using best practices in risk communication and website design. Sources of information were thoroughly referenced with web links to help convey transparency and credibility. Participants in the VSM and VI arms had access to the same base vaccine content, which they accessed through a link sent to their e-mail address. Participants in the website + interactive social media arm also had access to interactive components including a blog, discussion forum, chat room, and an “Ask a Question” portal through which participants could ask experts questions about vaccination. All interactive components were moderated to prevent bullying and disclosure of personal health information.
Comparator	Usual care. Participants enrolled in the usual care arm received routine obstetric care but did not have access to the website intervention.
Number of participants	1093
Duration of follow-up	Uptake was measured at delivery (birth).
Loss to follow-up	None
Additional comments	This study also included data for influenza vaccine. However, influenza vaccine was not included in this evidence review. The data for this study has been presented separately to avoid double-counting because it is a substudy of Glanz 2017.

Study arms

Website with vaccine information and interactive social media components (N = 542)
Website with vaccine information (N = 371)
Usual care (N = 180)

Characteristics

Arm-level characteristics

	Website with vaccine information and interactive social media components (N = 542)	Website with vaccine information (N = 371)	Usual care (N = 180)
Age of mothers *(years)*			
Mean/SD	31.9 (4.7)	32.1 (4.4)	32.1 (4.2)

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	High *(There is no mention of blinding and they do not mention how data was collected. As a consequence, the lack of blinding could have lead to unequal effort to collect data for each arm.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Lack of blinding and no information about how data was collected.)*
	Overall Directness	Directly applicable

Payakachat, 2016

Bibliographic Reference	Payakachat, Nalin; Hadden, Kristie B; Ragland, Denise; Promoting Tdap immunization in pregnancy: Associations between maternal perceptions and vaccination rates.; Vaccine; 2016; vol. 34 (no. 1); 179-86

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Women's clinics at medical centres
Study dates	2014
Sources of funding	University of Arkansas for Medical Sciences, College of Pharmacy. The National Institute of Mental Health.

Inclusion criteria	Participants who spoke English Pregnant women At least 18 years of age.
Exclusion criteria	People who lacked the cognitive ability to make decisions concerning research participation
Intervention(s)	Participants were given a plain language version of the CDC's information on pertussis (Tdap) vaccine.
Comparator	Participants were given a standard version of the CDC's information on pertussis (Tdap) vaccine.
Outcome measures	Vaccine uptake
Number of participants	279
Duration of follow-up	11 to 13 months
Loss to follow-up	None
Additional comments	This study included a survey. However, it was not included because it did not have any outcomes of interest with regards to this evidence review.

Study arms

Plain language information on pertussis vaccine (N = 135)
Standard information on pertussis vaccine (N = 144)

Characteristics

Arm-level characteristics

	Plain language information on pertussis vaccine (N = 135)	**Standard information on pertussis vaccine (N = 144)**
Age *(years)*		
Mean/SD	26.2 (6.1)	26.5 (5.3)

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns *(Lack of blinding at data collection.)*
	Overall Directness	Directly applicable

Porter-Jones, 2009

Bibliographic Reference	Porter-Jones, G; Williams, S; Powell, C; Pusey, L; Roberts, R J; Impact of a novel way to communicate information about MMR on uptake of MMR vaccine: a randomized controlled trial.; Public health; 2009; vol. 123 (no. 1); 78-80

Study details

Study type	Randomised controlled trial (RCT)
Study location	UK
Study setting	Parent and toddler group
Study dates	Not provided.
Sources of funding	None declared.
Inclusion criteria	Individuals with a specified age (range) Children eligible for their first dose of MMR vaccine (MMR1) being seen by their health visitor for the routine 8-month assessment.
Exclusion criteria	Participants with specified circumstances Terminally ill infants and/or those who had a contraindication to the vaccine.
Intervention(s)	Normal management plus a teddy bear wearing a T-shirt displaying a website address and telephone number that provided information about MMR. The bear's T-shirt contained three items of information: 1. The statement 'Get the Bear Facts', and its Welsh translation "Mynnwch y Ffeithiau". 2. The address of the website set up by the research team (www.mmrmyths.com). 3. A telephone number. The website address imperceptibly directed all hits to an existing National Health Service (NHS) website (www.mmrthefacts.nhs.uk) which is the NHS portal for information on MMR vaccine in the UK. They were issued at the 8-month assessment, with MMR1 not due until 5 months later.
Comparator	Normal management alone.
Outcome measures	Vaccine uptake
Number of participants	974
Duration of follow-up	Not provided.
Loss to follow-up	None

Additional comments	Baseline characteristics were not provided.

Study arms

Teddy bears with a website address and telephone number that provided information about MMR (N = 542)
Standard MMR information (N = 432)

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Randomisation was by week of birth. Therefore, it may have been possible to predict which child would receive a teddy bear. No baseline characteristics were provided to assess randomisation.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	High *(They gave the teddy bear to children 5 months before vaccination was due. This delay may have been too long. They do not mention blinding in the study. Knowledge of the intervention could have affected the management staff provided.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(There were no details about how data was collected. No mention was made of blinding when data was collected.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Concerns with randomisation and lack of blinding. 5 month delay between intervention and vaccination.)*
	Overall Directness	Directly applicable

Pot, 2017

Bibliographic Reference	Pot, Mirjam; Paulussen, Theo Gwm; Ruiter, Robert Ac; Eekhout, Iris; de Melker, Hester E; Spoelstra, Maxine Ea; van Keulen, Hilde M; Effectiveness of a Web-Based Tailored Intervention With Virtual Assistants Promoting the Acceptability of HPV Vaccination Among Mothers of Invited Girls: Randomized Controlled Trial.; Journal of medical Internet research; 2017; vol. 19 (no. 9); e312

Study details

Trial registration number and/or trial name	NTR4935
Study type	Randomised controlled trial
Study location	The Netherlands
Study setting	Community
Study dates	Not provided.
Sources of funding	Netherlands Organization for Scientific Research
Inclusion criteria	Parents Mothers of adlolescents. No further information was provided.
Exclusion criteria	None
Intervention(s)	An HPV vaccine reminder was sent 1 week after the first invitation. One week after the reminder, participants in the intervention condition received an email inviting them to visit the Web-based tailored feedback. Two weeks after this invitation, a reminder was sent to use the website. The intervention consisted of a website providing mothers with tailored feedback from 2 virtual assistants. Computer-tailoring was the basic method for change and fitted the outcome of a previously conducted needs assessment indicating that the mothers preferred personalized feedback. Tailoring is a health communication strategy in which messages are individualized to the person's preferences and needs. 2 virtual assistants were used for delivering the tailored feedback; a mother- and doctor-like assistant. They provided opportunities for two-way interactions and for creating a highly personal experience. The website consisted of four menu options: (1) two-sided information about the HPV vaccination, (2) a decisional balance, (3) practical background information, and (4) frequently asked questions. In the first menu, mothers were able to collect tailored information about the HPV vaccination such as information about the risk of contracting an HPV infection, which may cause cervical cancer, as well as the risks and effectiveness of the HPV vaccine. In the second menu, a decisional balance gave mothers the opportunity to weigh their perceived pros and cons to balance the mothers' position toward vaccinating versus not vaccinating the daughter. In the third menu, mothers received practical information such as how and where to get the HPV vaccination and how to talk to their daughter and/or partner about the HPV vaccination.
Comparator	An HPV vaccine reminder was sent 1 week after the first invitation. Participants in both arms had access to the universal information about the HPV vaccination as part of the regular invitation for the HPV vaccination.

Outcome measures	Vaccine uptake
Number of participants	8062
Duration of follow-up	18 months
Loss to follow-up	None
Additional comments	In this study, uptake is the number of girls who received either 1 or 2 doses of HPV vaccine. There is no data for the first and second dose seperately.

Study arms

Website with tailored information (N = 3995)
Control (N = 4067)

Characteristics

Arm-level characteristics

	Website with tailored information (N = 3995)	**Control (N = 4067)**
Age of participants *(years)*		
Mean/SD	43.7 (4.27)	43.58 (4.22)

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Some concerns with data collection.)*
	Overall Directness	Directly applicable

Saitoh, 2013

Bibliographic Reference	Saitoh, Aya; Nagata, Satoko; Saitoh, Akihiko; Tsukahara, Yuki; Vaida, Florin; Sonobe, Tomoyoshi; Kamiya, Hajime; Naruse, Takashi; Murashima, Sachiyo; Perinatal immunization education improves immunization rates and knowledge: A randomized controlled trial; Preventive Medicine; 2013; vol. 56 (no. 6); 398-405

Study details

Evidence table available in an included systematic review	The evidence table for this study can be found in the Kaufman 2018 Cochrane review.

Saitoh, 2017

Bibliographic Reference	Saitoh, Aya; Saitoh, Akihiko; Sato, Isamu; Shinozaki, Tomohiro; Kamiya, Hajime; Nagata, Satoko; Effect of stepwise perinatal immunization education: A cluster-randomized controlled trial.; Vaccine; 2017; vol. 35 (no. 12); 1645-1651

Study details

Evidence table available in an included systematic review	The evidence table for this study can be found in the Kaufman 2018 Cochrane review.

Santa Maria, 2021

Bibliographic Reference	Santa Maria, D.; Markham, C.; Misra, S.M.; Coleman, D.C.; Lyons, M.; Desormeaux, C.; Cron, S.; Guilamo-Ramos, V.; Effects of a randomized controlled trial of a brief, student-nurse led, parent-based sexual health intervention on parental protective factors and HPV vaccination uptake; BMC public health; 2021; vol. 21 (no. 1); 585

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Health centre
Study dates	2015 to 2018
Sources of funding	National Institutes of Health
Inclusion criteria	Parents and caregivers of adolescents 11 to 14 years of age.

Exclusion criteria	None
Intervention(s)	In the face-to-face session, the parent and student nurse met for approximately 45 min to review the sexual health curriculum and HPV materials, motivate parents to talk with their children, and address specific components of the program. Student nurses helped parents designate a time to talk with their children and reviewed information about the context of the present-day teen's world (e.g., physical changes, teen thinking, peers, emotions, and teen moral development) and how a parent can help a teen through positive parenting (e.g., parenting styles, child discipline, parental monitoring, communication, relationship building, forming healthy relationships, self-esteem, refusal and negotiation skills, and risk reduction strategies). The student nurse reviewed information about adolescent vaccinations including the importance of the HPV vaccine, presented local resource materials detailing where and when the child can get vaccinated, and helped the parent make an appointment for vaccination when onsite vaccination clinics were available. Each parent received a manual that reiterated the above-mentioned information as well as three handouts to supplement the face-to-face session. The handouts discussed adolescent vaccinations, contraceptives, and healthy relationships. Parents were encouraged to work through the activities. The manual was divided into sections covering health and social consequences of premature sexual behaviors, positive parental influences on adolescent sexual behaviors, saying 'no' to sex, common teen beliefs about sex, monitoring and supervision strategies, parent-child relationship building, and communication tips. Two follow-up telephone-based booster calls were delivered at one- and three-months post-intervention. During the booster session call, the student nurse discussed the parent's progress with communication and vaccination and discussed barriers they were facing while progressing through the manual with their child. Bilingual nursing students were assigned to participants who preferred to receive the intervention discussion or materials in Spanish. When possible, they coordinated with a local pediatric mobile vaccination clinic to offer all childhood vaccinations free of charge through the Vaccines for Children program during the recruitment events. A total of seven vaccination events were coordinated.
Comparator	The attention control group parents received information from the student nurse on promoting healthy nutrition and exercise among adolescents in a 45-min session. During the session, the student nurse and the parent set a goal related to nutrition and physical activity for their child. Parents also received a brochure of healthy lifestyles and booster calls at 1- and 3-months post-intervention. Similarly, all materials and sessions were available in English and Spanish.
Outcome measures	Vaccine uptake
Number of participants	508
Duration of follow-up	6 months
Loss to follow-up	None
Additional comments	Numerical data for vaccine uptake was provided at 6 months for the 1st HPV dose. However, the investigators wrote that there was no statistical difference between the arms at 6 months for HPV completion (all 3 doses) - no numerical data was provided for this.

Study arms

Parental and adolescent education by a nurse. Written information for parents (N = 255)

Control (N = 253)

Characteristics

Arm-level characteristics

	Parental and adolescent education by a nurse. Written information for parents (N = 255)	Control (N = 253)
Mean age (SD) of adolescent *(years)*		
Mean/SD	12.58 (1.22)	12.57 (1.11)

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

Scarinci, 2020

Bibliographic Reference	Scarinci, I.C.; Hansen, B.; Kim, Y.-I.; HPV vaccine uptake among daughters of Latinx immigrant mothers: Findings from a cluster randomized controlled trial of a community-based, culturally relevant intervention; Vaccine; 2020; vol. 38 (no. 25); 4125-4134

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	“Community-based intervention”
Study dates	May 2013 - October 2017
Sources of funding	National Institute on Minority Health and Health Disparities
Inclusion criteria	18 years of age or older with at least one daughter between 9 and 12 years of age who had not had the HPV vaccine Latina immigrant who lived in a location in which the study was based

Exclusion criteria	None
Intervention(s)	Four group sessions and one individual session were delivered by a trained lay health educator. Each group session focused on specific topics with the first session introducing the program, the second discussing HPV and cervical cancer, the third on HPV vaccination and how to talk about HPV with partners and daughters, and the fourth on the importance of communication and self-responsibility. The individual session was a home visit, occurring between the third and fourth group sessions where the educator met with mothers in their homes to review course material and to talk about individual mother/daughter issues in related to communication and/or HPV vaccination.
Comparator	Four group sessions and one individual session were delivered by a trained lay health educator. Each group session focused on specific topics with the first session introducing the program, the second discussing HPV and cervical cancer, the third on HPV vaccination and how to talk about HPV with partners and daughters, and the fourth on the importance of communication and self-responsibility. The individual session was a home visit, occurring between the third and fourth group sessions where the educator met with mothers in their homes to review course material and to talk about individual mother/daughter issues in related to communication and/or HPV vaccination.
Outcome measures	Vaccine uptake % completed first, second and third dose
Number of participants	293
Duration of follow-up	7 months

Study arms

HPV vaccine promotion (N = 159)

20 clusters

Loss to follow-up	10

Healthy eating promotion (N = 158)

20 clusters

Loss to follow-up	9

Characteristics

Arm-level characteristics

	HPV vaccine promotion (N = 159)	Healthy eating promotion (N = 158)
Age of mother *(years)*		
Mean/SD	35.4 (5.9)	34.8 (5.1)
Age of daughter *(years)*		
Mean/SD	9.8 (0.9)	9.8 (1)

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Limited information about randomisation)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Some concerns *(Participants and probably trial personnel were aware of intervention arm)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Low *(Outcome assessors may have been aware of intervention but the outcome was objective)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Limited information about randomisation and participants could not be blinded to intervention)*
	Overall Directness	Directly applicable

Shourie, 2013

Bibliographic Reference	Shourie, S; Jackson, C; Cheater, F M; Bekker, H L; Edlin, R; Tubeuf, S; Harrison, W; McAleese, E; Schweiger, M; Bleasby, B; Hammond, L; A cluster randomised controlled trial of a web based decision aid to support parents' decisions about their child's Measles Mumps and Rubella (MMR) vaccination.; Vaccine; 2013; vol. 31 (no. 50); 6003-10

Study details

Study type	Cluster randomised controlled trial
Study location	UK
Study setting	Community (participants were at home)
Study dates	May 2009 - September 2010
Sources of funding	National Institute for Health Research, Research for Patient Benefit Programme
Inclusion criteria	First-time parents with a child aged 3–12 months being offered the first dose of the MMR vaccine

	An email address and sufficient English language skills
Exclusion criteria	None
Intervention(s)	**Intervention 1:** Parents were posted a web link to the MMR decision aid and received usual practice from their GP practice (same as in the usual practice arm). **Intervention 2:** Parents were sent a Health Scotland leaflet titled 'MMR your questions answered' and received usual practice (same as in the usual practice arm).
Comparator	Parents received an invite from their GP practice to have their child vaccinated for the first dose MMR at 12–13 months, usually including a leaflet with facts about the vaccine ('MMR the Facts') and an offer of a consultation if they had any concerns.
Outcome measures	Vaccine uptake
Number of participants	50 GP practices, 230 parents
Duration of follow-up	When children reached 15 months of age

Study arms

MMR decision aid (N = 50) 14 clusters	
Loss to follow-up	5 GP practices, 6 parents
MMR leaflet (N = 93) 18 clusters	
Loss to follow-up	8 GP practices, 10 parents
Usual practice (N = 77) 18 clusters	
Loss to follow-up	6 GP practices, 8 parents

Characteristics

Arm-level characteristics

	MMR decision aid (N = 50)	**MMR leaflet (N = 93)**	**Usual practice (N = 77)**
Mean age of parent *(years)*			
Mean/SD	32.2 (5.51)	33.29 (5.58)	31.43 (5.25)
Mean age of child *(Months)*			

	MMR decision aid (N = 50)	MMR leaflet (N = 93)	Usual practice (N = 77)
Mean/SD	9 (2.35)	8.04 (2.63)	8.33 (2.4)

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(At baseline, participants in the decision aid arm had a higher number of people who had decisional conflict than parents in the control arm)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Some concerns *(Usual practice already involved sending an information leaflet)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Low *(Outcome assessors may have been aware of the intervention but outcomes were objective)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(There were differences regarding decisional conflict at baseline between the arms. Usual practice involved sending out a leaflet)*
	Overall Directness	Directly applicable

Thomas, 2003

Bibliographic Reference	Thomas, Donna M; Ray, Susan M; Morton, Felicia J; Drew, Jennifer S; Offutt, Gardiner; Whitney, Cynthia G; Jacobson, Terry A; Patient education strategies to improve pneumococcal vaccination rates: randomized trial.; Journal of investigative medicine : the official publication of the American Federation for Clinical Research; 2003; vol. 51 (no. 3); 141-8

Study details

Study type	Randomised controlled trial (RCT)

Study location	USA
Study setting	Medical clinic
Study dates	1998
Sources of funding	Not mentioned
Inclusion criteria	Individuals with a specified age (range) Age 65 years and over, or heart and lung disease, or diabetes
Exclusion criteria	Participants with specified circumstances Deafness, blindness, language barriers, chart-documented dementia, visits that did not involve seeing a healthcare provider Participants had already had the vaccine
Intervention(s)	There were 2 intervention arms: videotape education + low-literacy brochure, and videotape education + control brochure. The videotape was 3 minutes in length and featured 3 black patients and 1 black physician. The actors modeled the desired behaviour of a patient and a physician discussing the pneumococcal vaccine. The context of the script was determined through the results of focus groups with clinic patients, as well as from literature findings regarding motivators and barriers to pneumococcal vaccination. In the videotape, the pneumococcal vaccine was referred to by the common term "pneumonia shot". Two low-literacy (written at the USA 5th grade reading level) brochures were also used in the study: an intervention brochure presented minimal information about the vaccine and prompted the patient to ask his/her doctor about the pneumonia shot today. The control brochure contained unrelated health information concerning nutrition.
Comparator	Control brochure only.
Number of participants	558
Duration of follow-up	Straight after the patient visit.
Loss to follow-up	None

Study arms

Videotape education + low-literacy brochure (N = 189)
Videotape education + control brochure (N = 187)
Control brochure (N = 182)

Characteristics

Arm-level characteristics

	Videotape education + low-literacy brochure (N = 189)	**Videotape education + control brochure (N = 187)**	**Control brochure (N = 182)**
Age *(years)*			
Mean/SD	63.4 (12.7)	61.9 (12.7)	63.3 (12.9)

	Videotape education + low-literacy brochure (N = 189)	Videotape education + control brochure (N = 187)	Control brochure (N = 182)
% Female *(%)*			
Nominal	76.2	74.9	65.4

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low *(There was no blinding. However, blinding may not have been possible given the intervention.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(There was no blinding at data collection. However, data was collected from the patient's records straight after the consultation. Therefore, data collection was systematic.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

Tiro, 2015

Bibliographic Reference Tiro, Jasmin A; Sanders, Joanne M; Pruitt, Sandi L; Stevens, Clare Frey; Skinner, Celette Sugg; Bishop, Wendy P; Fuller, Sobha; Persaud, Donna; Promoting HPV Vaccination in Safety-Net Clinics: A Randomized Trial.; Pediatrics; 2015; vol. 136 (no. 5); 850-9

Study details

Trial registration number and/or trial name	NCT01729429
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Paediatric clinic
Study dates	2011

Sources of funding	Cancer Prevention and Research Institute of Texas
Inclusion criteria	Individuals with a specified age (range) Females aged 11 to 18 years Parents had a clear understanding of English or Spanish
Exclusion criteria	Participants with specified circumstances Appointment was not with a primary care provider (eg, social worker) or did not allow for mailing of materials 1 to 2 weeks before the visit. Sibling enrolled in study. Participants had already had the vaccine Had already had one or more doses. No contact information Participant had a contraindication to the vaccine For example, they were pregnant.
Intervention(s)	To develop theory-based, HPV-specific materials, they conducted focus groups and interviews with parents of Parkland patients. They asked what information beyond that provided in the CDC's Vaccine Information Statement would help parents in the HPV vaccine decision process. Based on qualitative findings, they created a brochure focusing on 3 theoretical constructs: perceived risk, vaccine efficacy, and perceived barriers, particularly safety concerns. The brochure was translated and underwent cognitive testing with English and Spanish speakers. Both versions were reviewed by a community advisory board of local social services agency leaders, providers, and parents. Adjustments were made to ensure cultural sensitivity and fifth-grade reading level. Intervention patients were mailed this brochure with their invitation letter. For vaccine-eligible children, Electronic Health Record (EHR) programming requires providers to document in a discrete field parents' vaccine decision (given, refused, out of stock) at every encounter. Staff used weekly EHR reports to identify parents who declined at the index visit. Two weeks after the visit, a nurse called parents who consented for additional contact. She used a script reminding the parent that Parkland providers strongly recommended the vaccine and offered to schedule a nurse-only immunization appointment. Dose 2/3 recalls used similar methods. Staff used weekly EHR reports to monitor HPV dose 2/3 administration among Intervention patients who received dose 1 at index visit. The nurse called parents 4 weeks overdue for either dose 2 or 3 to administer a survey assessing HPV vaccine decisional stage, perceived risk, information seeking, and self-efficacy for completion. She stressed importance of receiving all 3 doses and offered to schedule a nurse-only appointment. Up to 6 attempts were made to deliver recalls for each dose.
Comparator	Those in Active Comparison received a CDC brochure about all Advisory Committee on Immunization Practices recommended vaccines. The active comparison group received no reminders.
Outcome measures	Vaccine uptake
Number of participants	875
Duration of follow-up	Not provided.
Loss to follow-up	None
Additional comments	No relevant baseline characteristics were recorded for each arm.

Study arms

HPV vaccine-specific brochure, + telephone reminder if declined 1st dose, + telephone reminder for doses 2 or 3 (N = 444)	
Intervention(s)	
Number of participants	
General vaccine information brochure. No reminders (N = 431)	

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Consent had to be sought before participants could be sent reminders in the intervention arm. This could have reduced uptake in the intervention arm.)*
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(The duration of the follow-up periods were not specified.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Follow-up periods were not specified for data collection. Additional consent had to be sought for reminders in the intervention arm.)*
	Overall Directness	Directly applicable

Underwood, 2019

Bibliographic Reference	Underwood, Natasha L; Gargano, Lisa M; Sales, Jessica; Vogt, Tara M; Seib, Katherine; Hughes, James M; Evaluation of Educational Interventions to Enhance Adolescent Specific Vaccination Coverage.; The Journal of school health; 2019; vol. 89 (no. 8); 603-611

Study details

Study type	Cluster randomised controlled trial

Study location	USA
Study setting	Schools and community
Study dates	2011 to 2014
Sources of funding	The US Centers for Disease Control and the National Institute of Mental Health.
Inclusion criteria	School children who attended schools involved with this study.
Exclusion criteria	None
Intervention(s)	**Intervention 1:** an educational brochure about adolescent vaccines mailed home to parents. The parent brochure consisted of an 8-page information booklet with one page specifically dedicated to describing each adolescent vaccine. Each page contained information of disease complications, information about how the disease is spread, vaccine benefits, and a recommendation for vaccination. The brochure also contained testimonials from parents and health care providers on the importance of vaccination, addressed common myths about vaccines and information for their local health department and the US Centers for Disease Control and Prevention. **Intervention 2:** an interactive curriculum implemented by science teachers in classrooms of adolescents, plus an educational brochure about adolescent vaccines mailed home to parents. (The same educational brochure as for intervention 1). All middle and high school students were required to take a science course every year, which permitted exposure of all students in this arm to the interactive educational intervention. The teacher delivered curriculum consisted of 120 minutes of instruction time with a variety of lesson plans and activities to implement over a 2- or 3-day period depending on class length. The day 1 curriculum included a PowerPoint presentation on infectious diseases, how they spread, ways to prevent infection, and identified vaccines recommended for adolescents. An interactive activity demonstrating how infectious diseases spread concluded the day 1 curriculum. The day 2 or 3 curriculum consisted of another presentation of vaccines recommended for adolescents, information about disease complications and vaccine benefits. This day concluded with an interactive group activity, where teams were quizzed on adolescent vaccine facts along with the creation of posters for students to synthesis and display information learned. This intervention happened each year for 2 years. Both the parent brochure and the interactive educational curriculum were based on a theoretical framework consisting of constructs from the Health Belief Model and the Theory of Reasoned Action.
Comparator	Control (no intervention)
Outcome measures	Vaccine uptake
Number of participants	2135
Duration of follow-up	Data was extracted at the end of the study (June 2014).
Loss to follow-up	None
Additional comments	Although this study had some data that was adjusted for clustering, we could not use it for the following reasons: • The adjusted data included results combined for HPV, MenACWY, and Tdap. Tdap is not given to adolescents on the UK vaccination schedule.

	• The adjusted data was the odds of receiving at least 1 dose of either HPV, MenACWY, or Tdap. We do not present data in this format. Therefore, we included data for HPV and MenACWY, but did not extract data for Tdap. We adjusted the data using an ICC of 0.05 because this study did not provide its own ICC.

Study arms

Education of adolescents by teachers and information for parents (N = 690)
Information for parents (N = 668)
Control (no intervention) (N = 777)

Characteristics

Arm-level characteristics

	Education of adolescents by teachers and information for parents (N = 690)	**Information for parents (N = 668)**	**Control (no intervention) (N = 777)**
% Female *(%)*			
Nominal	49.3	49.1	49.8

Section	**Question**	**Answer**
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(The Tdap coverage before the intervention was unequal across the 3 arms. However, the Tdap vaccine is not on the UK routine vaccination schedule for children of this age.)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Low
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Some concerns with randomisation.)*
	Overall Directness	Directly applicable

Underwood, 2015

Bibliographic Reference	Underwood, Natasha L; Weiss, Paul; Gargano, Lisa M; Seib, Katherine; Rask, Kimberly J; Morfaw, Christopher; Murray, Dennis; DiClemente, Ralph J; Hughes, James M; Sales, Jessica M; Human papillomavirus vaccination among adolescents in Georgia.; Human vaccines & immunotherapeutics; 2015; vol. 11 (no. 7); 1703-8

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Schools
Study dates	2011 to 2013
Sources of funding	Centers for Disease Control and Prevention
Inclusion criteria	Adolescents attending middle and high schools (age 11 to 18 years)
Exclusion criteria	None reported
Intervention(s)	**Intervention 1:** An educational brochure about adolescent vaccines mailed home for parents, and a curriculum implemented by science teachers in classrooms of adolescents. **Intervention 2:** An educational brochure about adolescent vaccines mailed home for parents.
Comparator	Control (no intervention).
Outcome measures	Vaccine uptake
Number of participants	686
Duration of follow-up	3 to 5 months
Loss to follow-up	None
Additional comments	Baseline characteristics were not provided. The adjusted odds ratio of 'educational literature for parents + classroom teaching for adolescents versus educational literature for parents' was excluded from the analysis because the data had a typo: "0.865 (1.33, 3.42)". This 95% confidence interval is impossible.

Study arms

Educational literature for parents + classroom teaching for adolescents (N = 0) The number of clusters and participants was not provided for each arm.
Educational literature for parents (N = 0)

The number of clusters and participants was not provided for each arm.

Control (N = 0)

The number of clusters and participants was not provided for each arm.

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(The method of randomisation was not provided and baseline characteristics for each of the 3 arms was not provided to check whether randomisation was successful.)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(Uptake was reported by parents. Parents may have felt pressurised to exaggerate uptake in the intervention arms because they required more effort. The data for the comparison education for parents and adolescents versus parents alone had a typo. Therefore, it could not be used.)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Concerns with randomisation and recording of data.)*
	Overall Directness	Directly applicable

Winer, 2016

Bibliographic Reference	Winer, Rachel L; Gonzales, Angela A; Noonan, Carolyn J; Buchwald, Dedra S; A Cluster-Randomized Trial to Evaluate a Mother-Daughter Dyadic Educational

Intervention for Increasing HPV Vaccination Coverage in American Indian Girls.; Journal of community health; 2016; vol. 41 (no. 2); 274-81

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Hopi Tribe Reservation
Study dates	March 2012 - April 2012
Sources of funding	National Cancer Institute
Inclusion criteria	≥18 years, part of the Hopi Tribe with residence on the reservation, and a mother or female legal guardian of a girl aged 9–12 years
Exclusion criteria	None
Intervention(s)	Mothers were invited to a dinner with an educational presentation on HPV. The presentation was delivered by research staff and included information on HPV prevalence and transmission, HPV vaccine recommendations, dosage schedule, and vaccine efficacy and safety. An educational brochure with similar content was also created to accompany the presentation.
Comparator	Mothers were invited to a dinner with an educational presentation on juvenile diabetes. The presentation was delivered by Hopi Special Diabetes Program staff and included information on material from the IHS Division of Diabetes Treatment and Prevention, with a focus on risk factors for type 2 juvenile diabetes, healthy nutrition, physical activity, and what parents can do to prevent or manage diabetes for their children.
Outcome measures	Vaccine uptake
Number of participants	97
Duration of follow-up	11 months

Study arms

HPV presentation (N = 43)	
2 clusters	
Loss to follow-up	17
Juvenile diabetes presentation (N = 54)	
2 clusters	
Loss to follow-up	24

Characteristics

Arm-level characteristics

	HPV presentation (N = 43)	Juvenile diabetes presentation (N = 54)
Mother's age *(years)*		
Mean/SD	42 (12)	40 (9)
Number aged 9-10 years		
Sample Size	n = 24 ; % = 56	n = 22 ; % = 42
Number aged 11-12 years		
Sample Size	n = 19 ; % = 44	n = 31 ; % = 58

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Limited information about the randomisation process)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Some concerns *(Only 63% completed the follow-up survey but the numbers lost to follow up were similar between trial arms)*
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	High *(Outcome was parent-reported and parents were aware of intervention received)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Limited information about randomisation, only 63% completed the follow-up survey (although similar numbers between trial arms) and outcomes were parent-reported)*
	Overall Directness	Directly applicable

Zuniga de Nuncio, 2003

Bibliographic Reference	Zuniga de Nuncio, Maria Luisa; Nader, Philip R; Sawyer, Mark H; De Guire, Michelle; Prislin, Radmila; Elder, John P; A prenatal intervention study to improve timeliness of immunization initiation in Latino infants.; Journal of community health; 2003; vol. 28 (no. 2); 151-65

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Perinatal clinics
Study dates	1998 to 1999
Sources of funding	National Center for Disease Control
Inclusion criteria	Pregnant women Latina women who were at or beyond 34 weeks of gestation.
Exclusion criteria	None
Intervention(s)	The curriculum for this study was designed to teach parents about the importance of timely infant immunization through reinforcement of the standard immunisation schedule, and to provide them with techniques that they could use to immunise their child on schedule. The curriculum consisted of participants receiving a one-on-one, interactive, immunisation education/behaviour modification session. The session included a 15-minute video emphasising immunisation timing and the diseases that are prevented through immunisation, and a personalised immunisation reminder calendar, with the standard “2, 4, 6, 12, and 15-month” schedule printed in easy-to-read “baby blocks” at the top. The perinatal health educator asked the woman to write down her estimated due date on the calendar, and then worked with her to estimate when the baby would be due for her/his first set of immunisations. An immunisation reminder magnet to hold the calendar on the refrigerator was also provided.
Comparator	A parallel educational session, including a video and one-on-one education on preventing Sudden Infant Death Syndrome (SIDS), was provided to women in the control group.
Outcome measures	Vaccine uptake
Number of participants	348
Duration of follow-up	Immunisation status at 3 months of age (92 days from birth).
Loss to follow-up	None
Additional comments	There were no relevant baseline characteristics. Data was collected at 60 and 92 days from birth. In the review, data at 92 days was used because this is the final data collection point and is more likely to be a summative result.

Study arms

Educational video + vaccination calendar + face-to-face advice (N = 173)
Control (video and face-to-face advice not about vaccines) (N = 175)

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low

Section	Question	Answer
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low *(Blinding is not mentioned in this study. However, this study has not been downgraded because there is no mention of routine healthcare staff at the clinic being involved.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Blinding of investigators was not mentioned at data collection. This could have introduced bias because data collection in this study required effort - the medical records had to be sought.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Lack of blinding during data collection, which required effort.)*
	Overall Directness	Directly applicable

Summary risk of bias judgements for the Cochrane review

The following overall risks of bias judgements and assessment of directness were made by the Guideline Updates Team based on information provided in the evidence tables in Kaufman 2018.

Table 19 Overall risk of bias and directness for studies included in the Kaufman 2018 Cochrane review

Author	Risk of bias*	Reason	Directness
Jackson 2011	Some concerns	Outcome was subjective (based on parent-reported questionnaire). A substantial number of parents did not receive the intervention but all parents randomised to the control arm received the control, although the researchers took this into account in the analysis.	Directly applicable
Quinlivan 2003	Low	Although there was no blinding of the healthcare staff, blinding was probably not possible. Vaccine uptake was self-reported but data was checked against immunisation register and Child Health Books.	Directly applicable
Saitoh 2013	Some concerns	Vaccine uptake was self-reported by the participants. This could have pressurised participants in the intervention arm to say	Directly applicable

		they had been vaccinated because more effort went into their care.	
Saitoh 2017	Some concerns	Outcome was subjective (parent-reported). Parents were not blinded to the intervention.	Directly applicable

*Risk of bias in the Kaufman 2018 Cochrane review was scored for 7 types of bias (random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, selective reporting, other bias) using the Cochrane Risk of bias tool 1. Here all risks of bias have been combined into one final score based on the number of risks and a judgement of the importance of each risk for this review question. Some concerns is equivalent to moderate risk of bias.

Information/education plus reminders primary studies

Dapp, 2011

Bibliographic Reference	Dapp U; Anders JA; von Renteln-Kruse W; Minder CE; Meier-Baumgartner HP; Swift CG; Gillmann G; Egger M; Beck JC; Stuck AE; ; A randomized trial of effects of health risk appraisal combined with group sessions or home visits on preventive behaviors in older adults.; The journals of gerontology. Series A, Biological sciences and medical sciences; 2011; vol. 66 (no. 5)

Study details

Study type	Cluster randomised controlled trial
Study location	Germany
Study setting	General practices
Study dates	Not provided
Sources of funding	European Union
Inclusion criteria	People aged 60 years and older.
Exclusion criteria	People who could not understand German and those who required a carer for activities of daily living.
Intervention(s)	Intervention group patients received a self-administered questionnaire immediately after randomisation. The questionnaire contained the following sections: administrative information, chronic conditions, preventative care use, medication use, signs and symptoms, self-perceived health, physical activity, nutrition, injury prevention, tobacco use, alcohol use, vision, hearing, depressive symptoms, memory, social network, social support, basic and instrumental activities of daily living, socioeconomic information education, occupation, living arrangement, and health measurements (weight, height, blood pressure, and cholesterol). Completed questionnaires were double entered at the study centre, and individualised computer-generated feedback reports were produced for participants and their GPs. Participant's reports included individually tailored information and recommendations based on the older persons' responses, general health information in the domains of the questionnaire, and local sources of further information. All GPs were allocated to training and participated in bimonthly 2-hour training sessions led by an experienced geriatrician during the whole intervention period. The main purpose was to train them in reinforcing recommendations related to identified risk factors identified by the questionnaire and to make them aware of the

	reinforcement program offered by the geriatric centre. As a basis for these training sessions, they used cases from GPs practices, and an evidence-based manual with guidance notes for GPs participating in the intervention. Key topics of the training included cardiovascular risk prevention, immunisations, cancer screening, health maintenance, specific health issues (pain, medication use, injury, incontinence), and psychosocial health and behaviour. As an incentive, physicians participating in the training sessions received credits required for their documentation of continuing education. The GPs received a personal summary report with personal information on recommendations based on risk factors identified by the questionnaire. Patients were encouraged to discuss these recommendations with their GPs, but it was up to the GPs and the participants to decide how the issues raised in the reports were addressed: directly, opportunistically, or not at all. Additional personal reinforcement.—Patients of the intervention group having returned the questionnaire had the choice between two offers of reinforcement: participation in group sessions or home visits. The study made use of the healthcare structures and professions established in Germany, and of the interdisciplinary geriatric team located at a geriatric centre, trained in health promotion and motivational methods. Group session.—Groups of 12 seniors took part in one half-day group session at the geriatric centre. Information on healthy eating, physical activity, active social participation, and successful aging was provided in group sessions by the geriatric team: nutritionist, physiotherapist, social worker, and geriatrician (team leader). First, geriatric team members gave structured information about the selected health topics, and the complex interactions between health topics. Second, each person was asked to complete an individual dietary and physical activity record. Such self-reflection of participants proved helpful to the four advisors of the geriatric team for developing individual recommendations and setting individual goals (preventive assessment). Two weeks later, all participants received a personal report with recommendations confirming the agreements reached during the group session, including individually selected addresses of, for example, sports clubs and senior citizens' organizations close to the participant's home to promote lasting lifestyle changes (motivation, self-efficacy, empowerment). Group session participants were offered a second follow-up appointment at the geriatric centre in 6 months' time to check adherence to the recommendations. Home visits.—A specially trained nurse conducted a first home visit including a multidimensional assessment of mobility, functional decline, falls, pain, medication use, nutrition, cognition, vision, hearing, social contacts, housing, and living location. Based on this assessment and the feedback report, the nurse discussed each case with the geriatric team at the centre. Recommendations were formulated, prioritized, reinforced, or modified for each participant. Nurse and geriatrician provided the participant's GP with a short written report containing the assessment results and recommendations given. Intensive cooperation between nurse, social worker, and GP resulted in finding solutions for special needs uncovered during home visits (eg, meals on wheels, application for nursing care). The nurse conducted a second follow-up home visit after 6 months to check adherence to the recommendations.
Comparator	Participants randomised to control received usual care over the study period, but GPs of control patients had received special training and were involved in care of intervention group patients, and might therefore have changed their preventive care practice.
Outcome measures	Vaccine uptake
Number of participants	1910 (For the 2 included arms)

Duration of follow-up	1 year
Loss to follow-up	None
Additional comments	There was an additional 'comparison arm' that was not included in the analysis in the evidence review. This is because these practices were not randomised. The only relevant outcome from this study was vaccine uptake for pneumococcal vaccine. We did not include blood tests, check-ups unrelated to vaccination, influenza vaccination, or health behaviours. The investigators included an odds ratio that was adjusted for clustering, so we used this.

Study arms

Group education or 2 home visits by a nurse for patients + tailored reminder with information for patients and GPs. (N = 568)
Control (N = 1342)

Characteristics

Arm-level characteristics

	Tailored information about each patient for both patients and GPs. Either a group session education by a geriatric team or 2 educational home visits by a nurse (N = 878)	**Control (N = 1702)**
Mean age (SD) *(years)*		
Mean/SD	71.9 (7.7)	71.8 (7.6)
% Female *(%)*		
Nominal	61.5	63.3

Section	**Question**	**Answer**
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(Vaccine uptake was self-reported by the patients. Therefore, it was not*

Section	Question	Answer
		blinded and prone to bias.)
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Some concerns with data collection)*
	Overall Directness	Directly applicable

Fiks, 2013

Bibliographic Reference	Fiks, Alexander G; Grundmeier, Robert W; Mayne, Stephanie; Song, Lihai; Feemster, Kristen; Karavite, Dean; Hughes, Cayce C; Massey, James; Keren, Ron; Bell, Louis M; Wasserman, Richard; Localio, A Russell; Effectiveness of decision support for families, clinicians, or both on HPV vaccine receipt.; Pediatrics; 2013; vol. 131 (no. 6); 1114-24

Study details

Trial registration number and/or trial name	NCT01159093
Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Primary care practices
Study dates	May 2010 - May 2011
Sources of funding	Agency for Healthcare Research and Quality and the Eunice Kennedy Shriver National Institute of Child Health & Human Development
Inclusion criteria	Primary care centres in The Children's Hospital of Philadelphia (CHOP) Pediatric Research Consortium Urban resident teaching practices and suburban practices not involved in resident teaching Girls aged 11-17 years due at least 1 dose of the HPV vaccine during the study period Who had a preventive visit within 15 months of randomisation
Exclusion criteria	None reported
Intervention(s)	**Intervention 1:** Clinician and family intervention. Practice-based education, audits and feedback plus patient information phone calls and reminders. **Intervention 2:** Clinician intervention and no family intervention. Practice-based education, audits and feedback but no patient information or reminders. **Intervention 3:** No clinician intervention but family intervention. Patient information phone calls and reminders but no clinical education.

	Clinician intervention: Clinician-focused vaccine alerts, education, audits and feedback based on the electronic health record. This included (1) EHR-based alerts programmed to appear prominently during any appointment at the practice, (2) a 1 hour presentation (online or in person) with information about the intervention, site-specific vaccine data and information on vaccine safety, efficacy and strategies to overcome barriers, and (3) 3 quarterly performance feedback reports with suggestions for the clinician. Family intervention: 3 types of automated phone calls based on the electronic health record: (1) reminder calls prior to scheduled appointments, (2) up to 2 reminder calls for people who had not visited the practice within 10 months and did not have a visit scheduled, (3) a reminder call for people due for dose 2 or 3 of the vaccine, with a second reminder call 1 month later if needed. Calls listed vaccines due, emphasised that the vaccines were recommended by their clinician and referred people to an internet site with educational materials
Comparator	Clinician control: No electronic health record-based alerts, education or feedback Family intervention control: No information or reminders
Outcome measures	Vaccine uptake Number who received all 3 vaccines within the study period. Results also available for vaccines 1 and 2
Number of participants	22 practices, 22633 patients
Duration of follow-up	1 year
Loss to follow-up	Clinician and family intervention: 45; clinician intervention, no family intervention: 36; no clinician intervention but family intervention: 34; no clinician intervention and no family intervention: 32
Additional comments	Comparisons between arm 1 and control, arm 3 and control, arms 1 and 2, and arms 2 and 3 are included in the multicomponent review. Comparisons between arm 2 and control and between arms 2 and 3 are in the review for education and reminders. Study reports that it adjusted for clustering and this data was used in our analyses. In the study, the population included in the percentage uptake calculation only had adolescents who were eligible for that dose. For example, an adolescent could not be eligible for HPV dose 2 unless they had received dose 1. We have taken this into consideration and calculated the uptake for the intention to treat population for HPV doses 2 and 3. For example, in the control arm, 16% of 5688 participants received HPV dose 1. 65% of that 16% went on to receive dose 2. Therefore, this is 10.4% of the original 5688 participants (all percentages were adjusted for clustering).

Study arms

Clinician intervention and family intervention (N = 5606) 11 practices randomised to clinician-focused intervention. Within those practices, 5606 patients randomised to family-based intervention (vaccine information and reminder calls)
Clinician intervention and no family intervention (N = 5593) 11 practices randomised to clinician-focused intervention. Within those practices, 5593 patients randomised to control (no family-based intervention or reminders)
No clinician intervention but family intervention (N = 5714) 11 practices randomised to no clinician-focused intervention. Within those practices, 5714 patients randomised to family-based intervention (vaccine information and reminder calls)

No clinician intervention and no family intervention (N = 5720)
11 practices randomised to no clinician-focused intervention. Within those practices, 5720 patients randomised to control (no family-based intervention or reminders)

Characteristics

Arm-level characteristics

	Clinician intervention and family intervention (N = 5606)	Clinician intervention and no family intervention (N = 5593)	No clinician intervention but family intervention (N = 5714)	No clinician intervention and no family intervention (N = 5720)
% aged 11-13 years				
Custom value	70%	70%	68%	68%
% aged 14-17 years				
Custom value	30%	30%	32%	32%

Risk of bias

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions (If your aim is to assess the effect of assignment to intervention, answer the following questions).	Risk of bias judgement for deviations from intended interventions	Some concerns *(Unclear whether any practices or patients were analysed in a different group to the one that they were clustered to)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Low
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Some concerns *(Unclear whether any practices or patients were analysed in a different group to the one that they were clustered to. Study states that it adjusted for cluster randomisation, but no information about the ICC used for this)*
	Overall Directness	Directly applicable

Freed, G. L., Freeman, V. A., Mauskopf, A., & Jacobson, 1999

Bibliographic Reference	Freed, G. L., Freeman, V. A., Mauskopf, A., & Jacobson RM; Age-appropriate immunization laws: A randomized trial of information dissemination; Ambulatory Child Health; 1999; vol. 5 (no. 1); 43-51

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Community (North Carolina area)
Study dates	1996
Sources of funding	Not specified
Inclusion criteria	Parents Parents of newborn babies
Exclusion criteria	Parents Parents of adopted children or babies who might have vaccines delayed because of medical reasons Families whose mail was returned undelivered
Intervention(s)	There were 2 interventions: a health message group and a law message group. Mailings to the health message group and the law group had many similarities. The first mailing to both groups consisted of a letter to the parent congratulating them on the birth of their infant and included the immunisation schedule with the 2-month immunisations highlighted. A toll-free phone number to call the state immunisation help desk for more information was also included. In addition, the health message group letter included the slogan "Health is the prize when you immunize." In addition to the immunisation schedule, the law message group letter included a statement describing the existence of state laws not only requiring immunisations for school entry but on-time immunisation for all ages as well and a slogan about the law: "If your kids don't get their shots on time - it's a crime". Subsequently, both intervention groups received postcard reminders of the immunisation schedule approximately 2 weeks in advance of the 4- and 6-month well-child visits. These postcards also had the same health or law message and the age-appropriate immunisations highlighted.

Comparator	The control group did not receive any mailings
Outcome measures	Vaccine uptake Vaccines considered up to date if the child had received 3 DTP vaccines, 2 polio vaccines, no MMR vaccine, 2 Hib vaccines and 2 HBV vaccines by their 7 month birthday
Number of participants	629
Duration of follow-up	Until the child was 11 months of age (7 months for vaccine uptake)
Loss to follow-up	None
Additional comments	Results presented are for children who had completed all vaccines at 7 months of age. Results were also presented for 3 vaccines, excluding hepatitis B but these are not presented in the review. The results of the 2 intervention arms (health message and law message) were merged. There were no baseline characteristics for the children.

Study arms

Information with reminder (N = 411)
No reminder (N = 218)

Risk of bias

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Randomisation methods are unclear and no information about allocation concealment)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Limited information about analysis methods)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(No mention of assessor blinding but outcome was objective)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Limited information about blinding, allocation concealment and analysis methods)*
	Overall Directness	Directly applicable

Gutschi, 1998

Bibliographic Reference	Gutschi, L.M.; Vaillancourt, R.; Homes, M.; Lafoley, L.; Mulvihill, J.; Taichmann, J.; Trottier, M.; Wells, G.; Effect of pharmacist interventions on pneumococcal and influenza vaccination rates: A seamless care approach; Canadian Pharmaceutical Journal; 1998; vol. 131 (no. 8); 32-38

Study details

Study type	Randomised controlled trial (RCT)
Study location	Canada
Study setting	University of Ottawa Heart Institute
Study dates	October 1996 - December 1996
Sources of funding	None reported
Inclusion criteria	Patients discharged from the Heart Institute who were admitted to the cardiac surgery programme
Exclusion criteria	Allergy to eggs, previous serious reaction, or if they had received both an influenza and a pneumococcal vaccination in the previous 2 years
Intervention(s)	Patients were given information on the risks and benefits of influenza and pneumococcal vaccinations. Patients in one intervention arm were also sent a follow-up letter and a pharmacy care plan was sent to their community pharmacist. Patients in the second intervention arm were sent a follow-up letter and the pharmacy care plan was sent to both their community pharmacist and their family physician
Comparator	Patients were given information on the risks and benefits of influenza and pneumococcal vaccinations but no follow-up letter or care plan
Outcome measures	Vaccine uptake Number of people who had a pneumococcal vaccine within 3 months of hospital discharge
Number of participants	150
Duration of follow-up	3 months post-discharge
Loss to follow-up	5 (arm-level data not reported)
Additional comments	Data from 2 intervention arms (both information and reminders) was pooled

Study arms

Hospital pharmacist counselling (N = 44)

Hospital pharmacist counselling and community pharmacist follow-up (N = 44)
Hospital pharmacist counselling and community pharmacist and physician follow-up (N = 47)

Characteristics

Arm-level characteristics

	Hospital pharmacist counselling (N = 44)	**Hospital pharmacist counselling and community pharmacist follow-up (N = 44)**	**Hospital pharmacist counselling and community pharmacist and physician follow-up (N = 47)**
Age *(years)*			
Mean/SD	59.6 (11.8)	62 (11.4)	59.5 (11.1)
% Female			
Custom value	20.5%	13.6%	31.9%

Risk of bias

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information about randomisation process or allocation concealment)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Limited information about analysis methods)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Outcome was patient-reported so could be subject to bias)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Limited information about analysis methods)*
Overall bias and Directness	Risk of bias judgement	High *(Limited information about randomisation, allocation concealment and analysis methods. Outcome was patient-reported)*
	Overall Directness	Directly applicable

Harari, 2008

Bibliographic Reference	Harari, Danielle; Iliffe, Steve; Kharicha, Kalpa; Egger, Matthias; Gillmann, Gerhard; von Renteln-Kruse, W; Beck, John; Swift, Cameron; Stuck, Andreas; Promotion of health in older people: a randomised controlled trial of health risk appraisal in British general practice; Age and Ageing; 2008; vol. 37 (no. 5); 565-571

Study details

Trial registration number and/or trial name	ISRCTN 28458424 (PRO-AGE trial)
Study type	Randomised controlled trial (RCT)
Study location	UK
Study setting	3 London group practices (18 GPs)
Study dates	April 2001 - April 2002
Sources of funding	European Union and the Federal Education and Science Ministry
Inclusion criteria	Age 65+ years And registered with one of the GP practices
Exclusion criteria	Residents of nursing homes, people who needed help in basic activities of daily living, people with dementia or a terminal disease and people who did not speak English
Intervention(s)	Participants were mailed the HRA-O questionnaire which included health behaviour and preventative care uptake domains, plus self-reported health-related sections on chronic conditions, medication use, eyesight, hearing, depressive symptoms, memory problems, falls, physical function, continence, social support and health measurements (weight, height, blood pressure and cholesterol). Participants' responses were entered into a specifically designed database. This interfaced with the HRA-O decision support software, which generated individualised written feedback both to patients and their GPs. A 20–35 page individualised report was sent to patients, accompanied by a letter from the practice encouraging recipients to discuss issues raised with their GP or practice nurse, followed by a reminder card sent to non-responders 6 months later.
Comparator	No education during the trial - advised by post that they would be sent the HRA-O questionnaire after 12 months.
Outcome measures	Vaccine uptake Pneumococcal vaccine uptake (ever, not just during the trial)
Number of participants	2006

Duration of follow-up	1 year
Loss to follow-up	24% of the intervention group, 16% of control group

Study arms

Education and reminders (N = 940)
Control (N = 1066)

Characteristics

Arm-level characteristics

	Education and reminders (N = 940)	**Control (N = 1066)**
Age *(years)*		
Mean/SD	74.7 (6.3)	74.2 (6)
% Female		
Custom value	56%	52.9%

Risk of bias

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information about allocation concealment)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Some concerns *(Greater proportion of missing data for the intervention arm (24%) than the control arm (16%))*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	High *(Patient-reported outcome. Outcome was whether patients had ever received a pneumococcal vaccination, not just during the trial - not clear how many people received the vaccination during the trial period.)*

Section	Question	Answer
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(No information about allocation concealment and there is more data missing for the intervention than then control arm. The outcome is patient-reported and was not just based on vaccinations that were received during the trial period.)*
	Overall Directness	Directly applicable

Henrikson, 2018

Bibliographic Reference	Henrikson NB; Zhu W; Baba L; Nguyen M; Berthoud H; Gundersen G; Hofstetter AM; Outreach and Reminders to Improve Human Papillomavirus Vaccination in an Integrated Primary Care System.; Clinical pediatrics; 2018; vol. 57 (no. 13)

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	7 primary care clinics
Study dates	July 2015 - August 2016
Sources of funding	Group Health Foundation, Group Health Cooperative, Seattle, WA
Inclusion criteria	Patients aged 10-12 years who received care at one of the primary care clinics
Exclusion criteria	Patients who had received any doses of HPV vaccine
Intervention(s)	Mailed outreach letters with telephone/text reminder components. The mailed component was a one-off letter addressed to the parent of the child containing a statement that the child was due for the HPV vaccine, that the immunization team strongly recommended the vaccine, facts about the vaccine schedule and where patients could get the vaccine, and a statement that the parent would receive a follow-up reminder call. The mailout also included a single page trifold educational brochure with more information about vaccine safety and effectiveness. Reminder calls were sent out 8 weeks later and used interactive voice recognition with interactive prompts. For the dose 1 call, the script stated that the call was a follow-up to the letter sent previously, asked if the parent was intending to get their child vaccinated against HPV, and, if not, asked the parent to indicate barriers to HPV vaccination. It also restated the health system clinic locations where the HPV vaccine was available. At the end of

	the call, the parent was asked if they would like to receive future reminders by text message. If the parent could not be reached, an automated voice mail message asked for a return call to a toll-free number about their child's immunizations.
Comparator	Usual care - no outreach letter or reminder call
Outcome measures	Vaccine uptake During study period and within 210 days of the first dose
Number of participants	1805
Duration of follow-up	Duration of study period and within 210 days of first vaccine dose
Additional comments	Results in the review are reported for all 3 completed doses within the study period (1 year). Data was also reported for all 3 doses within 210 days of the 1st dose. Two results are reported in the review: 1. Vaccine uptake for information and reminders (2 intervention arms pooled) vs no information. 2. Vaccine uptake for information and reminder for vaccination 1 vs information and reminders for all 3 vaccinations

Study arms

Outreach letter and dose 1 reminder (N = 236)
Outreach letter and dose 1, 2 and 3 reminders (N = 227)
Control (no letter or reminders) (N = 451)

Characteristics

Arm-level characteristics

	Outreach letter and dose 1 reminder (N = 236)	**Outreach letter and dose 1, 2 and 3 reminders (N = 227)**	**Control (no letter or reminders) (N = 451)**
% age 10 years at randomisation			
Custom value	46.8%	Intervention groups combined: 46.2%	*empty data*
% age 11 years at randomisation			
Custom value	31.3%	Intervention groups combined: 33.5%	*empty data*
% age 12 years at randomisation			
Custom value	22.0%	20.3%	*empty data*

	Outreach letter and dose 1 reminder (N = 236)	Outreach letter and dose 1, 2 and 3 reminders (N = 227)	Control (no letter or reminders) (N = 451)
% Female			
Custom value	53.3%	Intervention groups combined: 51.1%	*empty data*

Risk of bias

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information about randomisation process or allocation concealment)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Limited information about analysis methods)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Limited information about randomisation, allocation concealment and analysis methods.)*
	Overall Directness	Directly applicable

Hofstetter, 2017

Bibliographic Reference	Hofstetter, Annika M; Barrett, Angela; Camargo, Stewin; Rosenthal, Susan L; Stockwell, Melissa S; Text message reminders for vaccination of adolescents with chronic medical conditions: A randomized clinical trial.; Vaccine; 2017; vol. 35 (no. 35ptb); 4554-4560

Study details

Trial registration number and/or trial name	NCT02231957
Study type	Randomised controlled trial (RCT)

Study location	USA
Study setting	Community - adolescents receiving care at a paediatric clinic.
Study dates	2014 to 2015
Sources of funding	This study was supported in part by a grant from Pfizer.
Inclusion criteria	Individuals with a specified age (range) The adolescents, aged 11 to 17 years needed to have at least 1 chronic medical condition. Parents With adolescent children aged 11 to 17 years who had chronic medical conditions. The parents needed to have visited a participating clinic in the last 12 months. Parents had a clear understanding of English or Spanish Own a phone that could receive text messages The number had to be listed in the medical center's registration system.
Exclusion criteria	Participants who were considering moving away from the study area
Intervention(s)	The educational reminders addressed infection risk, vaccine safety/efficacy, and physician recommendations. They included one interactive message where parents could text numbered response(s) to receive information on selected topic(s) via text message. Both arms received usual care in the clinic, including telephone appointment reminders.
Comparator	Plain text message reminder. Both arms received usual care in the clinic, including telephone appointment reminders.
Outcome measures	Vaccine uptake
Number of participants	295
Duration of follow-up	24 weeks after the initial reminder.
Loss to follow-up	None
Additional comments	This study also included data for influenza vaccine and pneumococcal vaccine. However, this data was not relevant to the UK vaccination schedule 11 to 18 year age range. Follow-up was at 4, 12 and 24 weeks. Data for the 24 week follow-up has been used in this evidence review because it is the latest time-point and therefore summative.

Study arms

Educational text message reminders (N = 154)
Plain text message reminders (N = 141)

Characteristics

Arm-level characteristics

	Educational text message reminders (N = 154)	**Plain text message reminders (N = 141)**
% Female *(%)*		

	Educational text message reminders (N = 154)	Plain text message reminders (N = 141)
Nominal	43.5	48.2

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 2b: Risk of bias due to deviations from the intended interventions (effect of adhering to intervention)	Risk of bias judgement for deviations from the intended interventions (effect of adhering to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

Krieger, 2000

Bibliographic Reference Krieger, J W; Castorina, J S; Walls, M L; Weaver, M R; Ciske, S; Increasing influenza and pneumococcal immunization rates: a randomized controlled study of a senior center-based intervention.; American journal of preventive medicine; 2000; vol. 18 (no. 2); 123-31

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Senior centres in Seattle
Study dates	September 1996 - March 1997
Sources of funding	Centers for Disease Control and Prevention Cooperative Agreement and United Way of King County
Inclusion criteria	Age 65+ years and living in the areas covered by the senior centre
Exclusion criteria	None

Intervention(s)	Reminders and education: A specially designed educational brochure posted to each person along with a reply card for tracking of immunisation status. If no reply card was received or if the card showed they were not immunised, a volunteer called the person and used a script to encourage them to have the vaccination and to address barriers to immunization. They also made follow-up contact to establish whether immunisation(s) were received
Comparator	Usual care: usual senior centre and community immunisation promotion activities (newsletter article, health fair, pamphlets, posters, media announcements, a mailed reminder letter from the regional Medicare PRO to 10% of seniors, and vaccine availability at the senior centre)
Outcome measures	Vaccine uptake Number of people who received a pneumococcal vaccine within the study period
Number of participants	1246
Duration of follow-up	Duration of the study (6 months)
Loss to follow-up	Intervention: 92 (15%) Control: 71 (11%)

Study arms

Educational brochure and follow-up phone call (N = 622)
Usual care (N = 624)

Characteristics

Arm-level characteristics

	Educational brochure and follow-up phone call (N = 622)	**Usual care (N = 624)**
Age *(years (mean))*		
Nominal	75.1	75.6
% Female		
Custom value	42.8%	47.8%

Risk of bias

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Alternate survey respondents were allocated to intervention or control -*

Section	Question	Answer
		not truly randomised. No information about allocation concealment)
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(No information about blinding and limited information about analysis methods)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Outcome was patient-reported)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Study may not have been truly randomised. No information about allocation concealment or blinding, and outcomes were patient-reported)*
	Overall Directness	Directly applicable

Mason, 2000

Bibliographic Reference	Mason, B W; Donnelly, P D; Targeted mailing of information to improve uptake of measles, mumps, and rubella vaccine: a randomised controlled trial.; Communicable disease and public health; 2000; vol. 3 (no. 1); 67-8

Study details

Study type	Randomised controlled trial (RCT)
Study location	UK
Study setting	1 health authority in Wales
Study dates	November 1996 - April 1997
Sources of funding	Welsh Office of Research and Development for Health and Social Care
Inclusion criteria	Children aged 21 months who had not received the MMR vaccine
Exclusion criteria	None reported

Intervention(s)	Personal reminder letter and a leaflet (MMR - the facts) was sent to parents. The letter was copied to the child's GP and health visitor
Comparator	No reminder or information was sent to the parents, GP or health visitor
Outcome measures	Vaccine uptake Between 21 and 24 months of age, and beyond 24 months of age
Number of participants	511
Duration of follow-up	3 months (from 21 to 24 months of age) and beyond 24 months (exact follow-up time not specified)
Loss to follow-up	Intervention: 6 Control: 12
Additional comments	Results are for the number of children given an MMR vaccine between 21-24 months of age (primary study outcome). Data was also reported for children immunised after 24 months but this was not included in the review as we selected the primary outcome from the study

Study arms

Reminder and information (N = 255)
Control (N = 256)

Risk of bias

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	High *(No information about randomisation or allocation concealment and no baseline characteristics reported)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Limited information about analysis methods)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Unclear whether outcome assessors were aware of assigned interventions)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Unclear whether there was a pre-specified analysis plan)*
Overall bias and Directness	Risk of bias judgement	High *(No information about randomisation or allocation concealment and no baseline*

Section	Question	Answer
		characteristics reported. Limited information about analysis methods and unclear whether outcome assessors were aware of assigned interventions)
	Overall Directness	Directly applicable

O'Sullivan, 1992

Bibliographic Reference	O'Sullivan AL; Jacobsen BS; A randomized trial of a health care program for first-time adolescent mothers and their infants.; Nursing research; 1992; vol. 41 (no. 4)

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Hospital outpatient baby unit
Study dates	Not provided
Sources of funding	Robert Wood Johnson Foundation
Inclusion criteria	Parents Teenage parents aged 17 years or younger A well baby Delivered at a large urban teaching hospital
Exclusion criteria	Participants who intended to place their child for adoption
Intervention(s)	The experimental programme was given at a teen baby clinic in the same hospital as the control. The intervention was the same as the control except that the mother saw a paediatrician and a nurse on alternate visits, rather than just a paediatrician as in the control. The experimental programme was focussed on 4 goals: prevention of repeat pregnancy, return to school by the mother, up-to-date immunisations for the infant, and reduced use of the emergency room for infant care. In addition to the traditional care for well baby visits at the same designated times as the control group, the programme also provided the following special services: A social worker interviewed each mother at the 2-week visit regarding her understanding of family planning methods and provided counselling, including referral to a birth control clinic if appropriate. She acted as a role model for parenting behaviours and was available at other visits on request. A paediatrician and nurse asked about the mother's plans for returning to school, her use of family planning methods, and whether she was satisfied with her method. Health teaching in the waiting room by a nurse and trained volunteers using videotapes and slides, and one-to-one health teaching about infant care.

	If appointments were missed, mothers in this group were urged to reschedule. They received reminder phone calls and letters for 6 weeks after a missed appointment at the 2-week visit and for 8 weeks after a missed appointment at subsequent visits.
Comparator	The comparator was routine care: Mother-baby pairs assigned to the control group were scheduled for well-baby visits at the hospital (primary care clinic) at 2 weeks, 2 months, 4 months, 6 months, 9 months, 12 months, 15 months and 18 months. If appointments were kept, the infants received their vaccinations from a paediatrician. Reminders were not part of the routine process.
Outcome measures	Vaccine uptake Number of babies who were fully vaccinated at 18 months of age (specific vaccines not stated)
Number of participants	243
Duration of follow-up	After the 18 month visit.
Loss to follow-up	Data was taken from paper medical records. Data was not available for 7 participants in the intervention arm and 12 participants in the control arm.

Study arms

Face-to-face education and reminders (letters and phone calls) (N = 120)
Control (N = 123)

Characteristics

Arm-level characteristics

	Face-to-face education and reminders (letters and phone calls) (N = 120)	**Control (N = 123)**
Maternal age *(years)* Mean (no SD provided)		
Nominal	16.5	16.3

Risk of bias

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information about randomisation or allocation concealment)*
Domain 2a: Risk of bias due to deviations from the intended	Risk of bias for deviations from the intended	Some concerns *(No information about blinding. Limited information about analysis methods)*

Section	Question	Answer
interventions (effect of assignment to intervention)	interventions (effect of assignment to intervention)	
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(No information about blinding but outcome was objective)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Some concerns *(Limited information about analysis methods)*
Overall bias and Directness	Risk of bias judgement	High *(No information about randomisation or allocation concealment and limited information about analysis methods.)*
	Overall Directness	Directly applicable

Otsuka-Ono, 2019

Bibliographic Reference Otsuka-Ono H; Hori N; Ohta H; Uemura Y; Kamibeppu K; A childhood immunization education program for parents delivered during late pregnancy and one-month postpartum: a randomized controlled trial.; BMC health services research; 2019; vol. 19 (no. 1)

Study details

Study type	Randomised controlled trial (RCT)
Study location	Japan
Study setting	Hospital outpatient clinic
Study dates	2013 to 2014
Sources of funding	Pfizer Health Research Foundation
Inclusion criteria	Pregnant women Aged over 18 years. Recruited during gestational weeks 29–33. Participants were not scheduled to change hospital.
Exclusion criteria	None
Intervention(s)	In addition to the group guidance regarding immunisation provided by the hospital, participants in the intervention group also received two individual immunisation education sessions, once during late pregnancy and the second at the one-month postpartum check-up. The individual education sessions lasted approximately 10 min during late pregnancy and 3–5min at the one-month postpartum check-up. The

	first intervention session used the guidebook with an infant immunisation schedule. Participants assigned to the intervention group were provided with the guidebook and infant immunization schedule prior to the intervention after group assignment so that they could read them during the waiting time for the prenatal check-up. The second part of the intervention consisted of a check-up to determine whether parents had sought a paediatrician or primary care physician to vaccinate their child and confirmation of the date of initial vaccination using the checklist. When possible, the children's fathers and the women's partners or family members also attended the two sessions, which were conducted in an outpatient setting by a single investigator.
Comparator	"Control". No further details were provided.
Outcome measures	Vaccine uptake Number of babies who had completed all 4 vaccinations (hepatitis B, rotavirus, Hib B and pneumococcal) at 3 months of age
Number of participants	175
Duration of follow-up	After intervention
Loss to follow-up	None

Study arms

Literature and education (N = 88)
Control (N = 87)

Characteristics

Arm-level characteristics

	Literature and education (N = 88)	**Control (N = 87)**
Maternal age *(years)*		
Mean/SD	32.8 (3.9)	33 (4.9)

Risk of bias

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect	Risk of bias for deviations from the intended interventions (effect of	Low

Section	Question	Answer
of assignment to intervention)	assignment to intervention)	
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Uptake was self-reported by the parents. Although this bias may have been equal for both arms, it is a less reliable way of recording uptake compared to documentation when a participant receives it.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Vaccine uptake was self-reported.)*
	Overall Directness	Directly applicable

Quinlivan, 2003

Bibliographic Reference	Quinlivan, Julie A; Box, Helen; Evans, Sharon F; Postnatal home visits in teenage mothers: a randomised controlled trial; The Lancet; 2003; vol. 361 (no. 9361); 893-900

Study details

Study type	Randomised controlled trial (RCT)
Study location	Australia
Study setting	Community (home visits)
Study dates	1998 to 2000
Sources of funding	Health Department of Australia
Inclusion criteria	Pregnant women Pregnant women, younger than 18 years, pregnant for the first time, attending an antenatal clinic. Participants who spoke English
Exclusion criteria	Participants who intended to place their child for adoption Participants who intended to have an abortion Participants who were living too far away Fetal abnormality

Intervention(s)	Patients allocated to the intervention group received a series of structured home visits undertaken by one of two certified nurse midwives. The visits were after birth at: 1 week, 2 weeks, 1 month, 2 months, 4 months, and 6 months. The visits involved a lot of general education about childcare. Advice and information about vaccination was provided at the 1 month visit. Face-to-face reminders were at 2 months and 4 months. The midwives were able to contact the obstetrician associated with the teenage pregnancy clinic if urgent advice was required on a particular situation during a home visit. As a result, appointments or referrals could be made on behalf of mother or child. All participants were provided with routine postnatal support, counselling, and information services provided by the hospital, including access to routine hospital domiciliary home-visiting services.
Comparator	All participants were provided with routine postnatal support, counselling, and information services provided by the hospital, including access to routine hospital domiciliary home-visiting services. An unspecified vaccination reminder was sent out at 6 months. However, this was at the same time as data collection. Therefore, the reminder should not have made an impact on the data.
Outcome measures	Vaccine uptake Results for children who completed all 4 vaccines (diphtheria, tetanus, pertussis, MMR)
Number of participants	136
Duration of follow-up	When the child was 6 months of age.
Additional comments	Results were presented for children who completed all 4 vaccines. Data was also available for each individual vaccine, but vaccine completion is reported in this review

Study arms

Midwife home visit to educate and remind parents about vaccination (N = 65)
No midwife home visits (N = 71)

Characteristics

Arm-level characteristics

	Midwife home visit to educate and remind parents about vaccination (N = 65)	**No midwife home visits (N = 71)**
Maternal age *(years)*		
Mean/SD	16.4 (0.96)	16.6 (0.9)

Risk of bias

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low *(Although there was no blinding of the healthcare staff, blinding was probably not possible.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Vaccine uptake was self-reported but data was checked against immunisation register and Child Health Books)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

Richman 2019

Bibliographic Reference	Richman, A; Torres, E; Text and Email Messaging for Increasing Human Papillomavirus Vaccine Completion among Uninsured or Medicaid-insured Adolescents in Rural Eastern North Carolina; Journal of health care for the poor and underserved; 2019; vol. 30 (no. 4); 1499-1517

Study details

Trial registration number and/or trial name	NCT01908517
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	2 community clinics in North Carolina
Study dates	March 2014 - March 2016
Sources of funding	Merck & Co Inc.

Inclusion criteria	Uninsured or Medicaid-insured English- speaking and/or Spanish- speaking parents and their children ages 9 to 17 years Children must have never received a HPV vaccine Receiving services from a community clinic and had a working phone or email address
Exclusion criteria	Children under 9 or over 17 years of age, or children who had already received any doses of a HPV vaccine
Intervention(s)	Electronic reminders: 7 electronic messages once per month across seven months (four health education messages about HPV and the HPV vaccine, two appointment reminder messages, and one message asking participants to take the follow-up survey)
Comparator	Standard of care: Paper card that told people when to return for the second and third doses
Outcome measures	Vaccine uptake For 2nd and 3rd doses
Duration of follow-up	7 months
Additional comments	Results reported in the review are for the number of people who received all 3 doses. Data is also available for 2 doses, but this was not reported in the review

Study arms

Electronic reminders (N = 129)
Standard of care (N = 128)

Characteristics

Arm-level characteristics

	Electronic reminders (N = 129)	**Standard of care (N = 128)**
Parent age *(years)*		
Mean/SD	37.85 (8.06)	38.17 (8.67)
Child age *(years)*		
Mean/SD	11.95 (1.51)	11.98 (1.69)

Risk of bias

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information about randomisation process)*

Section	Question	Answer
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Limited information about analysis methods)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Limited information about randomisation and analysis methods)*
	Overall Directness	Directly applicable

Stuck, 2015

Bibliographic Reference	Stuck AE; Moser A; Morf U; Wirz U; Wyser J; Gillmann G; Born S; Zwahlen M; Iliffe S; Harari D; Swift C; Beck JC; Egger M; Effect of health risk assessment and counselling on health behaviour and survival in older people: a pragmatic randomised trial.; PLoS medicine; 2015; vol. 12 (no. 10)

Study details

Study type	Randomised controlled trial (RCT)
Study location	Switzerland
Study setting	General practices
Study dates	2000 to 2008
Sources of funding	European Union, the Federal Education and Science Ministry, the Swiss National Science Foundation, the Swiss National Science Foundation Swiss National Cohort, the Swiss Foundation for Health Promotion, the Velux Foundation, the Langley Research Institute (JCB).
Inclusion criteria	People aged 65 year and older who the practices had seen at least once over the past 5 years.
Exclusion criteria	Patients with disability (defined as needing human assistance for performing basic activities of daily living), cognitive impairment (equivalent to a Mini Mental State Examination score of 24 or less), terminal disease, or inability to speak German were excluded.
Intervention(s)	The questionnaire was developed based on a systematic literature review and expert panel consensus. Experts selected risk factors for functional status decline based on four criteria: potential impact on functional impairment, strength of evidence, potential for risk reduction, and feasibility of assessment. For each risk factor, assessment questions were selected based on reliability, validity, feasibility, and previous use in large studies of older individuals. The risk factors included unfavourable health behaviours, health and functional impairments, and social risk factors. For health behaviours, questions on participants' intention to change unfavourable behaviours were added. In addition, the expert panel also selected 11

	preventive care recommendations for inclusion in the questionnaire based on the 1996 guidelines of the US Preventive Services Task Force. Field tests among community-dwelling older individuals in the US, the UK, Germany, and Switzerland demonstrated the acceptance and feasibility of the questionnaire. The UK English version was translated and regionally adapted to the German language. For this trial, an intervention manual prepared for use in UK primary care practices was translated, regionally adapted, and modified for use by nurse counsellors and PCPs. This manual was used as training material and as a reference guide for the PCPs and nurse counsellors involved in the intervention. At baseline and 1-y follow-up, primary care physicians sent a questionnaire to patients allocated to the intervention arm. Based on completed questionnaires, individualised computer-generated participant and provider feedback reports were generated and returned to the primary care physicians and the participants. Primary care physicians used the reports to motivate patients to reduce unhealthy behaviours in collaboration with the nurse counsellors, to implement preventive care interventions (e.g., influenza vaccination, blood pressure measurement), and to refer patients for specialty-based preventive care (e.g., breast cancer screening, ophthalmology referral). Over the 2-y intervention period, nurse counsellors visited participants at home (at baseline and every 6 mo, and additionally if needed) and contacted them by phone (at 3 mo, and additionally if needed) to evaluate risks and reinforce the recommendations. The nurse counsellors had one initial meeting and then meetings each year during the 2-y intervention period with the geriatricians to refine recommendations for each participant. The primary care physicians and nurse counsellors received training and support from project geriatricians.
Comparator	Participants allocated to the control group continued to receive usual care from their primary care physicians.
Outcome measures	Vaccine uptake
Number of participants	2284
Duration of follow-up	at 2 years
Loss to follow-up	None

Study arms

Tailored information and nurse and primary care physician education (N = 874)
Control (N = 1410)

Characteristics

Arm-level characteristics

	Tailored information and nurse and primary care physician education (N = 874)	**Control (N = 1410)**
Mean age (SD) *(years)*		
Mean/SD	74.5 (5.8)	74.5 (6.1)
% Female *(%)*		
Nominal	56.9	56.5

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

Tiro, 2015

Bibliographic Reference	Tiro, Jasmin A; Sanders, Joanne M; Pruitt, Sandi L; Stevens, Clare Frey; Skinner, Celette Sugg; Bishop, Wendy P; Fuller, Sobha; Persaud, Donna; Promoting HPV Vaccination in Safety-Net Clinics: A Randomized Trial.; Pediatrics; 2015; vol. 136 (no. 5); 850-9

Study details

Trial registration number and/or trial name	NCT01729429
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	4 paediatric clinics
Study dates	February 2011 - December 2011
Sources of funding	Cancer Prevention and Research Institute of Texas grant, UT Southwestern Harold C. Simmons Cancer Center Support Grant and UT Southwestern Center for Translational Medicine grant
Inclusion criteria	Female patients aged 11-18 with an upcoming appointment at one of the centres
Exclusion criteria	If the child already had ≥1 HPV vaccine doses, no contact information, the appointment was not with a primary care provider or they did not allow for mailing of materials 1 to 2 weeks before the visit If the child had a sibling enrolled in the study, their parents did not speak English or Spanish, or if the patient had an HPV vaccine contraindication (e.g. pregnancy)

Intervention(s)	Dose 1 (information): Participants were sent a brochure focusing on 3 areas of vaccination: perceived risk, vaccine efficacy, and perceived barriers, particularly safety concerns. Two weeks after the visit, a nurse called parents who consented for additional contact and administered a short follow-up survey assessing HPV vaccine decisional stage, perceived risk, information seeking, self-efficacy for initiation, and provider recommendation. They also used a script reminding the parent that Parkland providers strongly recommended the vaccine and offered to schedule a nurse-only immunization appointment. Doses 2 and 3 (information and reminder): The nurse called parents 4 weeks overdue for either dose 2 or 3 to administer a survey assessing HPV vaccine decisional stage, perceived risk, information seeking, and self-efficacy for completion. She stressed importance of receiving all 3 doses and offered to schedule a nurse-only appointment. Doses 2 and 3 (information, no reminder): No additional contact or reminders following the information sent before dose 1
Comparator	Dose 1 (control): Participants were sent a general vaccines brochure focusing on 3 areas of vaccination: perceived risk, vaccine efficacy, and perceived barriers, particularly safety concerns. Parents did not consent to additional contact and so no follow-up phone calls were made. Two weeks after the visit, a nurse called parents who consented for additional contact and administered a short follow-up survey assessing HPV vaccine decisional stage, perceived risk, information seeking, self-efficacy for initiation, and provider recommendation. No additional contact was made for doses 2 and 3
Outcome measures	Vaccine uptake Number of people who received all 3 doses
Number of participants	875
Duration of follow-up	12 months
Additional comments	Trial was randomised into 2 arms for dose 1 - information vs control. For doses 2 and 3, each arm was split into two additional groups - parents who consented to additional contact (including reminders) and parents who did not. The trial therefore had 4 arms (information and reminders, information only, control and reminders, control only). Outcomes relevant to this review are for information vs control (dose 1) and information and reminders vs information only (dose 3).

Study arms

Control (N = 431) For dose 1. No further contact was made after dose 1
Information (N = 444) For dose 1. Arm for doses 2 and 3 was split into a further 2 arms based on participant consent (Arm 1 - information and reminder (n=164), Arm 2 - information, no reminder (n=246))

Characteristics

Arm-level characteristics

	Control (N = 431)	Information (N = 444)
% age 11-12 years		
Custom value	48%	52%
% age 13-18 years		
Custom value	52%	48%

Risk of bias

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(Split of intervention arm into reminder and no reminder is based on parental consent and not randomised. But multivariate modelling has accounted for this)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Low
	Overall Directness	Directly applicable

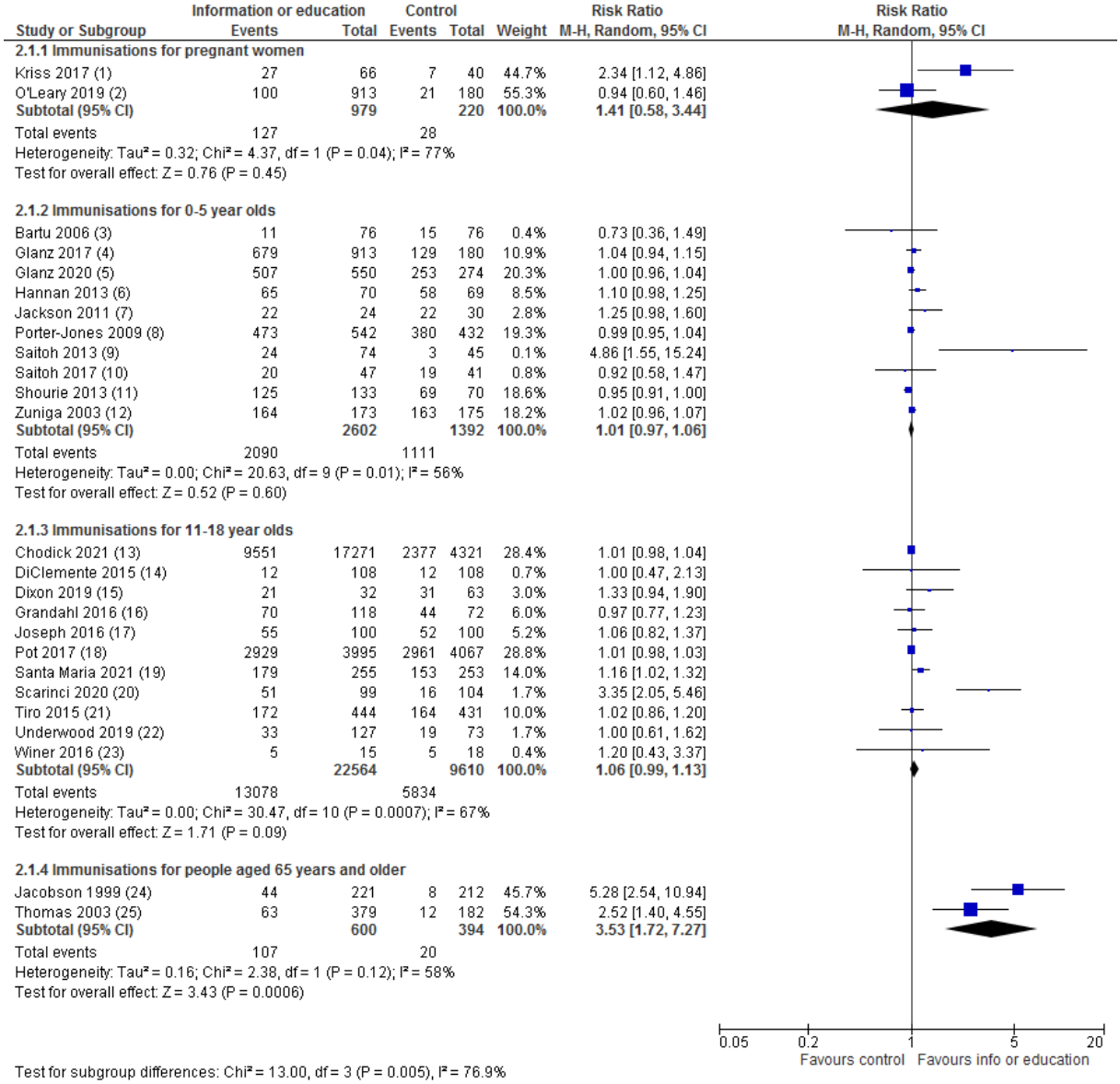
Appendix E – Forest plots

Information/education interventions

Information/education interventions aimed at individuals, parents/carers compared to control

Information and/or education versus control (subtotals only) by age group/life stage

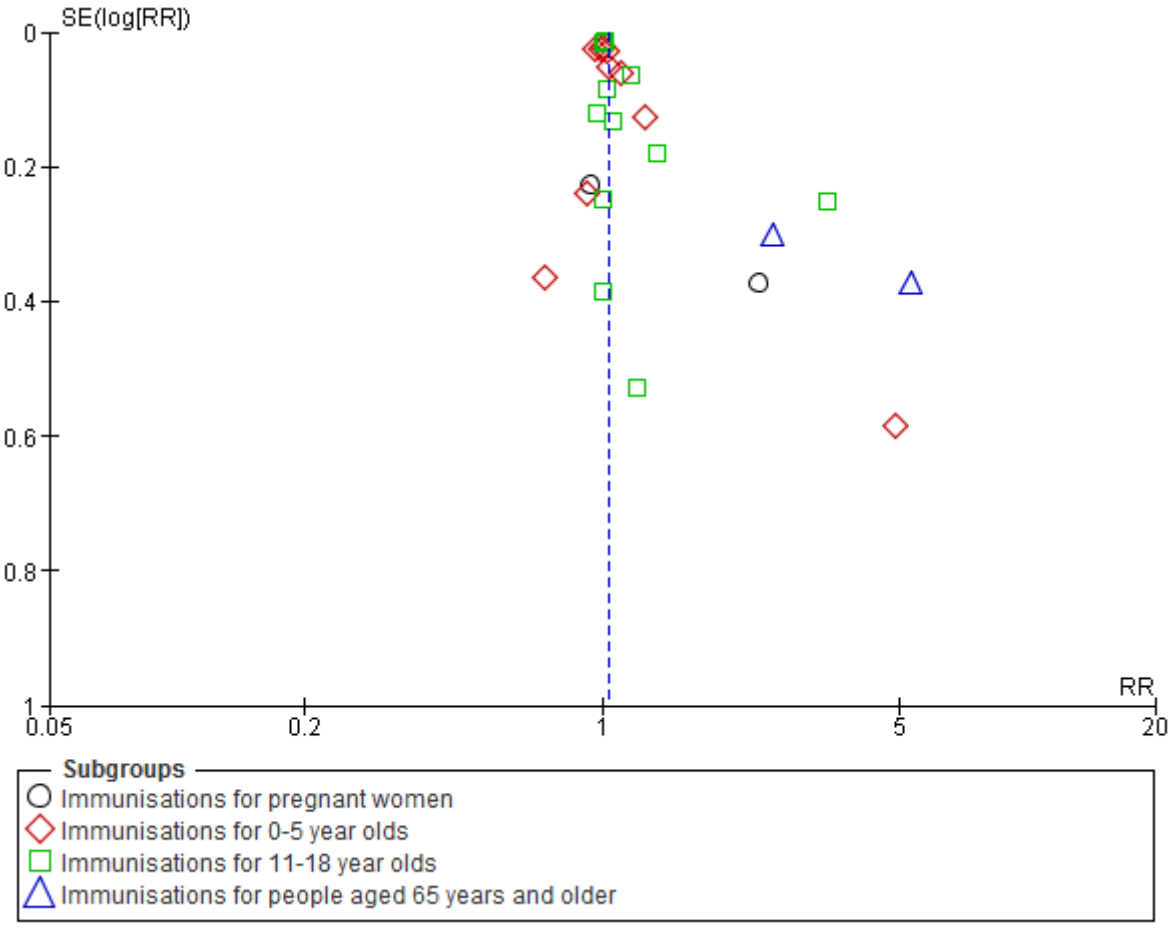
Note: The participants in O'Leary 2019 and Glanz 2017 were the same women making vaccination decisions for themselves as pregnant women (O'Leary 2019) and for their infants after birth (Glanz 2017). This meta-analysis has no total for the analysis as the decisions the pregnant women make for themselves and their babies will likely be correlated. The meta-analysis after this one has the total as we have omitted the Glanz 2017 study. This rationale applies to other plots where we have excluded Glanz 2017 from pooled totals.



Footnotes

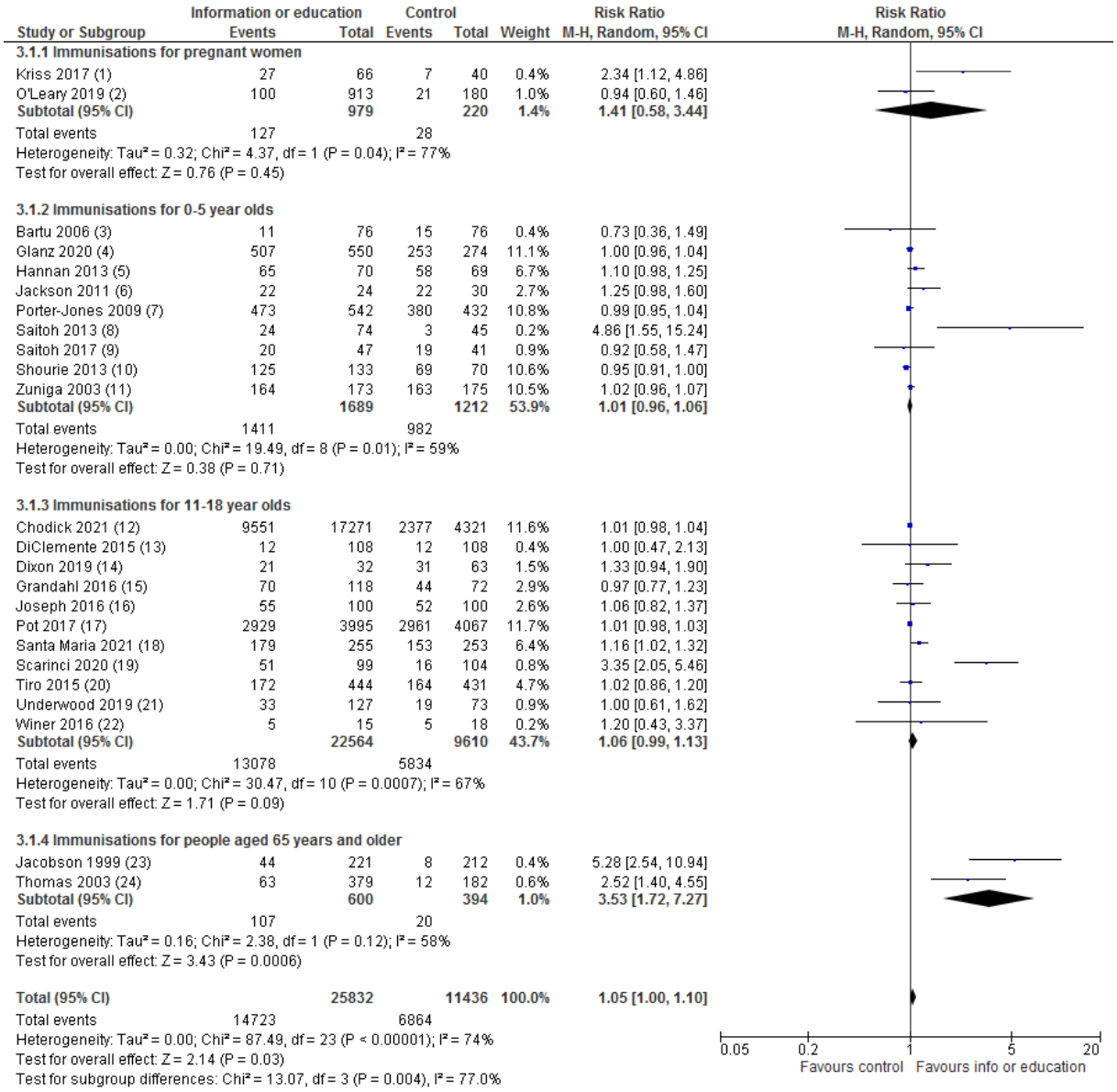
1) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines
2) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same pregnant women/mothers
3) Face-to-face education by visiting nurse
4) 2 arms combined for intervention: website with social media plus arm with website alone. Glanz 2017 and O'Leary involved the same women
5) 2 arms combined for intervention: website with tailored information plus website with untailored information.
6) Telephone call by nurse with advice
7) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
8) Teddy bear wearing information
9) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator
10) cRCT data adjusted for clustering. Face-to-face education was by midwives
11) cRCT data has been adjusted for clustering. 2 arms were combined: printed educational material and website decision aid. The printed educational material was a leaflet
12) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'
13) HPV 1 dose or more. Facebook campaign for parents.
14) 1st HPV dose. Intervention was interactive computer delivered media presentation
15) cRCT data adjusted for clustering. Video for parent(s) and the adolescent
16) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses
17) 1st HPV dose. Face-to-face education by provider to mother versus control
18) Website was for mothers of teenage girls
19) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
20) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language
21) HPV dose 1: Brochure aimed at parents.
22) cRCT data adjusted for clustering. HPV 1 dose or more. 2 intervention arms combined: Education of adolescents by teachers and information for parents plus information for parents. The MenACWY data was not included here to avoid double-counting of participants.
23) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers. A brochure was provided
24) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition
25) 2 arms combined for intervention: video and brochure, and video

Funnel plot for education versus control (subtotals only) by age/life stage



Information/education versus control (total but no Glanz 2017 data) (summary by age group)

Glanz 2017 has been omitted to avoid over-counting for the analysis of the total. This is because the same participants were involved as for O'Leary 2019.

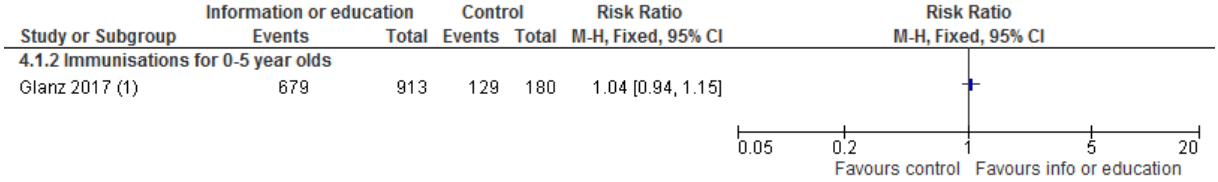


Footnotes

1) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines
2) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same pregnant women/mothers
3) Face-to-face education by visiting nurse.
4) 2 arms combined for intervention: website with tailored information plus website with untailored information.
5) Telephone call by nurse with advice.
6) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms
7) Teddy bear wearing information
8) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator
9) cRCT data adjusted for clustering. Face-to-face education was by midwives

10) cRCT data has been adjusted for clustering. 2 arms were combined: printed educational material and website decision aid. The printed educational material was a leaflet
11) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'.
12) HPV 1 dose or more. Facebook campaign for parents.
13) 1st HPV dose. Intervention was interactive computer delivered media presentation
14) cRCT data adjusted for clustering. Video for parent(s) and the adolescent
15) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses
16) 1st HPV dose. Face-to-face education by provider to mother versus control
17) Website was for mothers of teenage girls.
18) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
19) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language
20) HPV dose 1: Brochure aimed at parents.
21) cRCT data adjusted for clustering. HPV 1 dose or more. 2 intervention arms combined: Education of adolescents by teachers and information for parents plus information for parents. The MenACWY data was not included here to avoid double-counting of participants.
22) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers. A brochure was provided
23) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition
24) 2 arms combined for intervention: video and brochure, and video

Education versus control (Glanz 2017 separately)

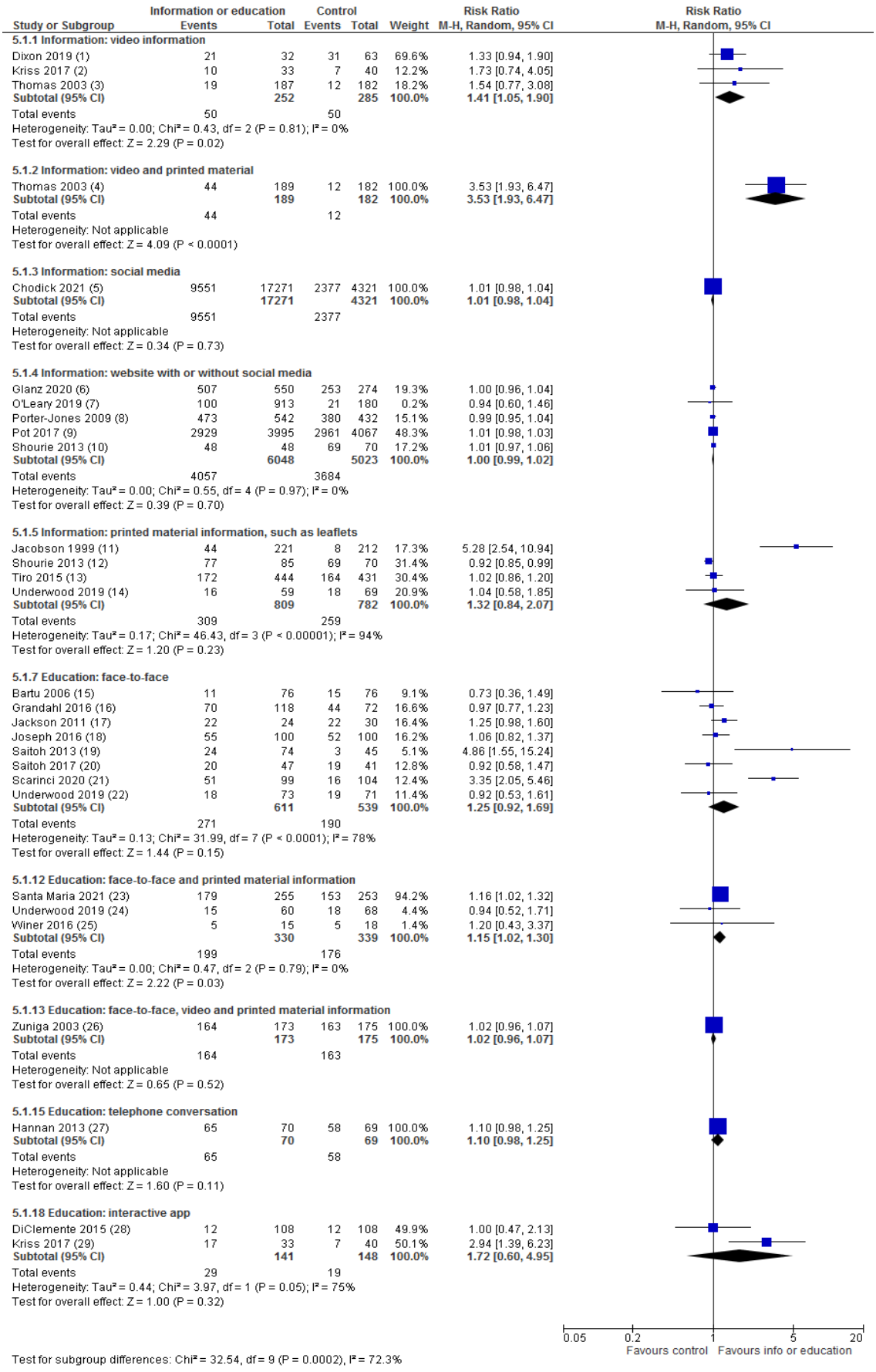


Footnotes

1) 2 arms combined for intervention: website with social media plus arm with website alone. Glanz 2017 and O'Leary involved the same women

Please note: the following 4 meta-analyses do not have funnel plots because they have the same studies as the first meta-analysis. No pooled meta-analysis results are presented because this is shown in the second forest plot above.

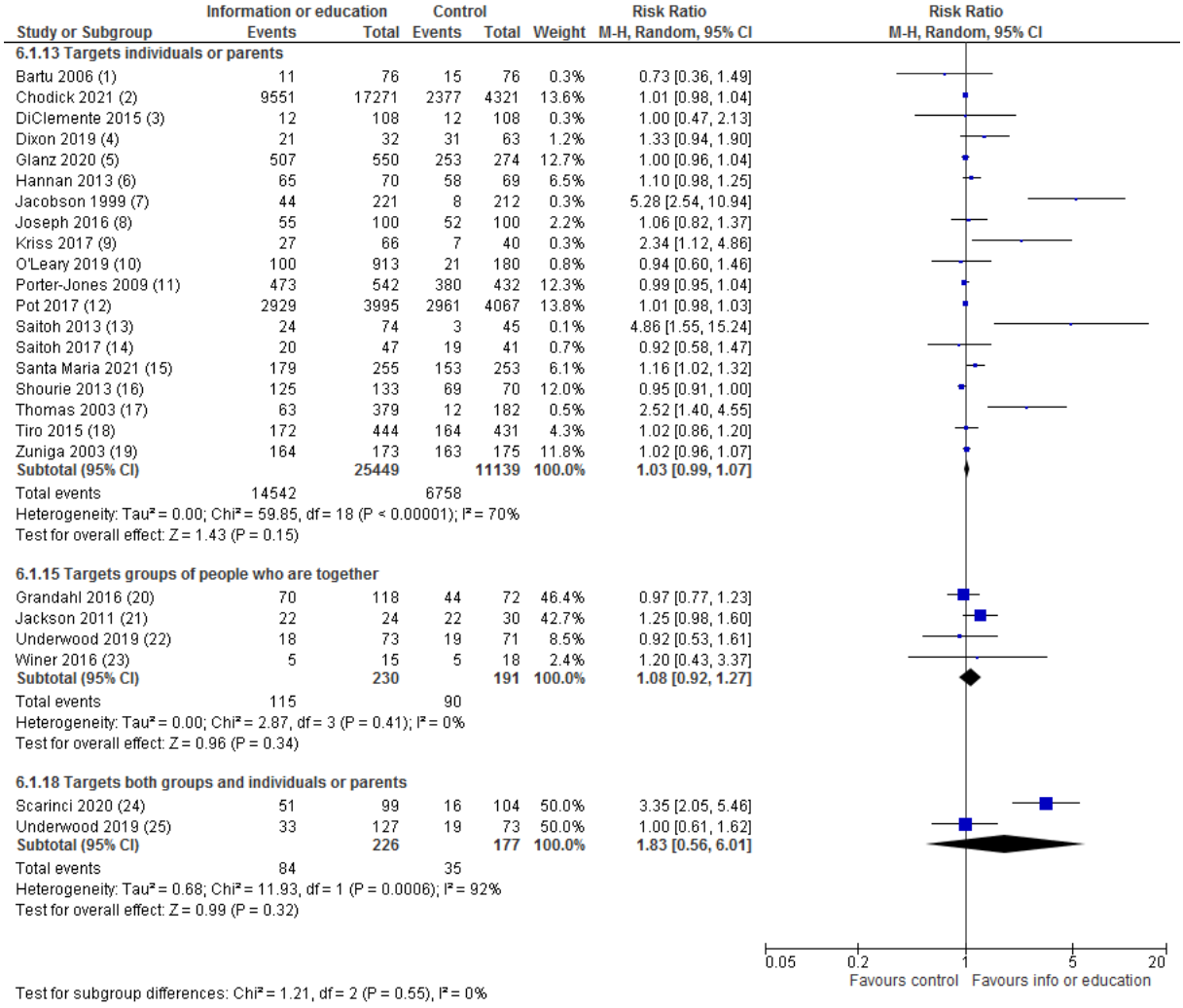
Information and/or education versus control by delivery method



Footnotes

1) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
2) Control was written advice from the CDC about vaccines in general (not specific to relevant vaccines).
3) Video.
4) Video and printed material. The printed educational material was a brochure.
5) HPV 1 dose or more. Facebook campaign for parents.
6) 2 arms combined for intervention: website with tailored information plus website with untailored information.
7) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same pregnant women/mothers. Therefore, Glanz 2017 was removed from this analysis.
8) Teddy bear wearing information about a website that has vaccine information and a contact number.
9) Website was for mothers of teenage girls.
10) cRCT data has been adjusted for clustering. Website decision aid. This meta-analysis has no total to avoid double counting the control arm in Shourie 2013.
11) Easy to read leaflet on vaccines versus easy-to-read leaflet on nutrition.
12) cRCT data has been adjusted for clustering. The printed educational material was a leaflet. This meta-analysis has no total to avoid double counting the control arm in Shourie 2013
13) HPV dose 1: Brochure aimed at parents.
14) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
15) Face-to-face education by visiting nurse.
16) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
17) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
18) 1st HPV dose. Face-to-face education by provider to mother versus control.
19) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
20) cRCT data adjusted for clustering. Face-to-face education was by midwives.
21) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
22) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
23) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
24) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers and information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
25) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers. A brochure was provided.
26) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'.
27) Telephone call by nurse with advice.
28) 1st HPV dose. Intervention was interactive computer delivered media presentation.
29) Interactive electronic book.

Information and/or education versus control by whether intervention targets an individual/parent or a group

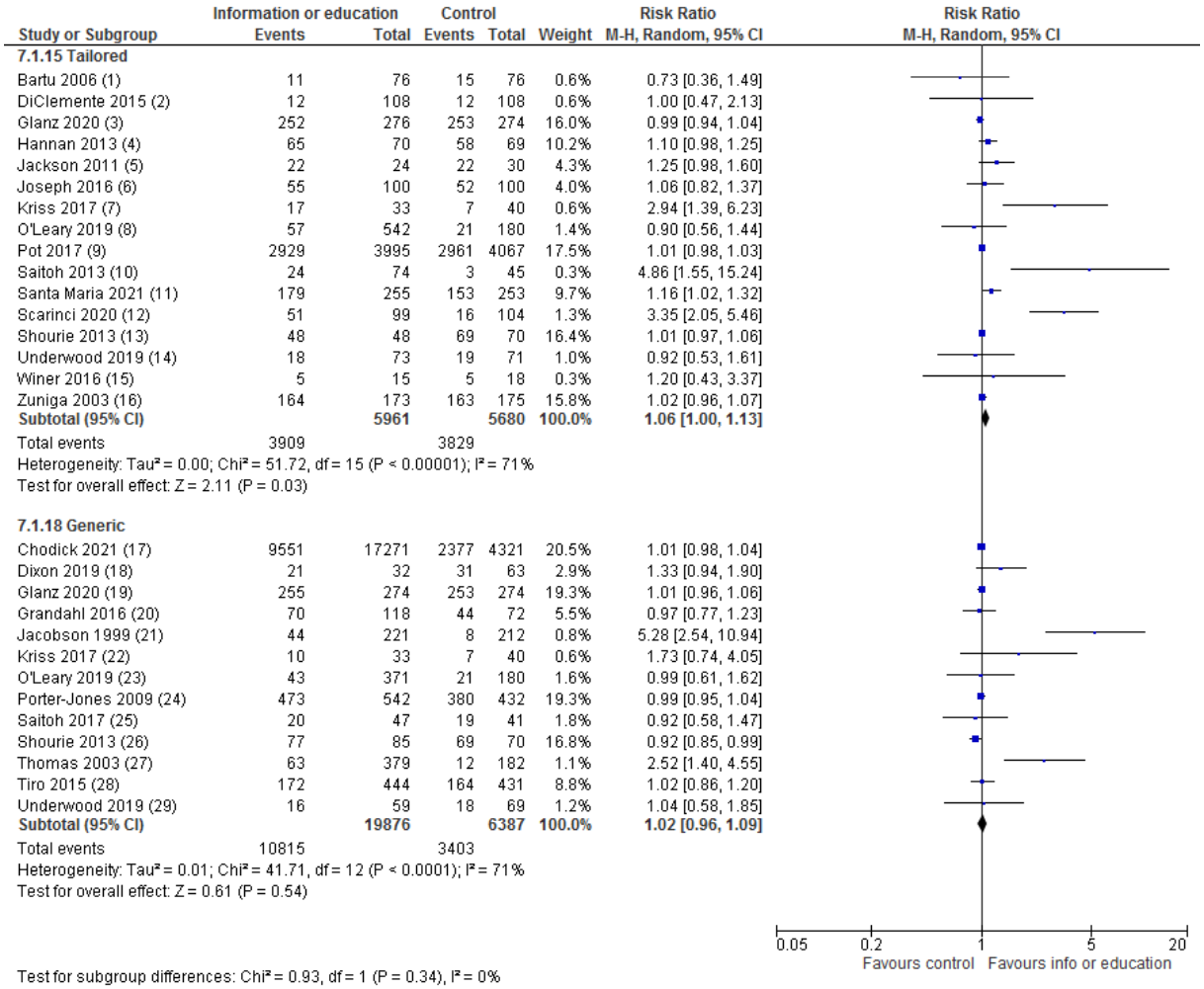


Footnotes

1) Face-to-face education by visiting nurse.
2) HPV 1 dose or more. Facebook campaign for parents.
3) 1st HPV dose. Intervention was interactive computer delivered media presentation.
4) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
5) 2 arms combined for intervention: website with tailored information plus website with untailored information.
6) Telephone call by nurse with advice.
7) Easy to read leaflet on vaccines versus easy-to-read leaflet on nutrition.
8) 1st HPV dose. Face-to-face education by provider to mother versus control.
9) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines.
10) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same pregnant women/mothers. Therefore, the Glanz 2017 data was removed.
11) Teddy bear wearing information about a website that has vaccine information and a contact number
12) Website was for mothers of teenage girls
13) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator
14) cRCT data adjusted for clustering. Face-to-face education was by midwives.
15) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.

16) cRCT data has been adjusted for clustering. 2 arms were combined: printed educational material and website decision aid. The printed educational material was a leaflet
17) 2 arms combined for intervention: video and brochure, and video
18) HPV dose 1: Brochure aimed at parents
19) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'
20) cRCT data adjusted for clustering. Face-to-face group lesson for adolescents by school nurses
21) cRCT data adjusted for clustering. Face-to-face education with a nurse and investigators who were healthcare practitioners. Leaflet was in both arms.
22) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
23) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers. A brochure was provided
24) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
25) cRCT data adjusted for clustering. HPV 1 dose or more. 2 intervention arms combined: Education of groups of adolescents by teachers and information for parents plus individual written information for parents. The MenACWY data was not included here to avoid double-counting of participants.

Information and/or education versus control divided into tailored or generic interventions

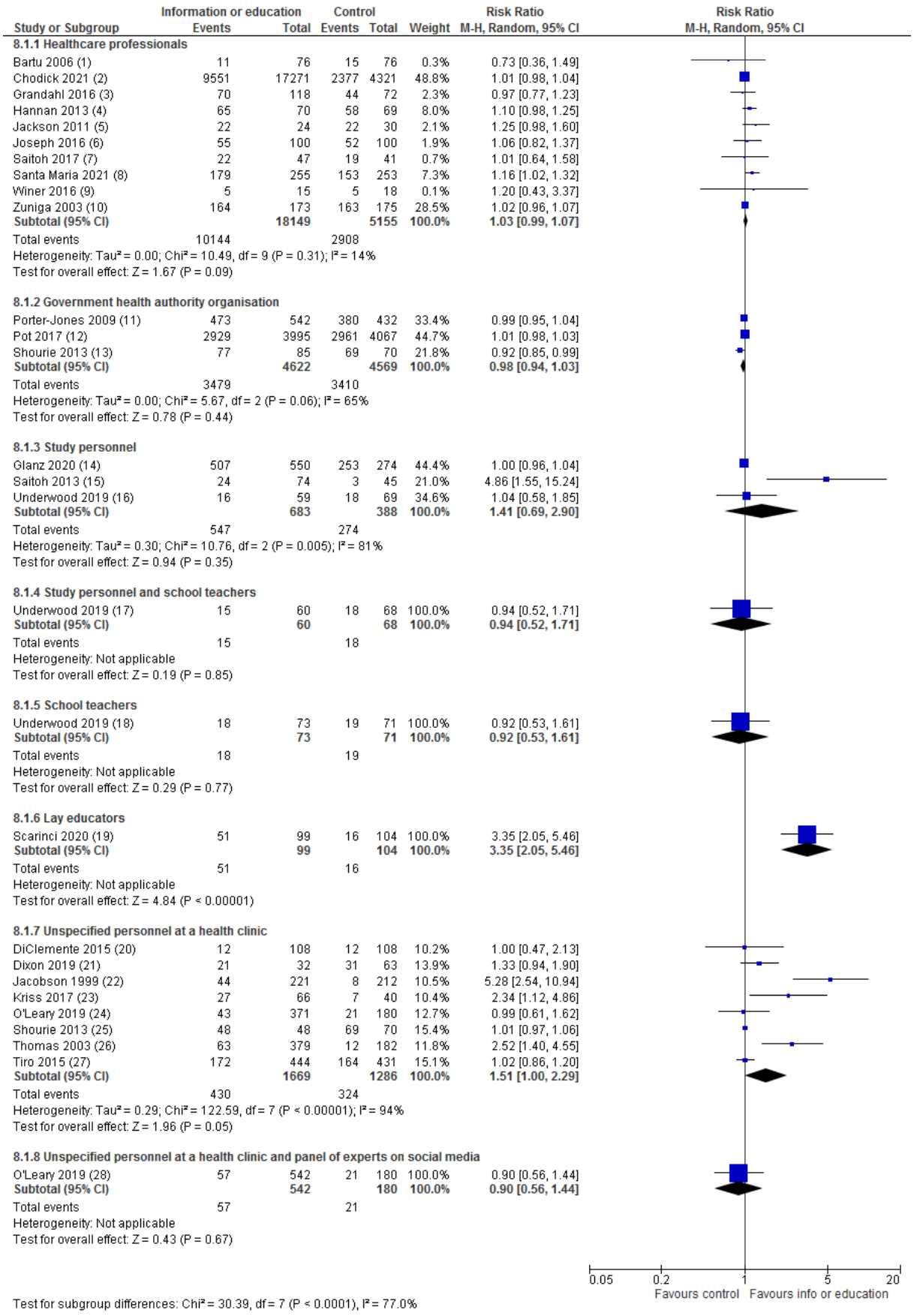


Footnotes

1) Face-to-face education by visiting nurse
2) 1st HPV dose. Intervention was interactive computer delivered media presentation.

3) Website with tailored information. This meta-analysis has no total to avoid double-counting the control arm in Glanz 2020.
4) Telephone call by nurse with advice. The nurse asked about any concerns.
5) cRCT data adjusted for clustering. Face-to-face education with nurse and investigators who were healthcare practitioners. There was a question and answer session. Leaflet was in both arms
6) 1st HPV dose. Face-to-face education by provider to mother versus control
7) Interactive electronic book
8) Website and social media. The social media had a tailored component because participants could ask questions from a paediatrician, vaccine safety researcher or risk communication specialist. This is a substudy of Glanz 2017. The same women who were pregnant made the decision as to whether their infant should be vaccinated after birth. Therefore, the Glanz 2017 data was removed.
9) Website was for mothers of teenage girls. Tailored information
10) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
11) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
12) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language
13) cRCT data has been adjusted for clustering. Website decision aid. This meta-analysis has no total to avoid double counting the control arm in Shourie 2013.
14) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
15) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers. A brochure was provided. There was a question and answer session
16) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator' and they answered questions.
17) HPV 1 dose or more. Facebook campaign for parents.
18) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
19) Website with untailored information. This meta-analysis has no total to avoid double-counting the control arm in Glanz 2020.
20) cRCT data adjusted for clustering. Face-to-face class lesson of adolescents by school nurses. It was generic because the of the lesson highly structured and there was no mention of questions and answers
21) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition
22) Control was written advice from the CDC about vaccines in general (not specific to relevant vaccines)
23) This is a substudy of Glanz 2017 and has the same pregnant women/mothers. Therefore, the Glanz 2017 data was removed
24) Teddy bear wearing information about a website that has vaccine information and a contact number
25) cRCT data adjusted for clustering. Face-to-face education was by midwives. Although this was one-to-one education, the content was very prescriptive and there was no mention of question and answers
26) cRCT data adjusted for clustering. The printed educational material was a leaflet. This meta-analysis has no total to avoid double counting the control arm in Shourie 2013
27) 2 arms combined for intervention: video and brochure, and video
28) HPV dose 1: Brochure aimed at parents
29) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.

Information and/or education versus control by who provided the information or education

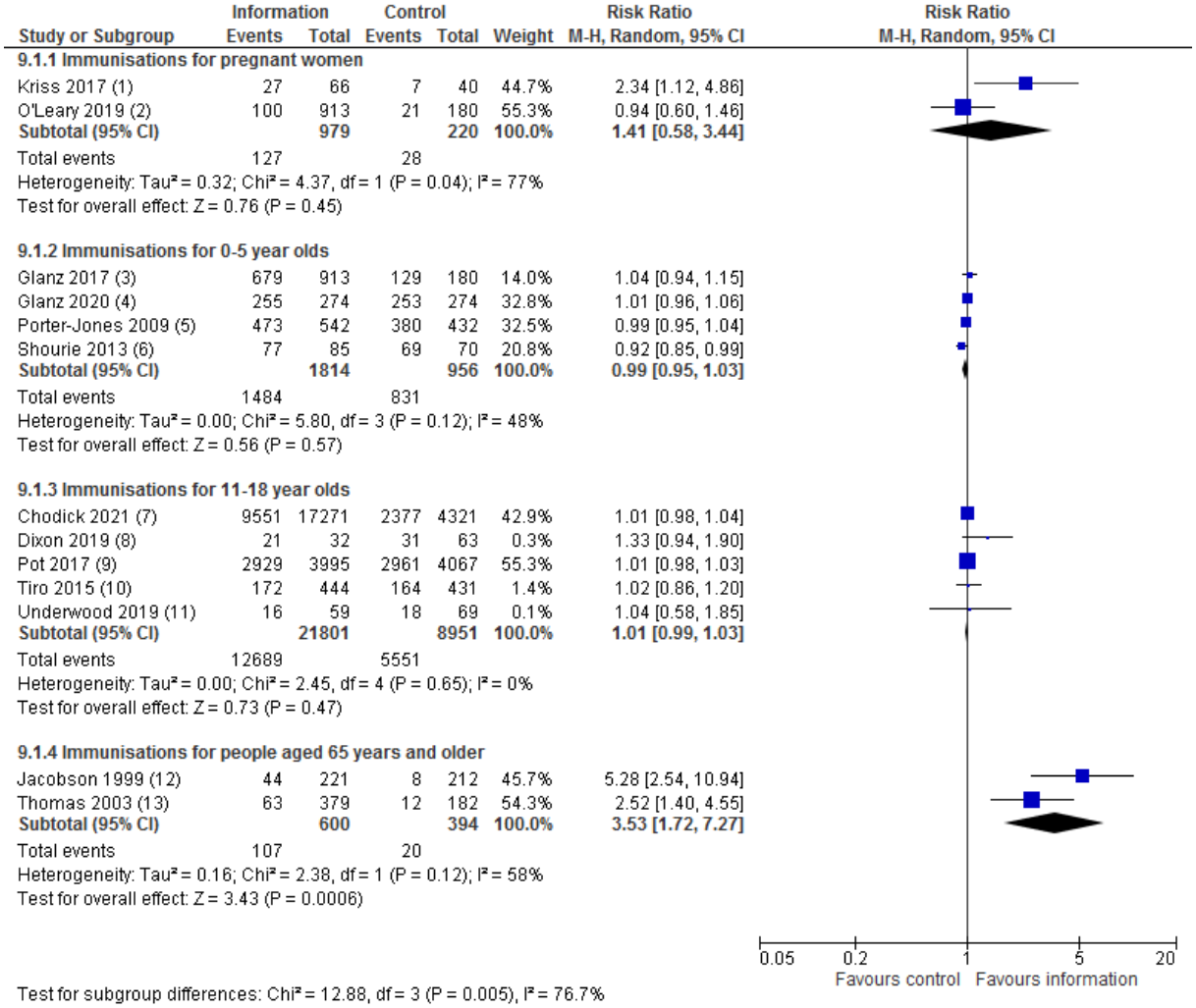


Footnotes

1) Face-to-face education by visiting nurse.
2) HPV 1 dose or more. Facebook campaign for parents by the Israel Pediatric Infectious Disease Association.
3) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses
4) Telephone call by nurse with advice
5) cRCT data adjusted for clustering. Face-to-face education with study personnel and a nurse. Leaflet was in both arms.
6) 1st HPV dose. Face-to-face education by a health educator to mother versus control
7) cRCT data adjusted for clustering. Face-to-face education was by midwives.
8) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
9) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers. A brochure was provided. The presentation was delivered by an investigator who was a healthcare practitioner
10) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator' at a perinatal clinic
11) Teddy bear wearing information about a website that has vaccine information and a contact number
12) Website was for mothers of teenage girls. Likely to be arranged by health authority because the Dutch National Immunisation Register was used
13) cRCT data has been adjusted for clustering. The printed educational material was a leaflet from Health Scotland. This meta-analysis has no total to avoid double counting the control arm in Shourie 2013.
14) 2 arms combined for intervention: website with tailored information plus website with untailored information.
15) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by study personnel in a health clinic.
16) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
17) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers and information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
18) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with trained lay health educators in groups and one-to-one in migrant's language. The education took place at unspecified locations.
19) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
20) 1st HPV dose. Intervention was interactive computer delivered media presentation. Delivered in a health clinic waiting room
21) cRCT data adjusted for clustering. Video for parent(s) and the adolescent
22) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition
23) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines
24) Website. This is a substudy of Glanz 2017 and has the same pregnant women/mothers. Therefore, the Glanz 2017 data was removed.
25) cRCT data has been adjusted for clustering. Website decision aid. This meta-analysis has no total to avoid double counting the control arm in Shourie 2013
26) 2 arms combined for intervention: video and brochure, and video
27) HPV dose 1: Brochure aimed at parents
28) Website and social media. The social media had a tailored component because participants could ask questions from a paediatrician, vaccine safety researcher or risk communication specialist. This is a substudy of Glanz 2017. The same women who were pregnant made the decision as to whether their infant should be vaccinated after birth. Therefore, the Glanz 2017 data was removed.

Information versus control by age group/life stage

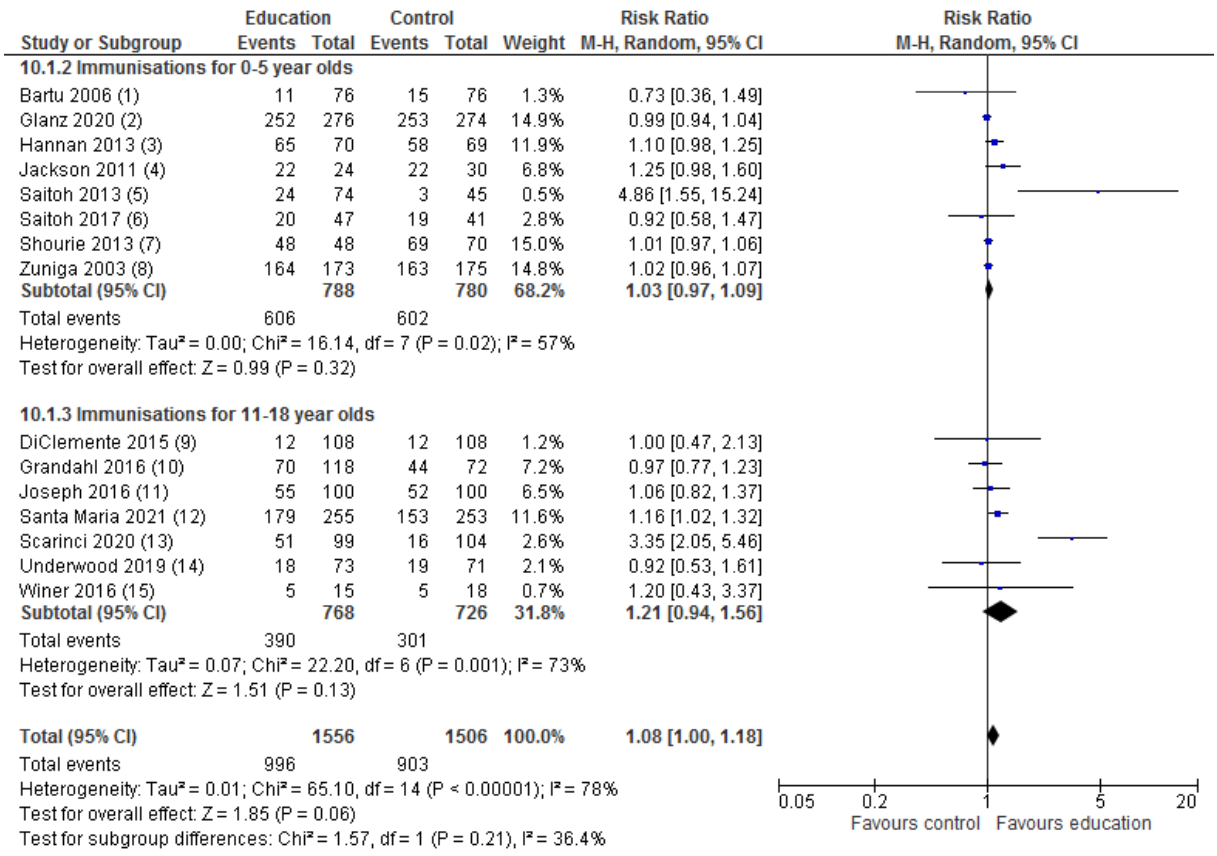
This meta-analysis has no total to avoid double-counting the control arm in Glanz 2020.



Footnotes

1) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines
2) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same women. Therefore, there is no total to avoid double counting the control arm
3) 2 arms combined for intervention: website with social media plus arm with website alone. Glanz 2017 and O'Leary involved the same women. Therefore, there is no total.
4) Website with untailored information.
5) Teddy bear wearing information
6) cRCT data has been adjusted for clustering. Printed educational material (leaflet).
7) HPV 1 dose or more. Facebook campaign for parents by the Israel Pediatric Infectious Disease Association.
8) cRCT data adjusted for clustering. Video for parents
9) Website was for mothers of teenage girls.
10) HPV dose 1: Brochure aimed at parents.
11) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants.
12) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition
13) 2 arms combined for intervention: video and brochure, and video

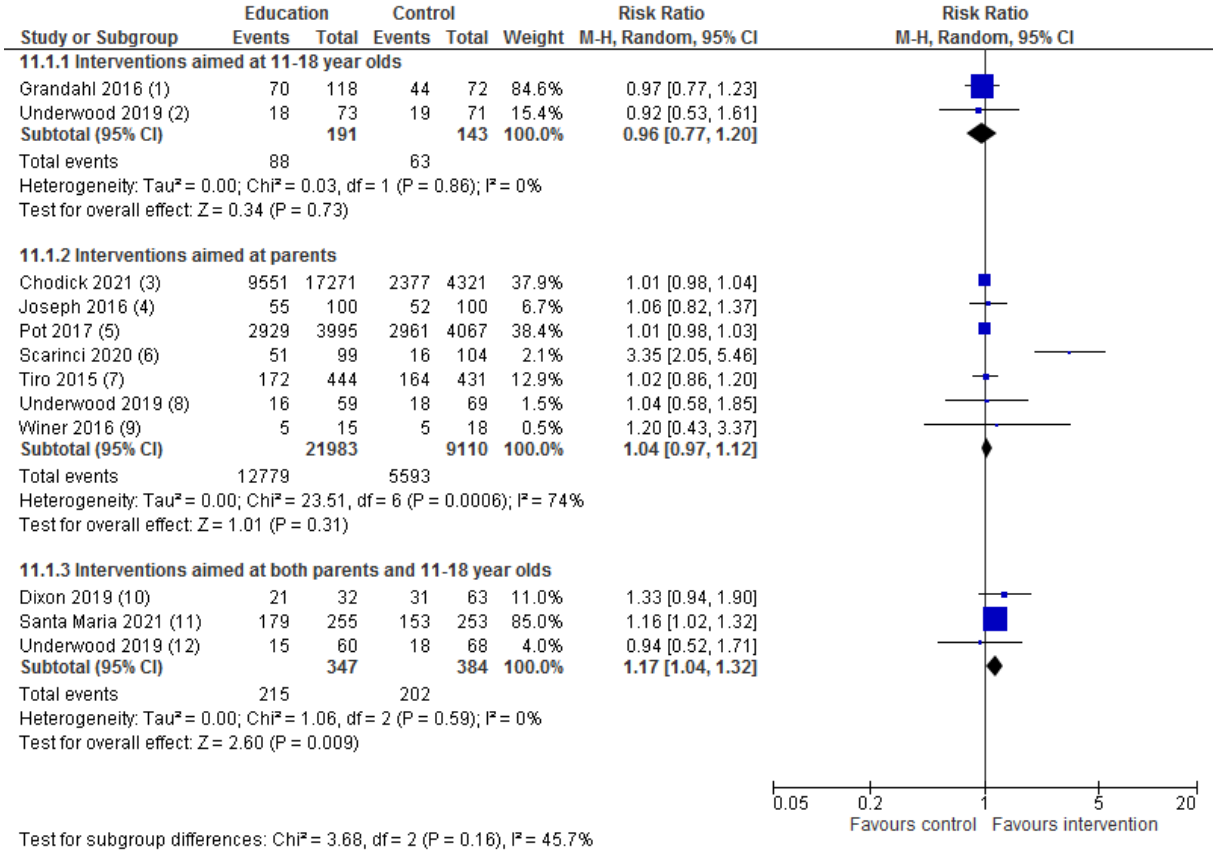
Education versus control by age group/life stage



Footnotes

1) Face-to-face education by visiting nurse.
2) Website with tailored information. This meta-analysis has no total to avoid double-counting the control arm in Glanz 2020.
3) Telephone call by nurse with advice.
4) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
5) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
6) cRCT data adjusted for clustering. Face-to-face education was by the investigators.
7) cRCT data has been adjusted for clustering. Interactive multi-media.
8) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'.
9) 1st HPV dose. Intervention was interactive computer delivered media presentation.
10) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses
11) 1st HPV dose. Face-to-face education by provider to mother versus control.
12) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
13) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
14) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
15) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers.

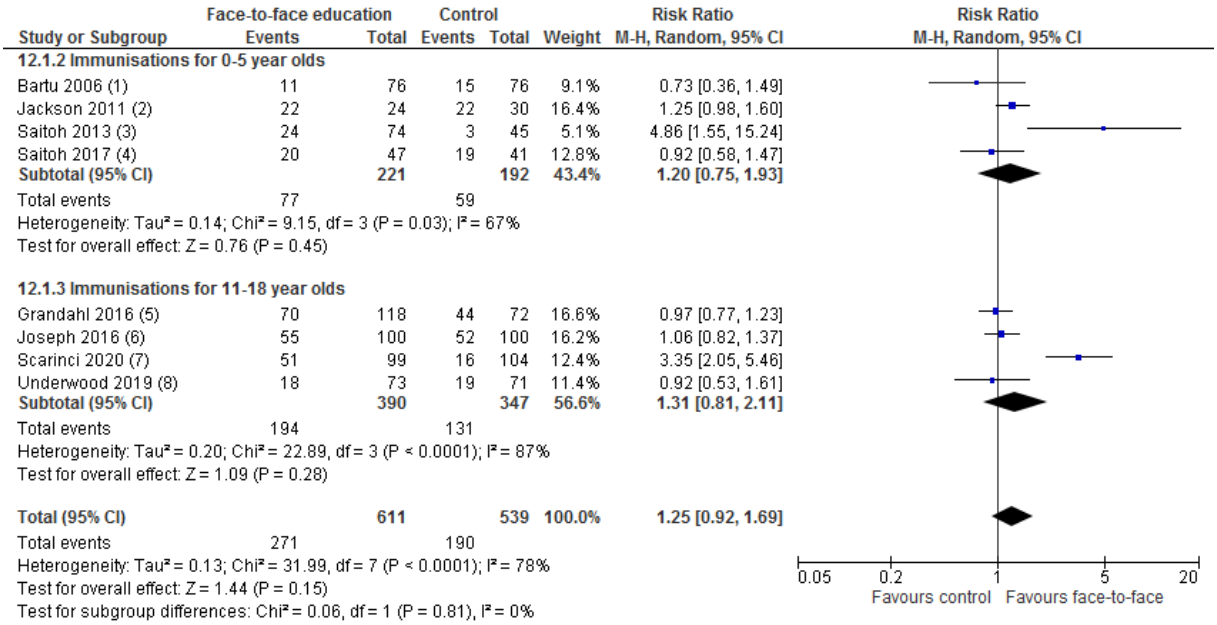
Vaccinations for adolescents aged 11-18 years, information/education versus control analysed by who the intervention was targeting



Footnotes

1) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
2) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
3) HPV 1 dose or more. Facebook campaign for parents by the Israel Pediatric Infectious Disease Association.
4) cRCT data adjusted for clustering. Video for parents
5) 1st HPV dose. Face-to-face education by provider to mother versus control
6) Website was for mothers of teenage girls
7) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
8) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
9) HPV dose 1: Brochure aimed at parents.
10) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers.
11) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
12) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers and information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.

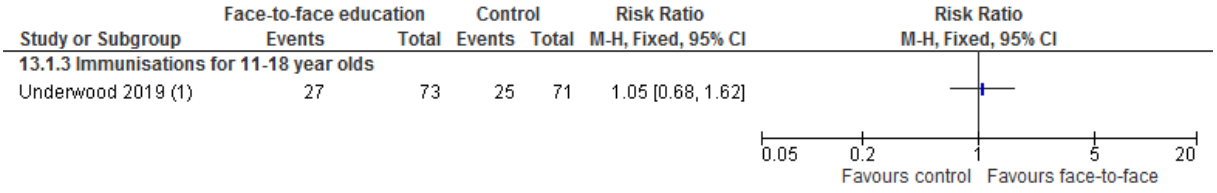
Face-to-face education vs control



Footnotes

1) Face-to-face education by visiting nurse
2) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
3) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator
4) cRCT data adjusted for clustering. Face-to-face education was by midwives
5) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses
6) 1st HPV dose. Face-to-face education by provider to mother versus control
7) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education was with educator in groups and one-to-one in migrant's language.
8) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.

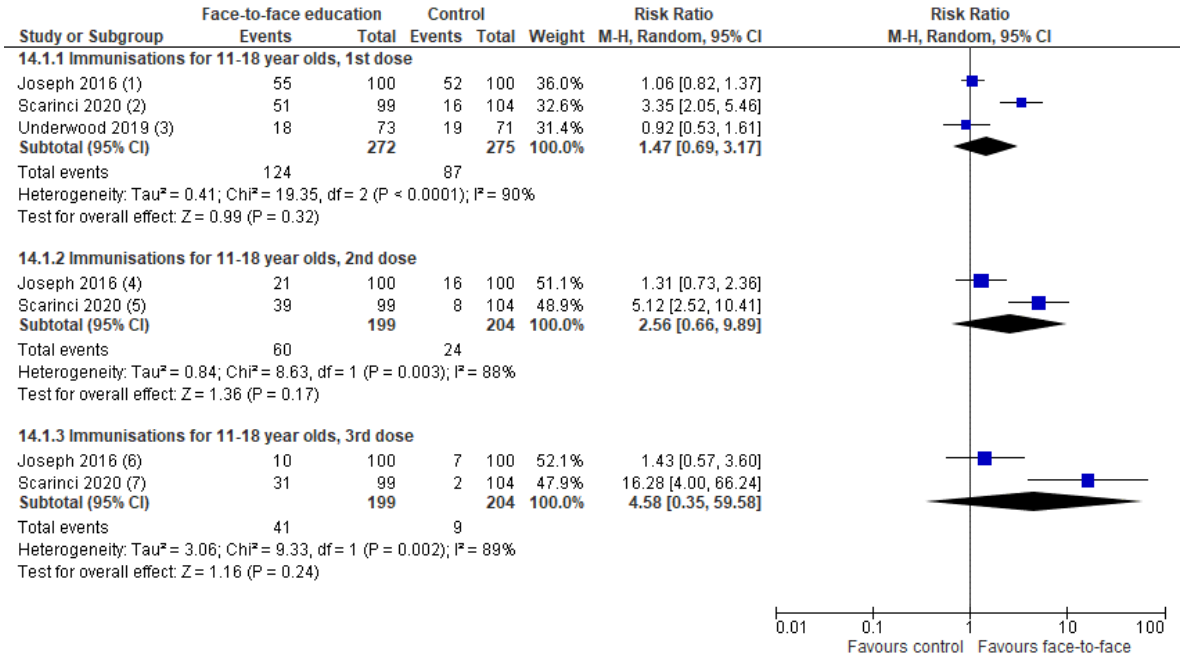
Face-to-face education vs control (MenACWY data)



Footnotes

1) cRCT data adjusted for clustering. MenACWY uptake. Education of adolescents by teachers. Written information for parents was in both arms. Data for HPV 1 dose or more is shown in other meta-analyses to prevent double-counting.

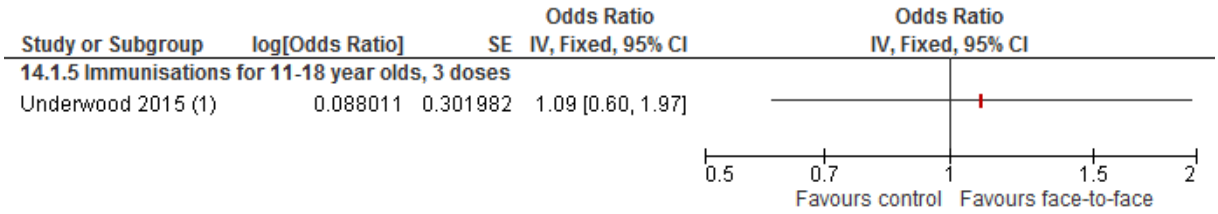
Face-to-face education vs control (HPV different doses)



Footnotes

1) Face-to-face education by provider to mother versus control
2) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education was with educator in groups and one-to-one in migrant's language.
3) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms.
4) Face-to-face education by provider to mother versus control
5) cRCT data adjusted for clustering. 2st HPV dose. Face-to-face education was with educator in groups and one-to-one in migrant's language
6) Face-to-face education by provider to mother versus control
7) cRCT data adjusted for clustering. 3rd HPV dose. Face-to-face education was with educator in groups and one-to-one in migrant's language

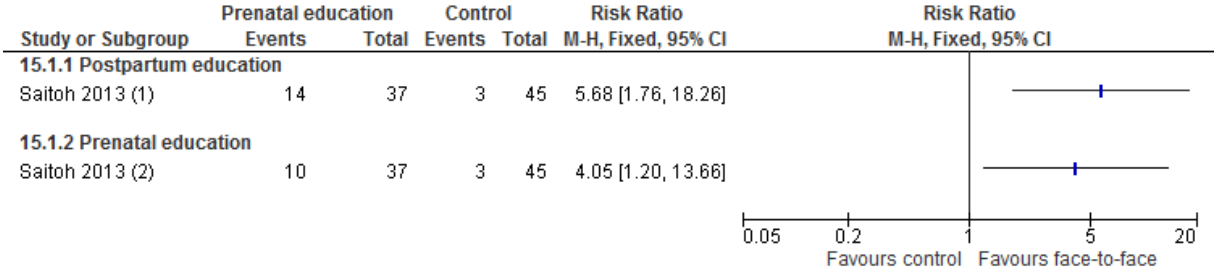
Face-to-face education versus control (adjusted odds ratio)



Footnote

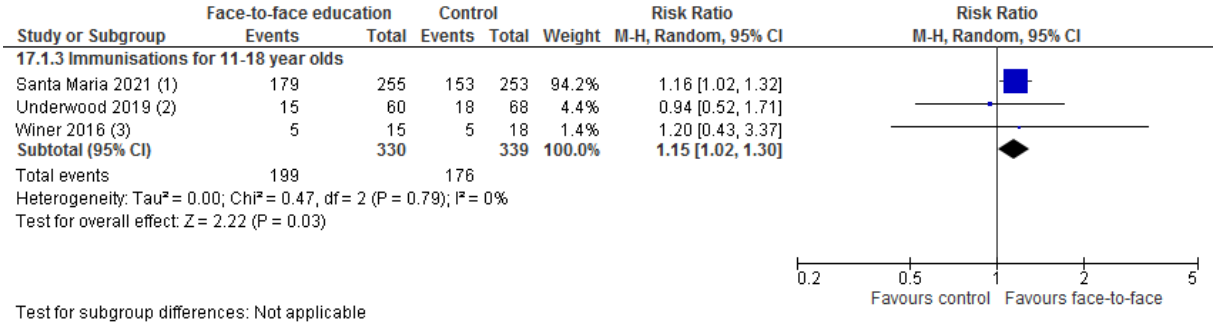
1) cRCT data adjusted for clustering. 3 HPV doses. Printed educational material for parents was in both arms. Face-to-face education for adolescents was classroom teaching by science teachers. Data for 1st dose had typos so could not be used.

Face-to-face education for children aged 0-5 years, prenatal and postpartum education versus control



Footnotes
(1) Face-to-face education was delivered by the investigators
(2) Face-to-face education was delivered by the intestigators

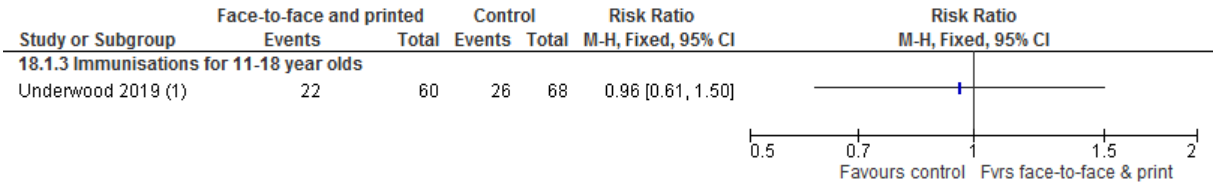
Face-to-face education and printed educational material versus control



Footnotes

1) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
2) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers and information for parents. The MenACWY data was not included here to avoid double-counting of participants. The MenACWY data is shown in the meta-analysis below.
3) cRCT data adjusted for clustering. Face-to-face education was educational presentations for mothers and daughters aimed at mothers. They were also given a brochure.

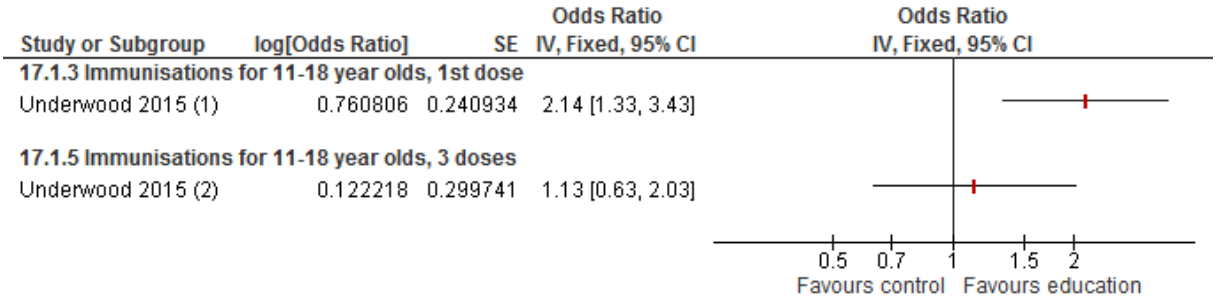
Face-to-face education and printed educational material versus control (MenACWY data)



Footnotes

1) cRCT data adjusted for clustering. MenACWY uptake. Education of adolescents by teachers and information for parents. Data for HPV 1 dose or more is shown in other meta-analyses.

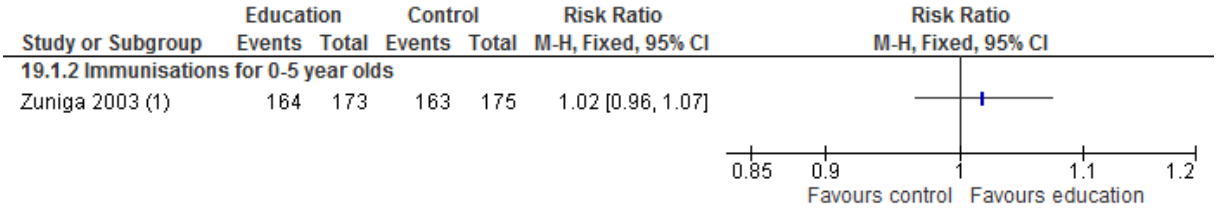
Face-to-face education and printed educational material versus control (different HPV doses)



Footnotes

1) cRCT data adjusted for clustering. 1st HPV dose. Printed educational material for parents was literature. Face-to-face education for adolescents was classroom teaching by science teachers.
2) cRCT data adjusted for clustering. 3 HPV doses. Printed educational material for parents was literature. Face-to-face education for adolescents was classroom teaching by science teachers.

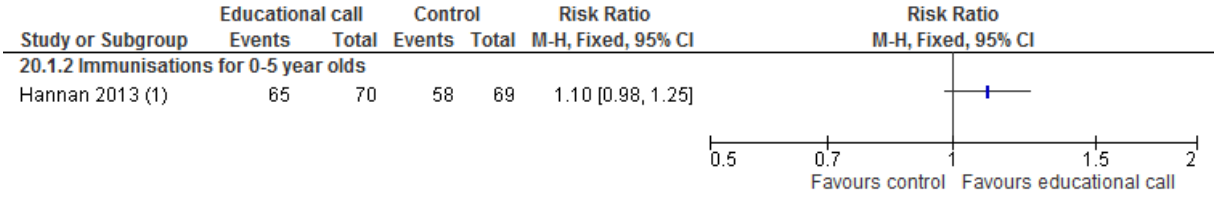
Face-to-face education, video and vaccination calendar versus control



Footnotes

(1) Face-to-face education was delivered by a 'perinatal health educator'

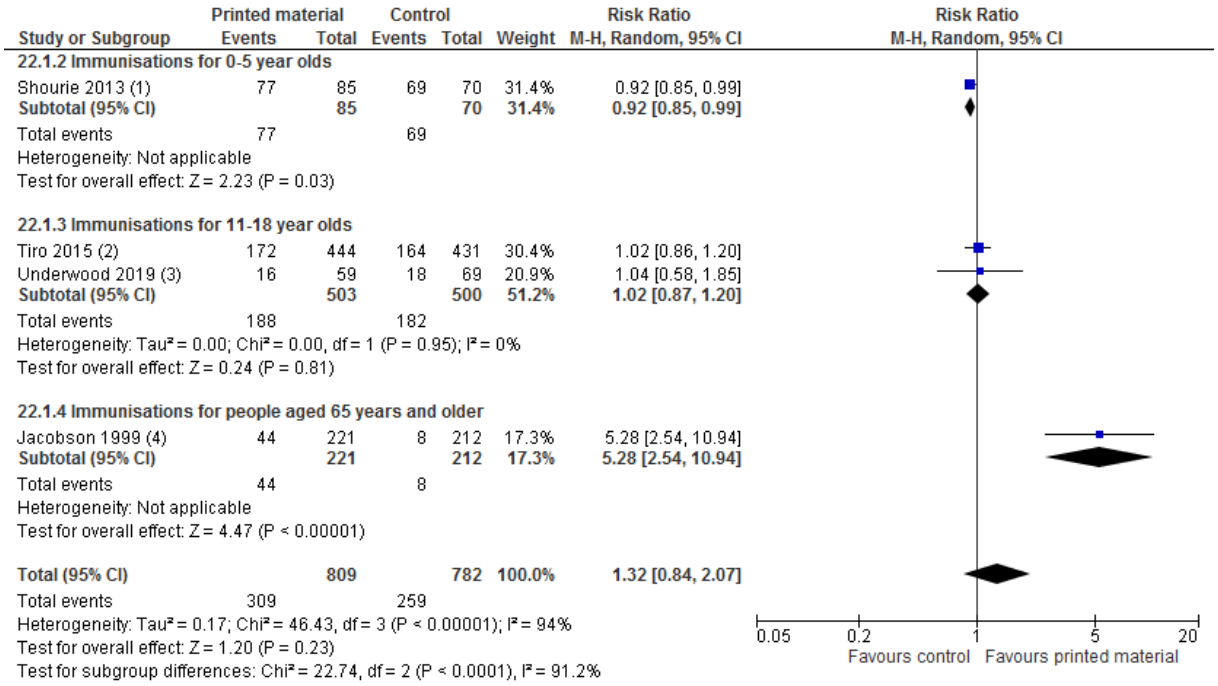
Educational telephone call versus control



Footnotes

(1) Telephone call by nurse with advice

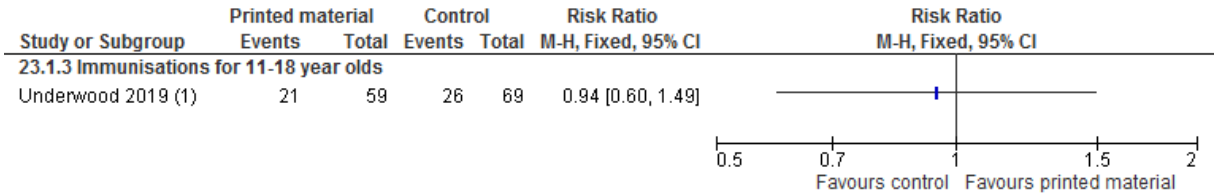
Printed educational material versus control



Footnotes

1) cRCT data has been adjusted for clustering. The printed educational material was a leaflet.
2) HPV dose 1: Brochure aimed at parents.
3) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. The MenACWY data is shown in the meta-analysis below.
4) Easy to read leaflet on vaccines versus easy-to-read leaflet on nutrition.

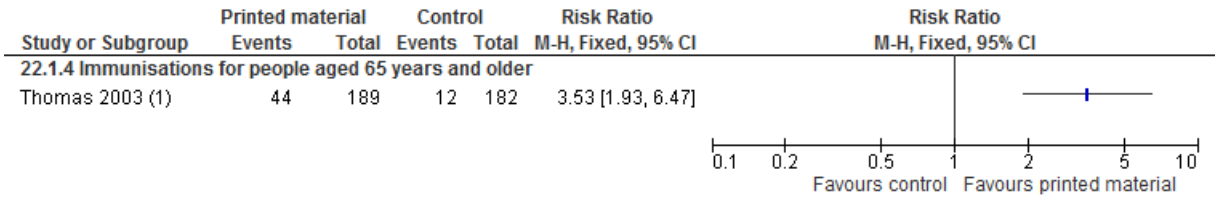
Printed educational material versus control (MenACWY data)



Footnotes

1) cRCT data adjusted for clustering. MenACWY uptake. Printed information for parents. Data for HPV 1 dose or more is shown in other meta-analyses.

Printed educational material and video education versus control

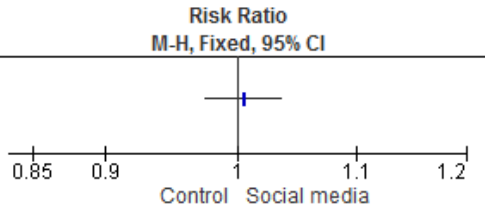


Footnotes

(1) The printed educational material was a brochure

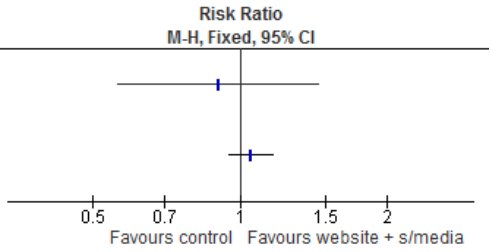
Social media versus control

Study or Subgroup	Social media Events	Total	Control Events	Total	Risk Ratio M-H, Fixed, 95% CI
25.1.3 Immunisations for 11-18 year olds					
Chodick 2021 (1)	9551	17271	2377	4321	1.01 [0.98, 1.04]



Website and social media versus control

Study or Subgroup	Website and social media Events	Total	Control Events	Total	Risk Ratio M-H, Fixed, 95% CI
22.1.1 Immunisations for pregnant women					
O'Leary 2019 (1)	57	542	21	180	0.90 [0.56, 1.44]
22.1.2 Immunisations for 0-5 year olds					
Glanz 2017	408	542	129	180	1.05 [0.95, 1.17]

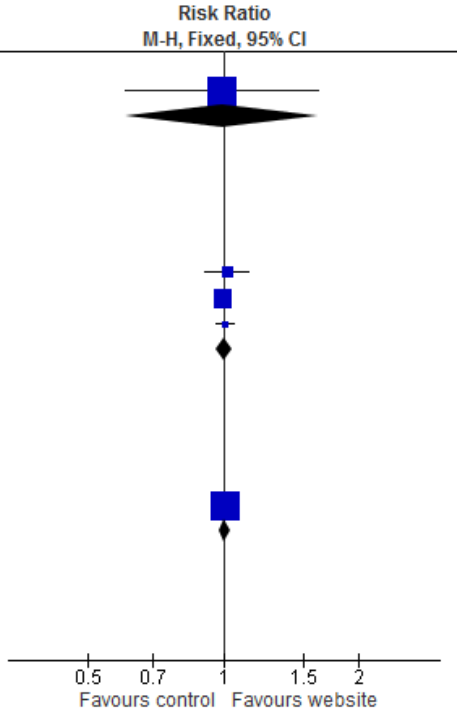


Footnotes

1) This is a substudy of Glanz 2017. The same women who were pregnant made the decision as to whether their infant should be vaccinated after birth. Therefore, there is no total to avoid double counting.

Website versus control (subtotals only due to Glanz and O'Leary studies sharing participants)

Study or Subgroup	Website Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
27.1.1 Immunisations for pregnant women						
O'Leary 2019 (1)	43	371	21	180	100.0%	0.99 [0.61, 1.62]
Subtotal (95% CI)		**371**		**180**	**100.0%**	**0.99 [0.61, 1.62]**
Total events	43		21			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.03 (P = 0.98)						
27.1.2 Immunisations for 0-5 year olds						
Glanz 2017 (2)	271	371	129	180	30.6%	1.02 [0.91, 1.14]
Glanz 2020 (3)	507	550	253	274	59.4%	1.00 [0.96, 1.04]
Shourie 2013 (4)	48	48	69	70	10.0%	1.01 [0.97, 1.06]
Subtotal (95% CI)		**969**		**524**	**100.0%**	**1.01 [0.96, 1.05]**
Total events	826		451			
Heterogeneity: Chi² = 0.23, df = 2 (P = 0.89); I² = 0%						
Test for overall effect: Z = 0.28 (P = 0.78)						
27.1.3 Immunisations for 11-18 year olds						
Pot 2017 (5)	2929	3995	2961	4067	100.0%	1.01 [0.98, 1.03]
Subtotal (95% CI)		**3995**		**4067**	**100.0%**	**1.01 [0.98, 1.03]**
Total events	2929		2961			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.52 (P = 0.60)						

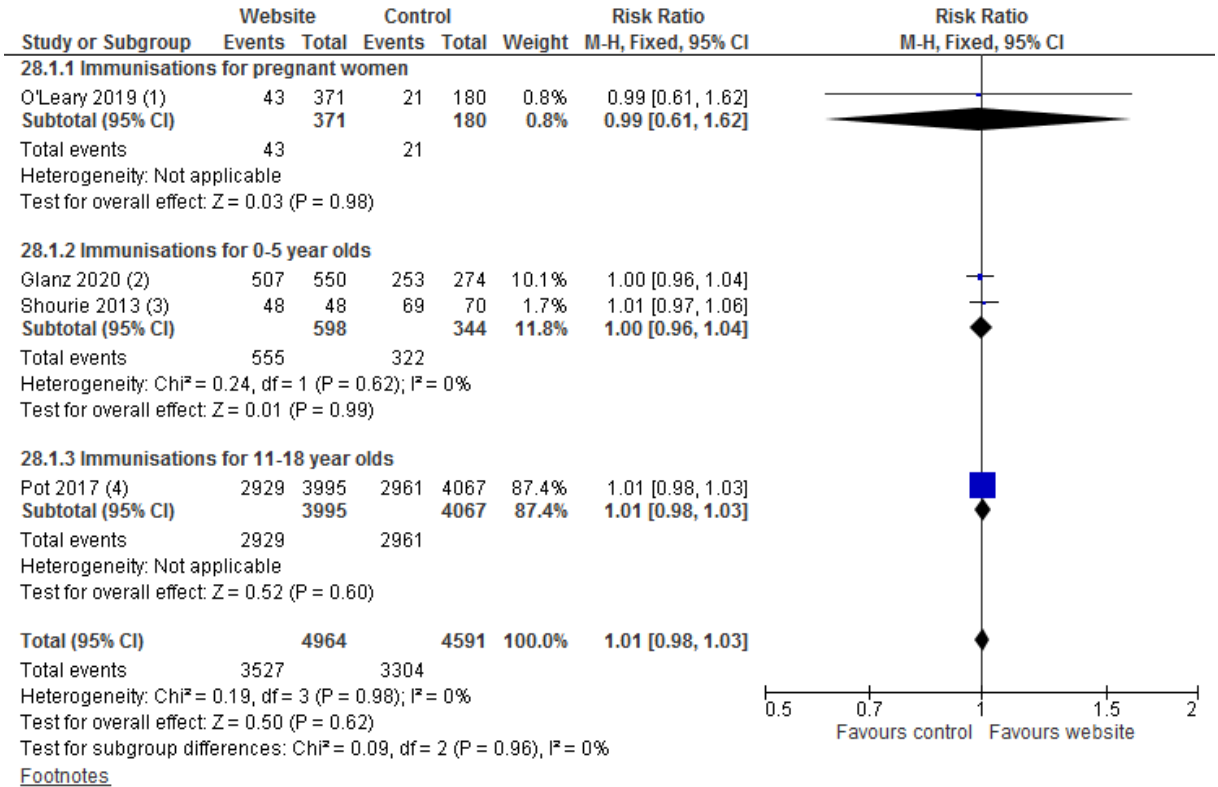


Test for subgroup differences: Chi² = 0.00, df = 2 (P = 1.00), I² = 0%

Footnotes

(1) This is a substudy of Glanz 2017 and has the same pregnant women/mothers
(2) Glanz 2017 and O'Leary involved the same pregnant women
(3) 2 arms combined for intervention: website with tailored information plus website with untailored information
(4) cRCT data has been adjusted for clustering. Website decision aid
(5) Website was for mothers of teenage girls

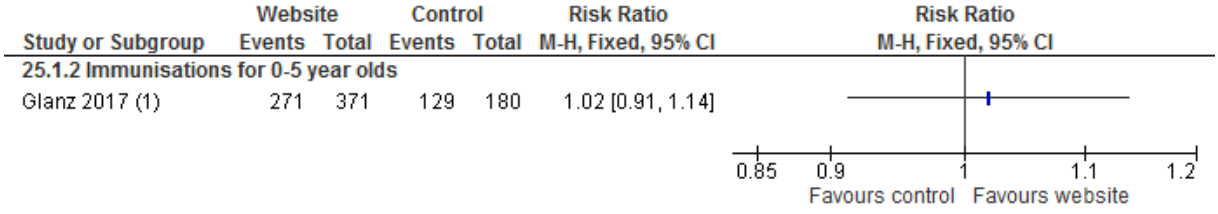
Website versus control (total but no Glanz 2017 data)



Footnotes

(1) This is a substudy of Glanz 2017 and has the same pregnant women/mothers
(2) 2 arms combined for intervention: website with tailored information plus website with untailored information
(3) cRCT data has been adjusted for clustering. Website decision aid
(4) Website was for mothers of teenage girls

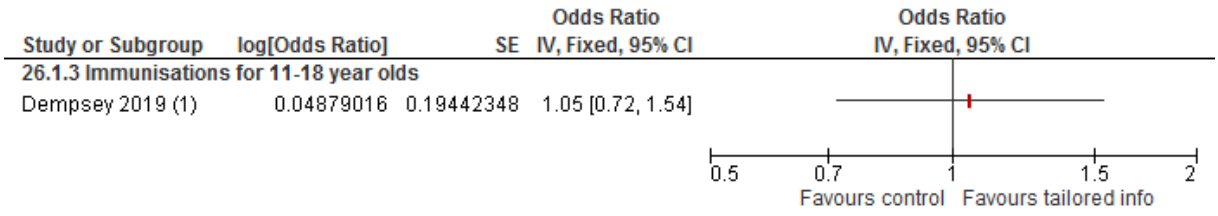
Website versus control (Glanz 2017 separately)



Footnotes

(1) This study involves the same pregnant women as O'Leary 2019

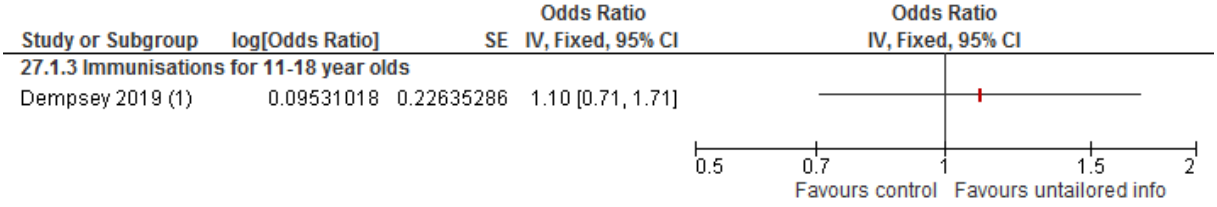
Tailored iPad information versus control



Footnotes

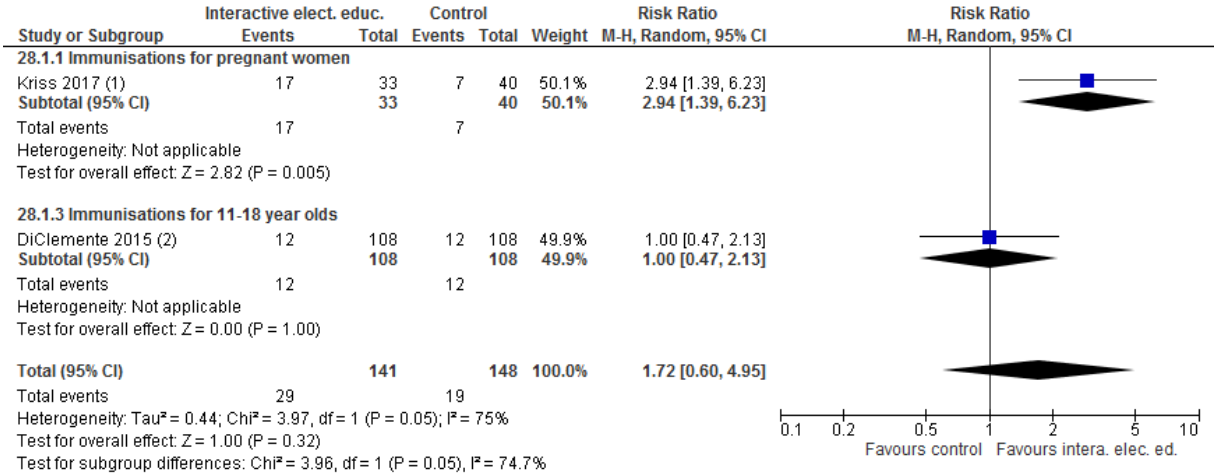
(1) The intervention was aimed at adolescents

Untailored iPad information versus control



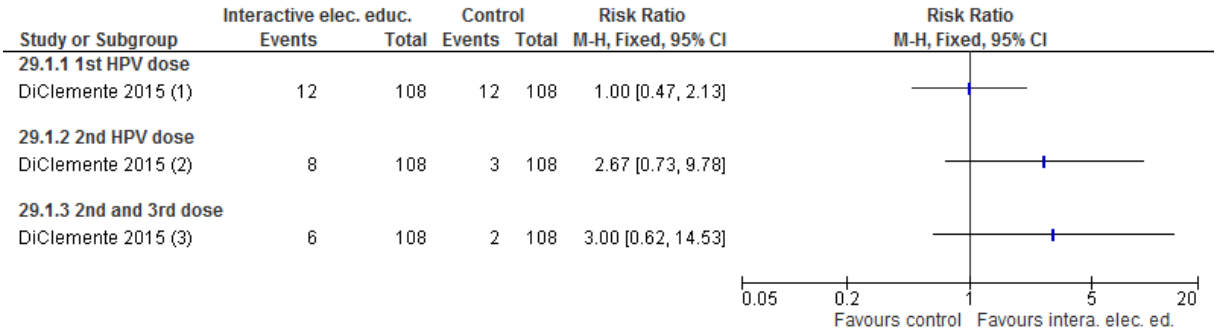
Footnotes
(1) The intervention was aimed at adolescents

Interactive app versus control



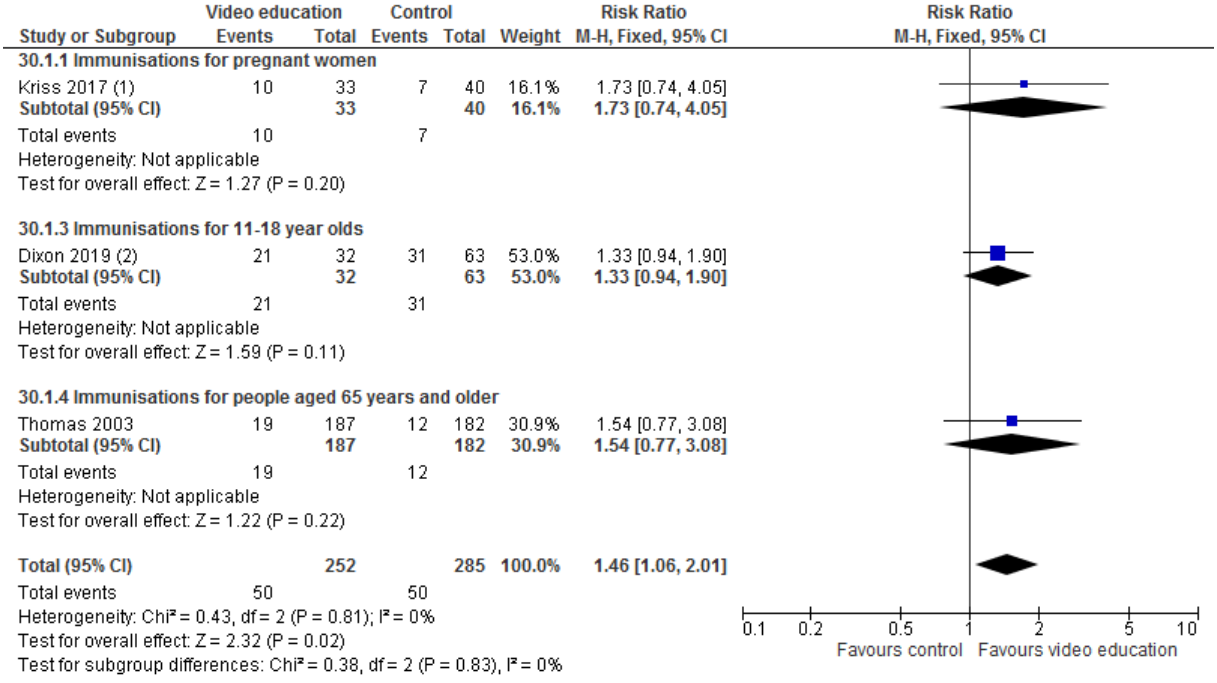
Footnotes
(1) Interactive electronic book
(2) 1st HPV dose. Computer app with interactive information and videos

Interactive app versus control (HPV doses)



Footnotes
(1) 1st HPV dose. Intervention was interactive computer delivered media presentation
(2) 2nd HPV dose. Intervention was interactive computer delivered media presentation
(3) 2nd and 3rd HPV doses. Intervention was interactive computer delivered media presentation

Video education versus control

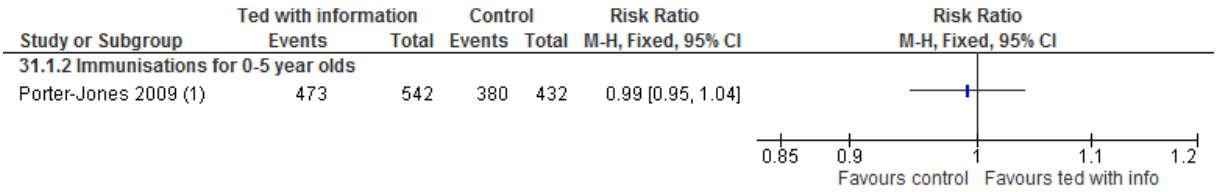


Footnotes

(1) Control was written advice from the CDC about vaccines in general (not specific to relevant vaccines)

(2) cRCT data adjusted for clustering. Video for parent(s) and the adolescent

Teddy bear wearing information versus control

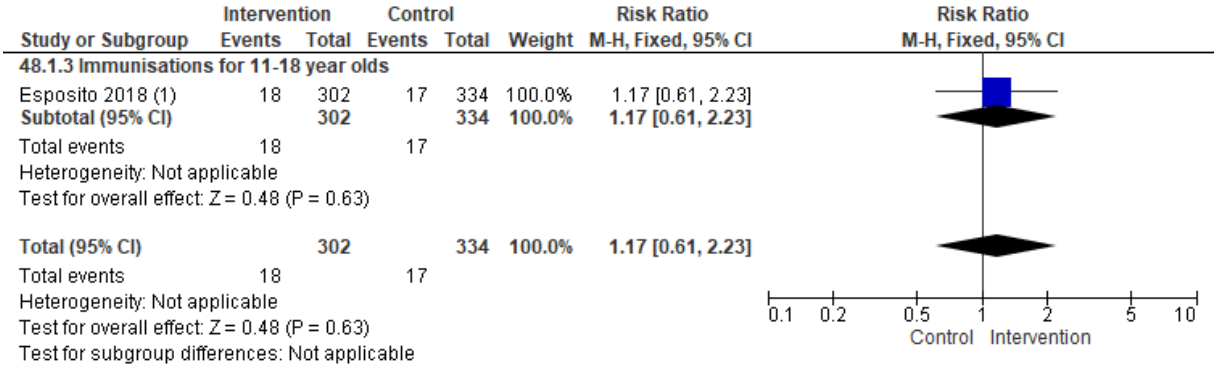


Footnotes

(1) The ted wore a website address that had information and a contact telephone number for the vaccination service

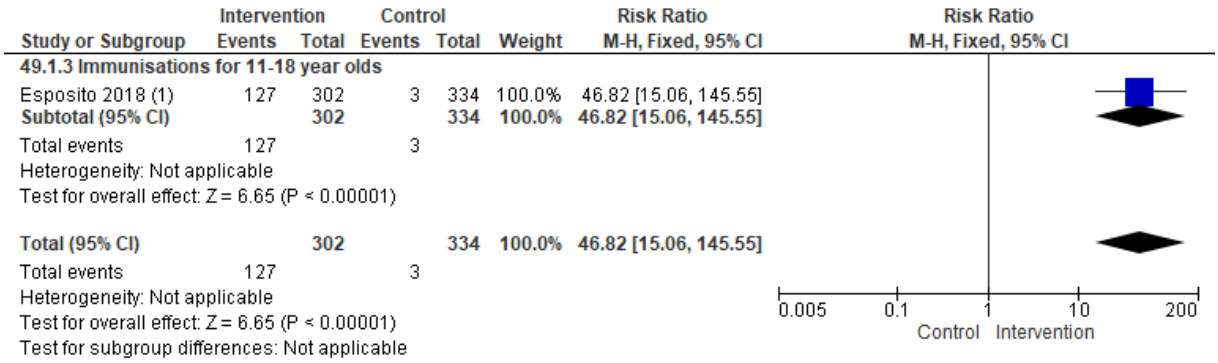
Website and lesson versus control (HPV)

Unadjusted cRCT



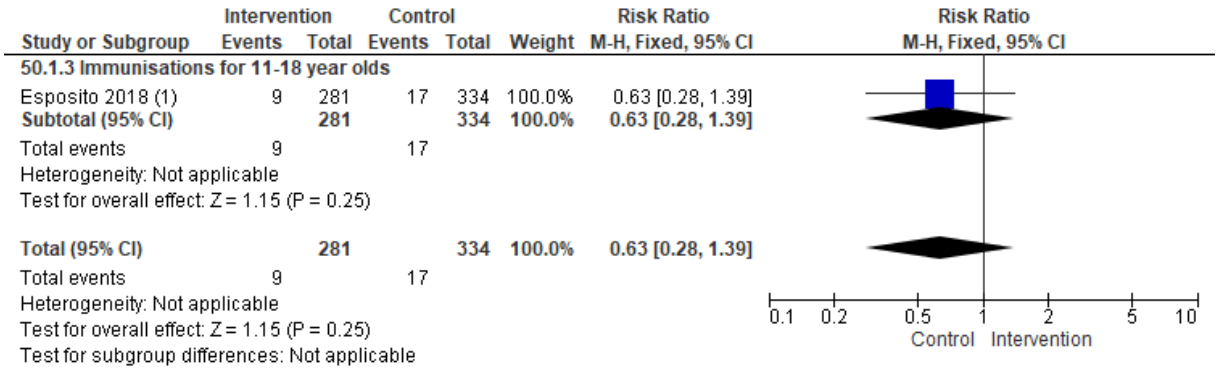
(1) The data could not be adjusted for clustering because there was no information provided in the study about the number of clusters. Website was in both arms. The lesson was aimed at adolescents.

Website and lesson versus control (MenACWY)
Unadjusted cRCT



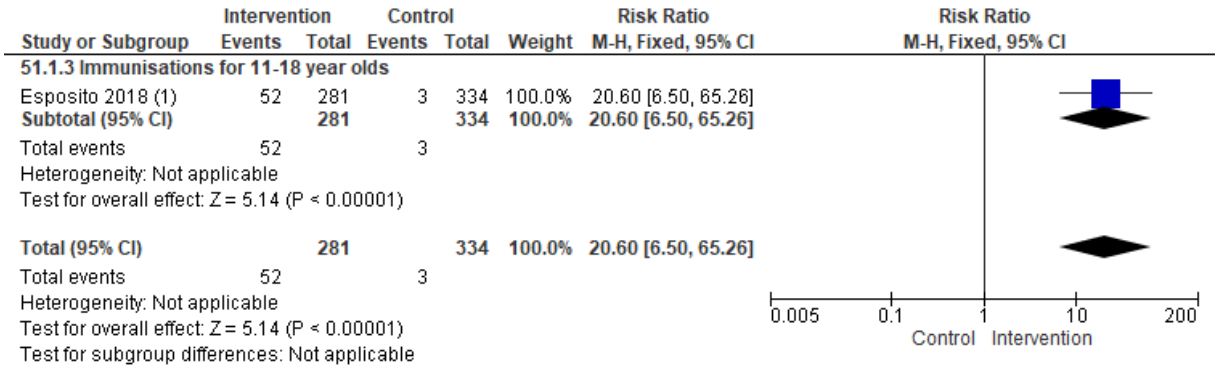
(1) The data could not be adjusted for clustering because there was no information provided in the study about the number of clusters. Website was in both arms. The lesson was aimed at adolescents.

Website versus control (HPV)
Unadjusted cRCT



(1) The data could not be adjusted for clustering because there was no information provided in the study about the number of clusters. Website was in both arms. The lesson was aimed at adolescents.

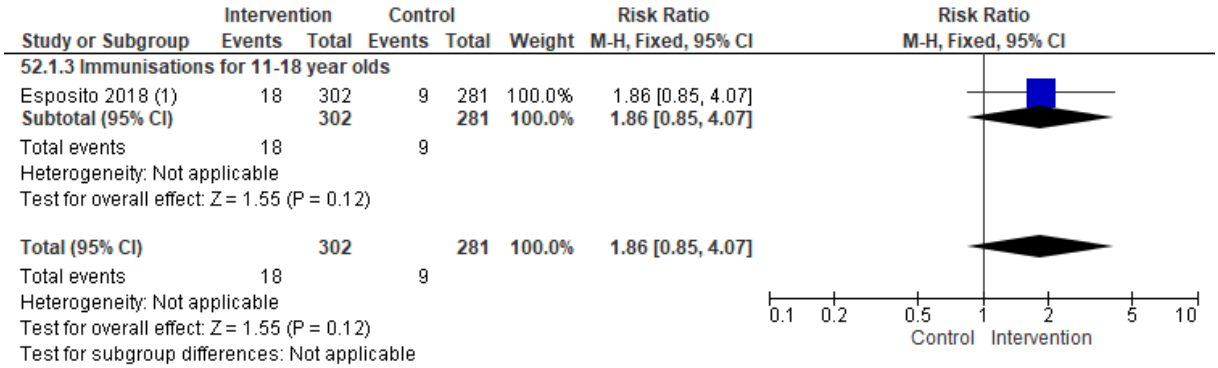
Website versus control (MenACWY)
Unadjusted cRCT



(1) The data could not be adjusted for clustering because there was no information provided in the study about the number of clusters. Website was in both arms. The lesson was aimed at adolescents.

Lesson versus control (HPV)

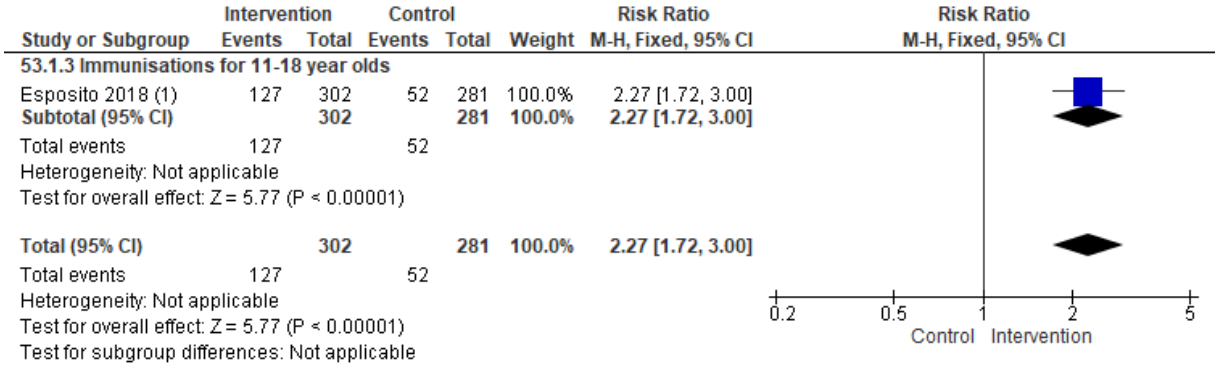
Unadjusted cRCT



(1) The data could not be adjusted for clustering because there was no information provided in the study about the number of clusters. Website was in both arms. The lesson was aimed at adolescents.

Lesson versus control (MenACWY)

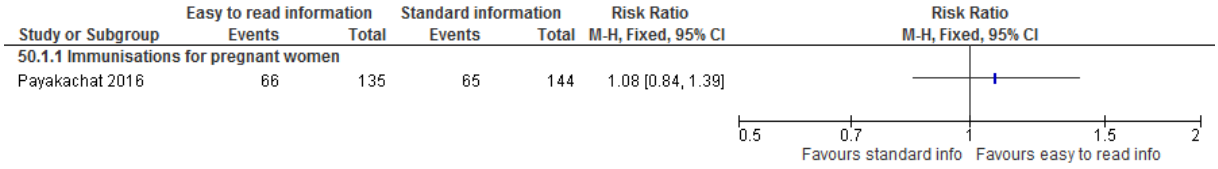
Unadjusted cRCT



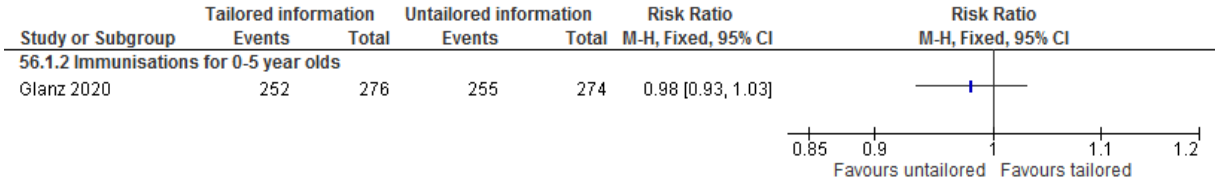
(1) The data could not be adjusted for clustering because there was no information provided in the study about the number of clusters. Website was in both arms. The lesson was aimed at adolescents.

Information/education interventions aimed at individuals, parents/carers compared to other information /information interventions

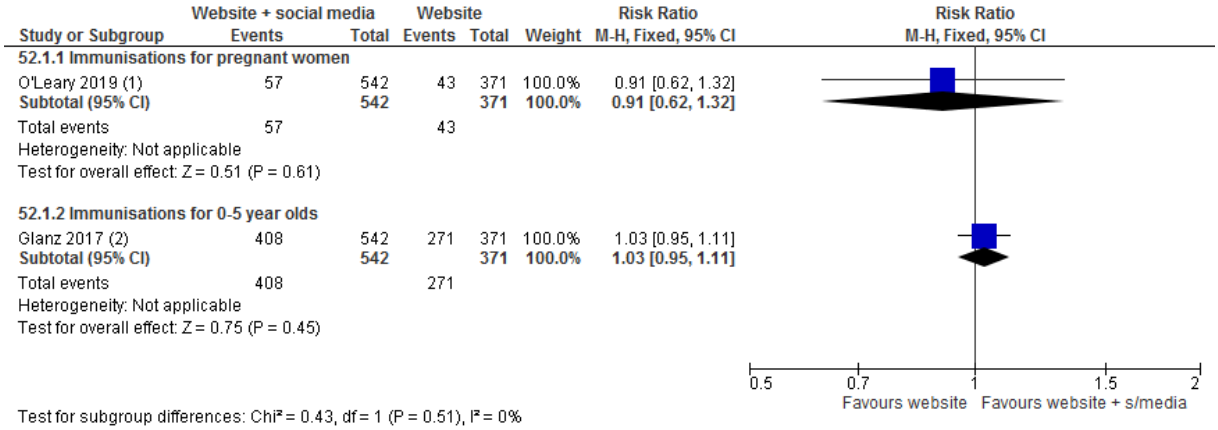
Easy to read printed information versus standard printed information



Website with tailored information versus website with untailored information



Website and social media versus website



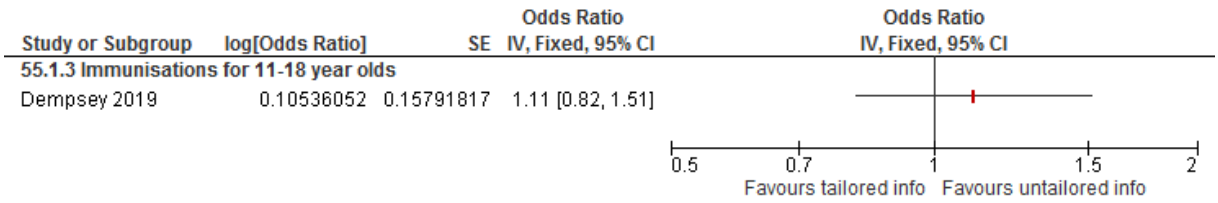
Test for subgroup differences: Chi² = 0.43, df = 1 (P = 0.51), I² = 0%

Footnotes

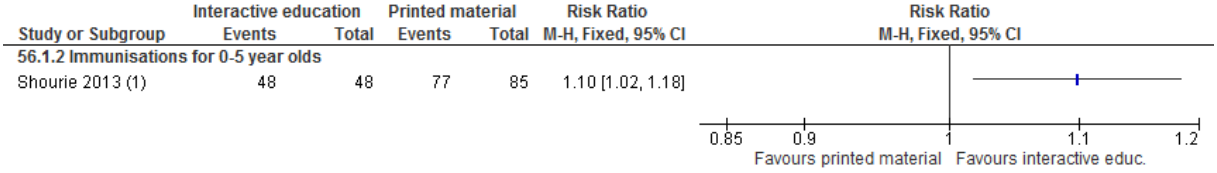
(1) This is a substudy of Glanz 2017.

(2) This study has the same participants as O'Leary: The same women made vaccination decisions at pregnancy and for infant vaccinations after birth

Tailored iPad information versus untailored iPad information

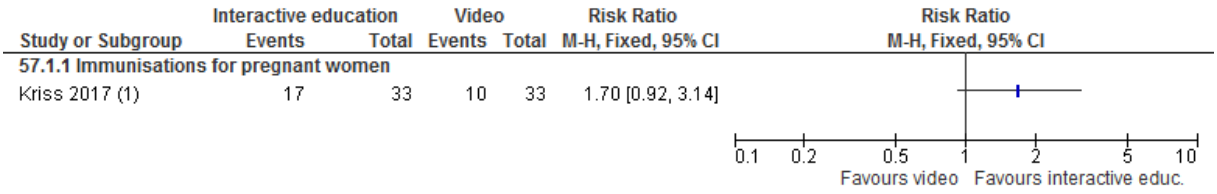


Interactive electronic education versus printed educational material



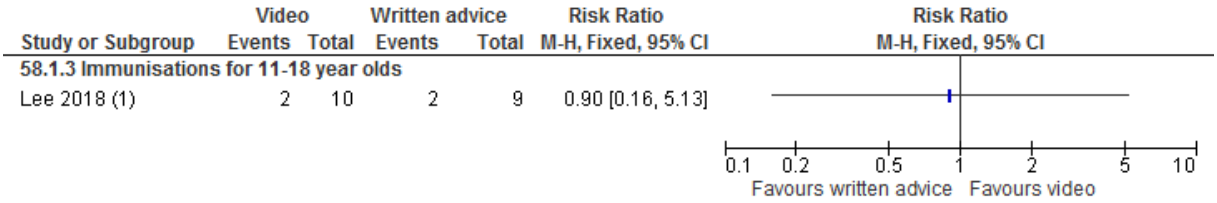
Footnotes
(1) cRCT data has been adjusted for clustering. Interactive online multi-media versus educational leaflet

Interactive electronic education versus video education



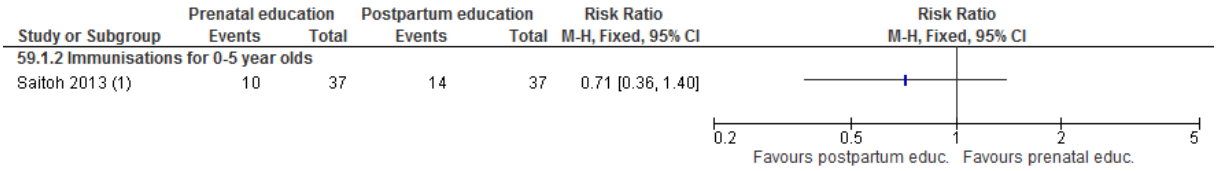
Footnotes
(1) Interactive electronic book

Video versus written advice



Footnotes
(1) The educational video and written advice were for both mothers and daughters

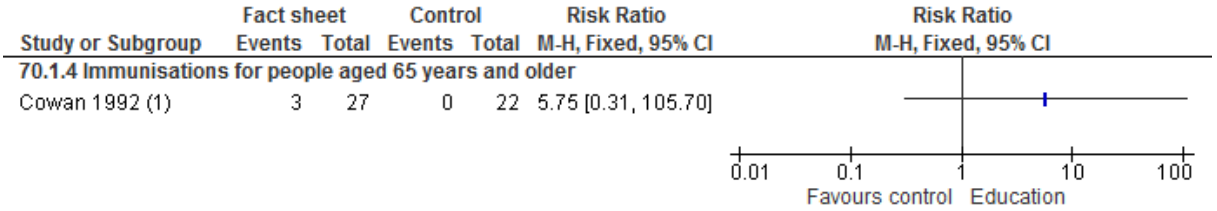
Prenatal face-to-face education versus postpartum education



Footnotes
(1) Face-to-face education

Information/education interventions aimed at providers compared to control

Fact sheet attached to all patient notes versus control

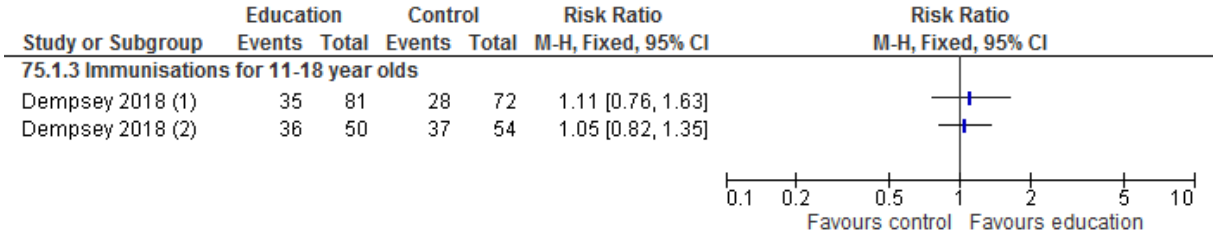


Footnote

1) cRCT data adjusted for clustering. Fact sheet attached to all patient notes in a clinic regardless of whether they should have the vaccine.

Education interventions aimed at providers and individuals and parents compared to control

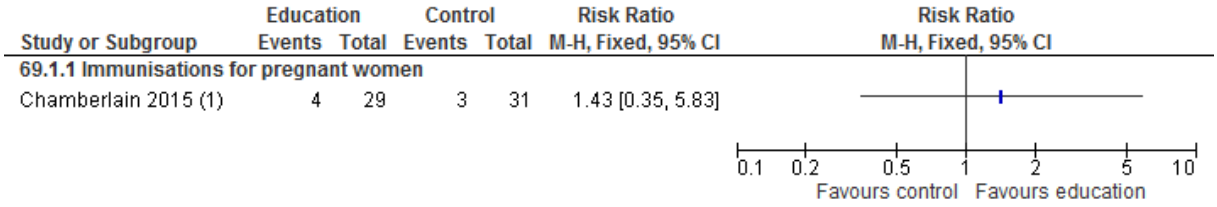
Face-to-face education with printed educational material for providers; and printed educational material, website, disease images for parents versus control



Footnotes

1) cRCT data adjusted for clustering. 3 or more HPV doses. Face-to-face education for providers was communication training, printed educational material for providers was a decision aid, printed educational material for parents was a fact sheet, the website and disease images were aimed at parents.
2) cRCT data adjusted for clustering. 1 or more HPV doses. Face-to-face education for providers was communication training, printed educational material for providers was a decision aid, printed educational material for parents was a fact sheet, the website and disease images were aimed at parents.

Face-to-face education, printed educational material and interactive multimedia to show parents versus control



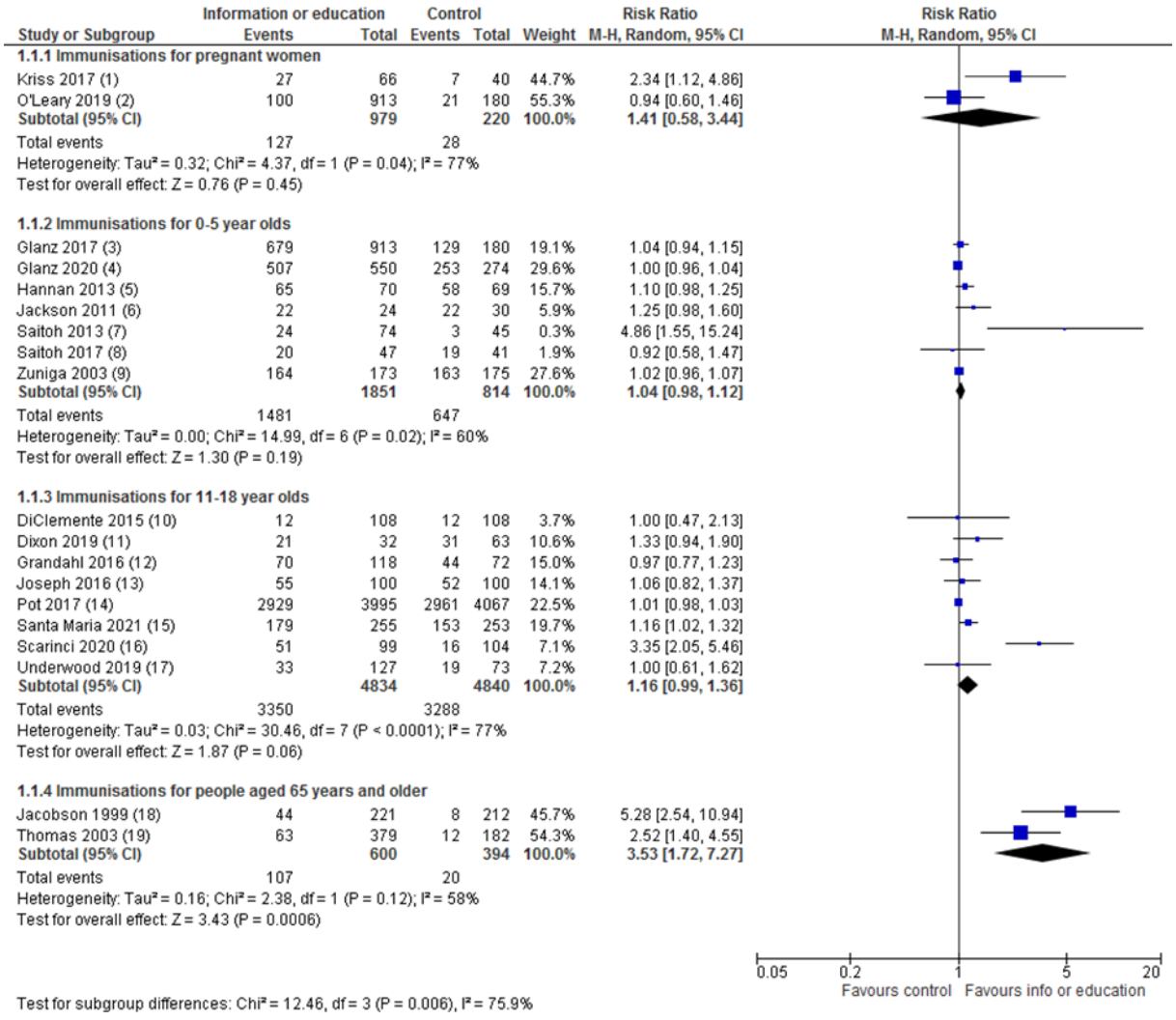
Footnotes

1) cRCT data adjusted for clustering. Face-to-face peer education was given by a physician. Brochures, posters and the iPad tutorial were aimed at parents.

Sensitivity analyses

Education interventions aimed at individuals, parents/carers compared to control

Information and/or education versus control (subtotals only) by age group/life stage



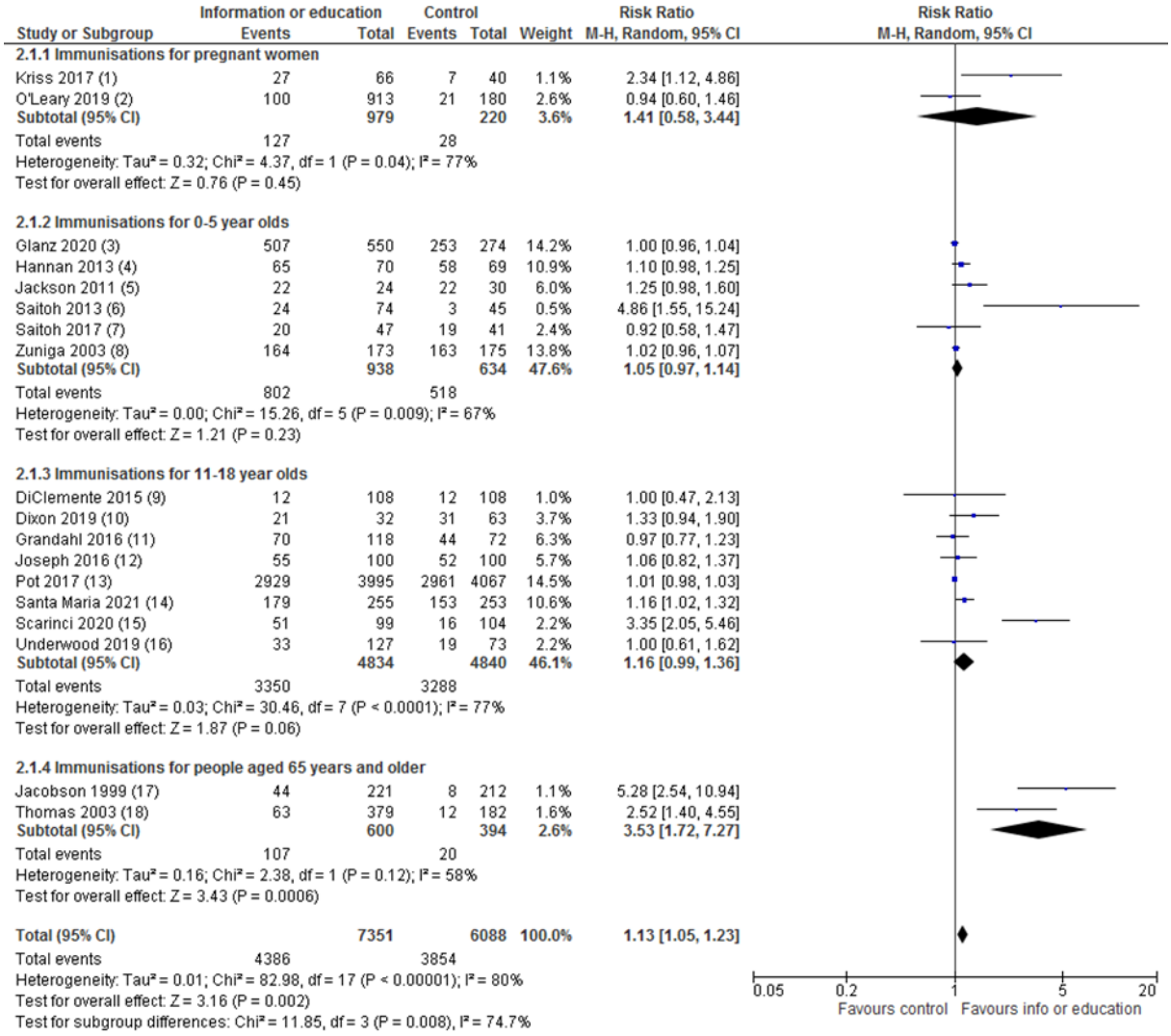
Footnotes

1) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines.
2) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same pregnant women/mothers.
3) 2 arms combined for intervention: website with social media plus arm with website alone. Glanz 2017 and O'Leary involved the same pregnant women.
4) 2 arms combined for intervention: website with tailored information plus website with untailored information.
5) Telephone call by nurse with advice.
6) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
7) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
8) cRCT data adjusted for clustering. Face-to-face education was by midwives.
9) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'.

10) 1st HPV dose. Intervention was interactive computer delivered media presentation.
11) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
12) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
13) 1st HPV dose. Face-to-face education by provider to mother versus control.
14) Website was for mothers of teenage girls.
15) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
16) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
17) cRCT data adjusted for clustering. HPV 1 dose or more. 2 intervention arms combined: Education of adolescents by teachers and information for parents plus information for parents. The MenACWY data was not included here to avoid double-counting of participants.
18) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition.
19) 2 arms combined for intervention: video and brochure, and video.

Information and/ or Education versus control (total but no Glanz 2017 data) (summary by age group)

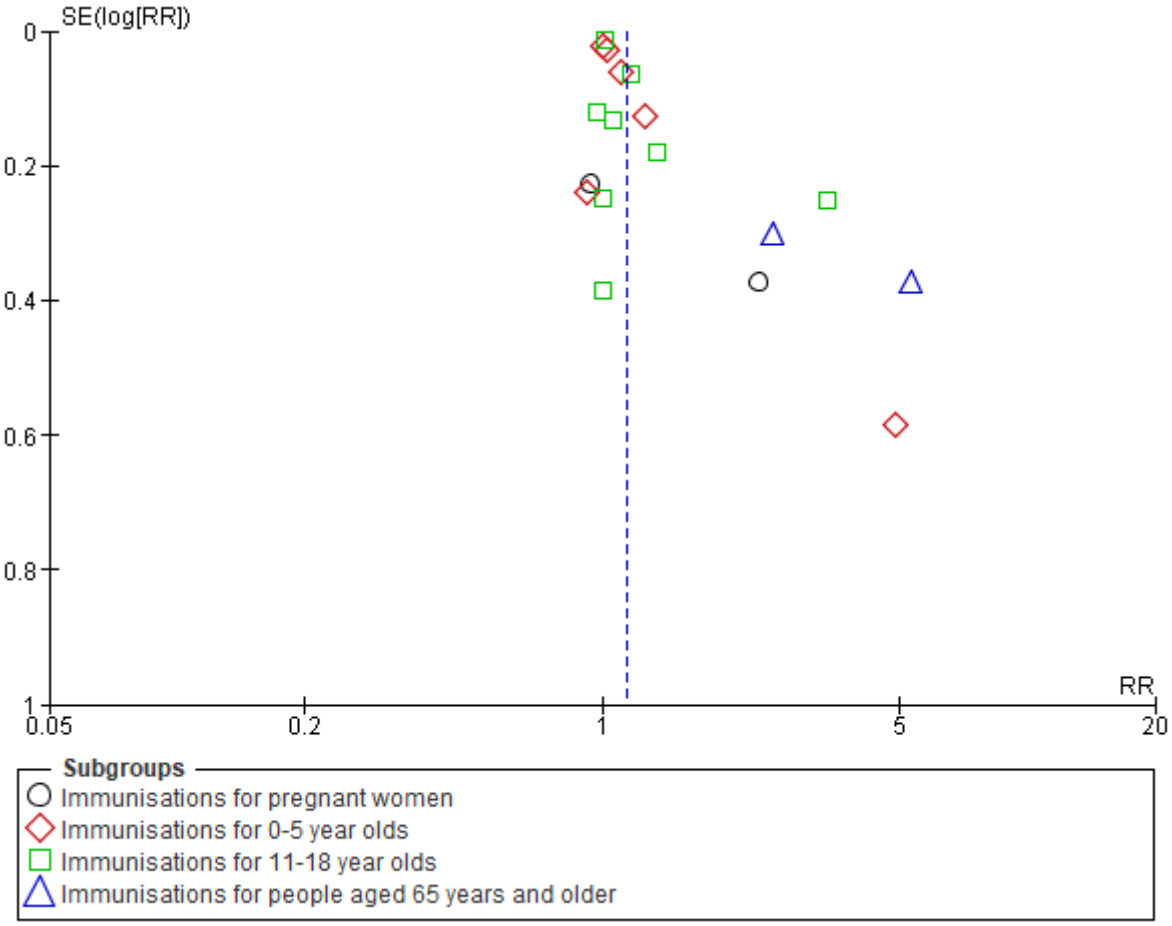
Glanz 2017 has been omitted to avoid double-counting for the analysis of the total. This is because the same participants were involved as for O'Leary 2019.



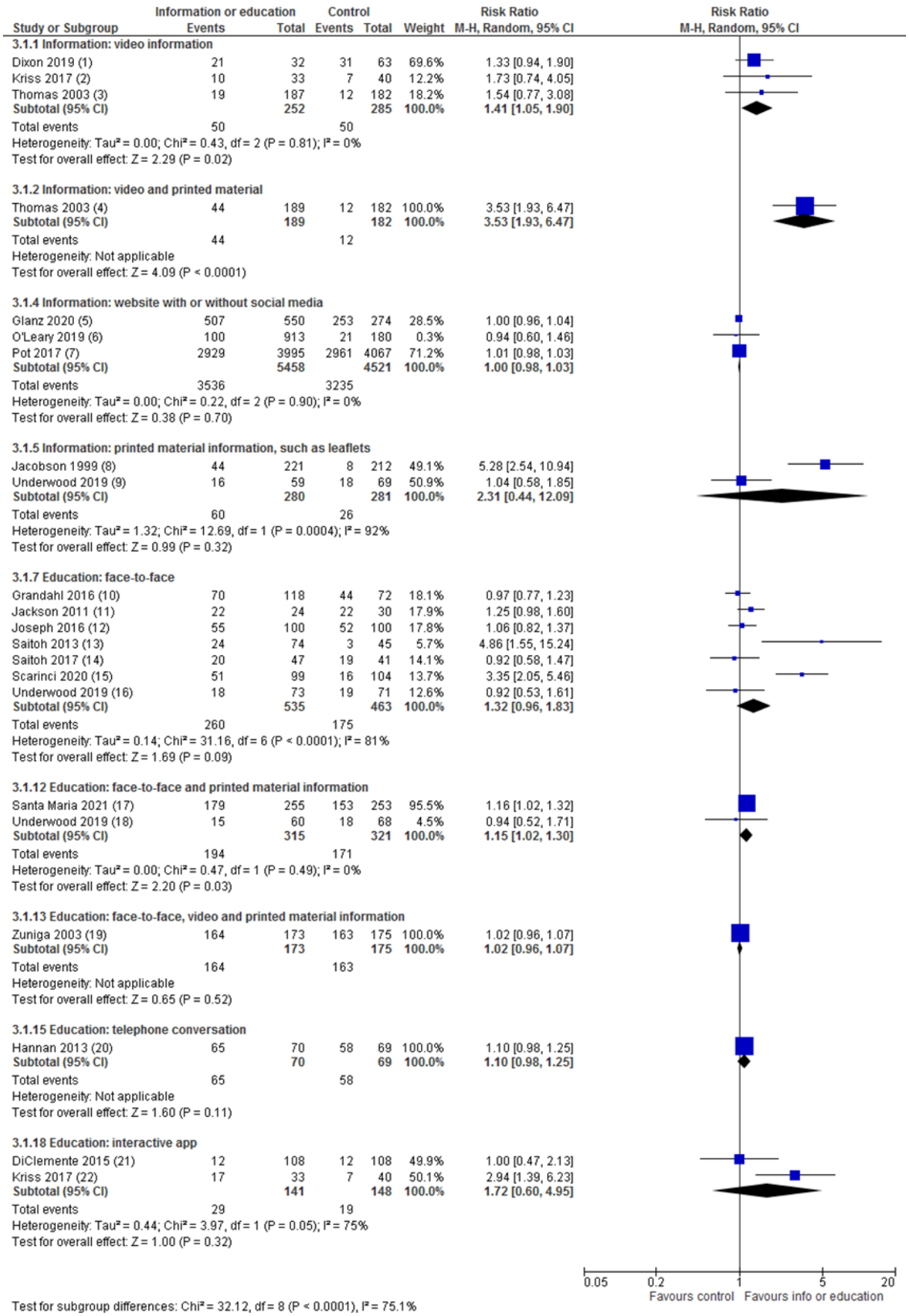
Footnotes

1) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines.
2) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same pregnant women/mothers.
3) 2 arms combined for intervention: website with tailored information plus website with untailored information.
4) Telephone call by nurse with advice.
5) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
6) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
7) cRCT data adjusted for clustering. Face-to-face education was by midwives.
8) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'.
9) 1st HPV dose. Intervention was interactive computer delivered media presentation.
10) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
11) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
12) 1st HPV dose. Face-to-face education by provider to mother versus control.
13) Website was for mothers of teenage girls.
14) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
15) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
16) cRCT data adjusted for clustering. HPV 1 dose or more. 2 intervention arms combined: Education of adolescents by teachers and information for parents plus information for parents. The MenACWY data was not included here to avoid double-counting of participants.
17) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition.
18) 2 arms combined for intervention: video and brochure, and video.

Funnel plot for information and/ or Education versus control (total but no Glanz 2017 data) (summary by age group)



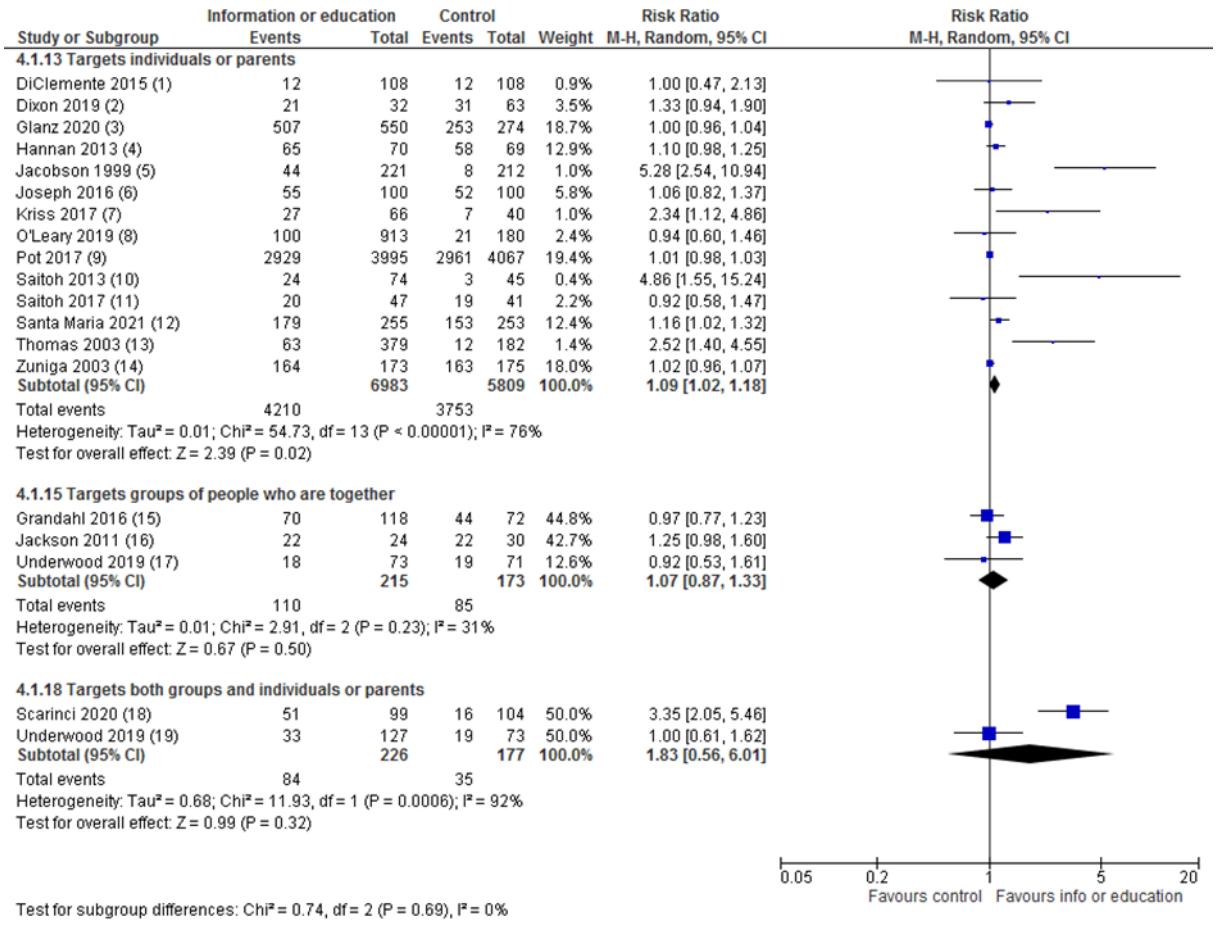
Information and/or education versus control (subtotal only by delivery method)



Footnotes

1) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
2) Control was written advice from the CDC about vaccines in general (not specific to relevant vaccines).
3) Video
4) Video and printed material. The printed educational material was a brochure.
5) 2 arms combined for intervention: website with tailored information plus website with untailored information.
6) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same pregnant women/mothers.
7) Website was for mothers of teenage girls.
8) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition.
9) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
10) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
11) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
12) 1st HPV dose. Face-to-face education by provider to mother versus control.
13) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
14) cRCT data adjusted for clustering. Face-to-face education was by midwives.
15) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
16) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
17) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
18) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers and information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
19) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'.
20) Telephone call by nurse with advice.
21) 1st HPV dose. Intervention was interactive computer delivered media presentation.
22) Interactive electronic book.

Information and/or education versus control (subtotals only) by whether intervention targets an individual/parent or a group

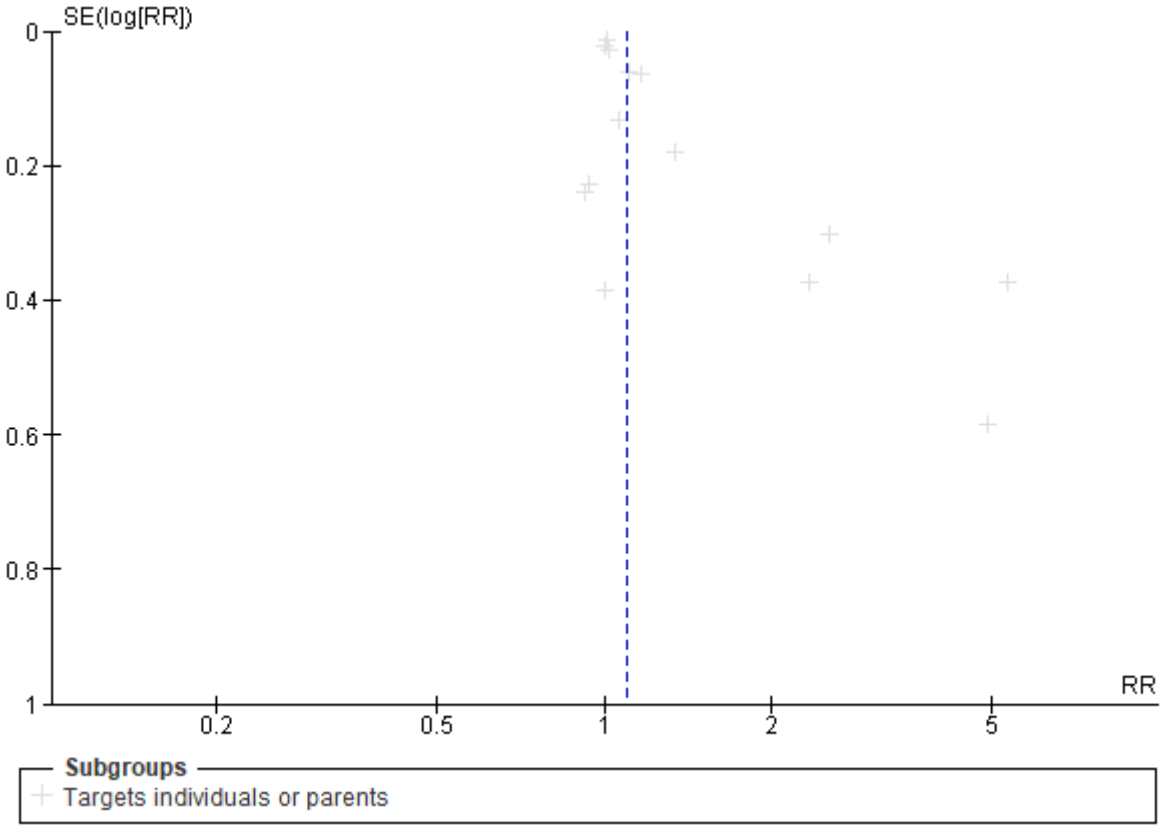


Footnotes

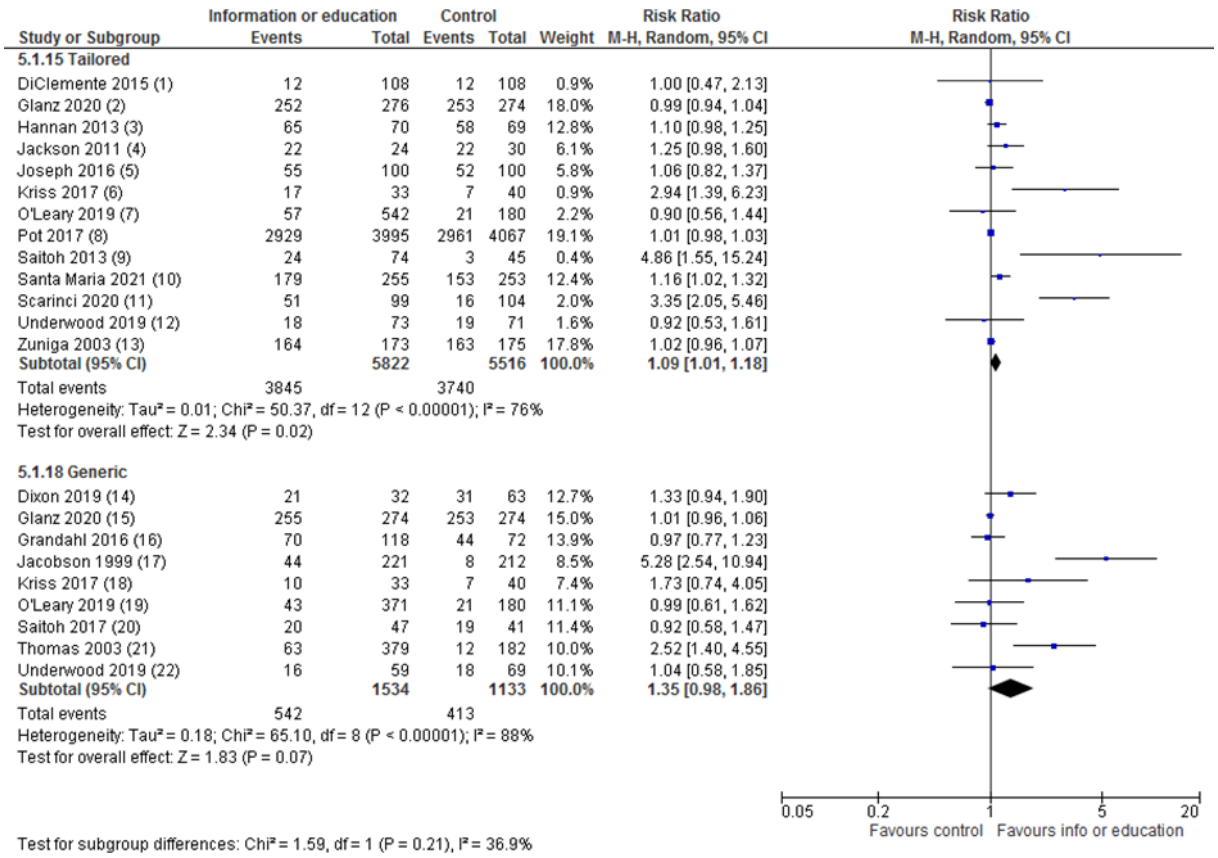
1) 1st HPV dose. Intervention was interactive computer delivered media presentation.
2) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
3) 2 arms combined for intervention: website with tailored information plus website with untailored information.
4) Telephone call by nurse with advice.
5) Easy to read leaflet on vaccines versus easy-to-read leaflet on nutrition.
6) 1st HPV dose. Face-to-face education by provider to mother versus control.
7) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines.
8) 2 arms combined for intervention: website with social media plus arm with website alone. This is a substudy of Glanz 2017 and has the same pregnant women/mothers.
9) Website was for mothers of teenage girls.
10) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
11) cRCT data adjusted for clustering. Face-to-face education was by midwives.
12) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
13) 2 arms combined for intervention: video and brochure, and video.
14) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'.
15) cRCT data adjusted for clustering. Face-to-face group lesson for adolescents by school nurses.
16) cRCT data adjusted for clustering. Face-to-face education with a nurse and investigators who were healthcare practitioners. Leaflet was in both arms.

17) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
18) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
19) cRCT data adjusted for clustering. HPV 1 dose or more. 2 intervention arms combined: Education of groups of adolescents by teachers and information for parents plus individual written information for parents. The MenACWY data was not included here to avoid double-counting of participants.

Funnel plot for information and/or education versus control (subtotals only) by whether intervention targets an individual/parent or a group



Information and/or education versus control (subtotals only) by whether the intervention is tailored or generic education



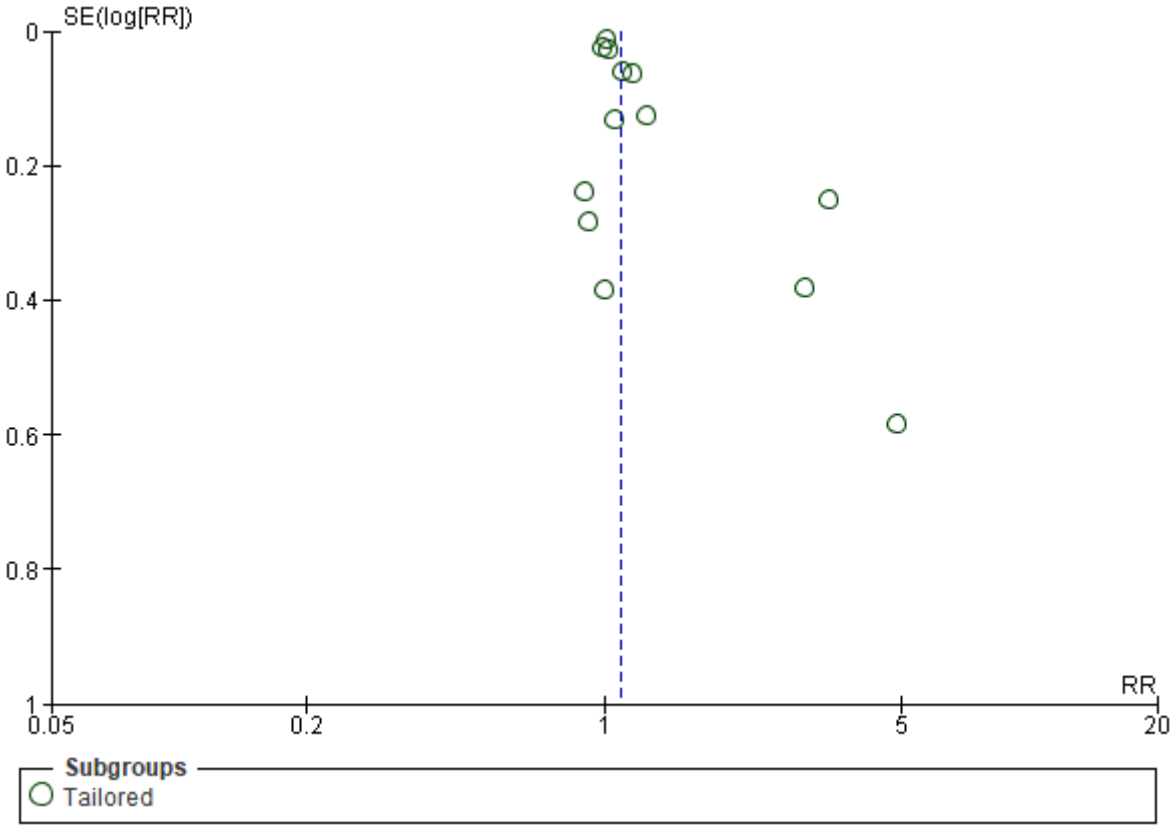
Footnotes

1) 1st HPV dose. Intervention was interactive computer delivered media presentation.
2) Website with tailored information. This meta-analysis has no total to avoid double-counting the control arm in Glanz 2020.
3) Telephone call by nurse with advice. The nurse asked about any concerns.
4) cRCT data adjusted for clustering. Face-to-face education with nurse and investigators who were healthcare practitioners. There was a question and answer session. Leaflet was in both arms.
5) 1st HPV dose. Face-to-face education by provider to mother versus control.
6) Interactive electronic book.
7) Website and social media. The social media had a tailored component because participants could ask questions from a paediatrician, vaccine safety researcher or risk communication specialist. This is a substudy of Glanz 2017. The same women who were pregnant made the decision as to whether their infant should be vaccinated after birth.
8) Website was for mothers of teenage girls. Tailored information.
9) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
10) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
11) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language. Information and/or education versus control (subtotals only) by who provided the information or education.
12) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was

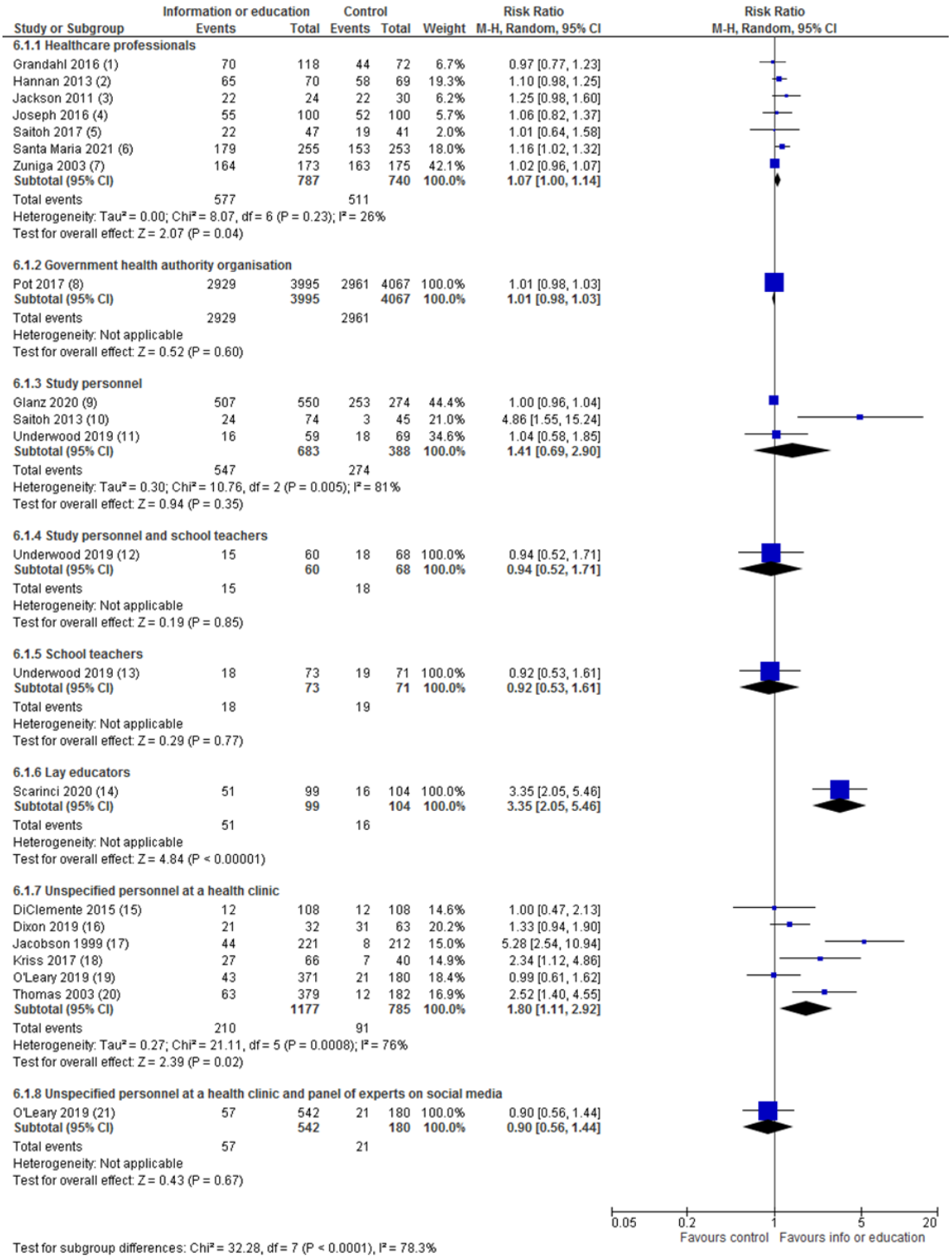
not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.

13) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator' and they answered questions.
14) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
15) Website with untailored information. This meta-analysis has no total to avoid double-counting the control arm in Glanz 2020.
16) cRCT data adjusted for clustering. Face-to-face class lesson of adolescents by school nurses. It was generic because the of the lesson highly structured and there was no mention of questions and answers.
17) Easy to read leaflet on vaccines versus easy-to-read leaflet on nutrition.
18) Control was written advice from the CDC about vaccines in general (not specific to relevant vaccines).
19) This is a substudy of Glanz 2017 and has the same pregnant women/mothers.
20) cRCT data adjusted for clustering. Face-to-face education was by midwives. Although this was one-to-one education, the content was very prescriptive and there was no mention of question and answers.
21) 2 arms combined for intervention: video and brochure, and video.
22) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.

Funnel plot for information and/or education versus control (subtotals only) by whether the intervention is tailored or generic education



Information and/or education versus control by who provided the information or education

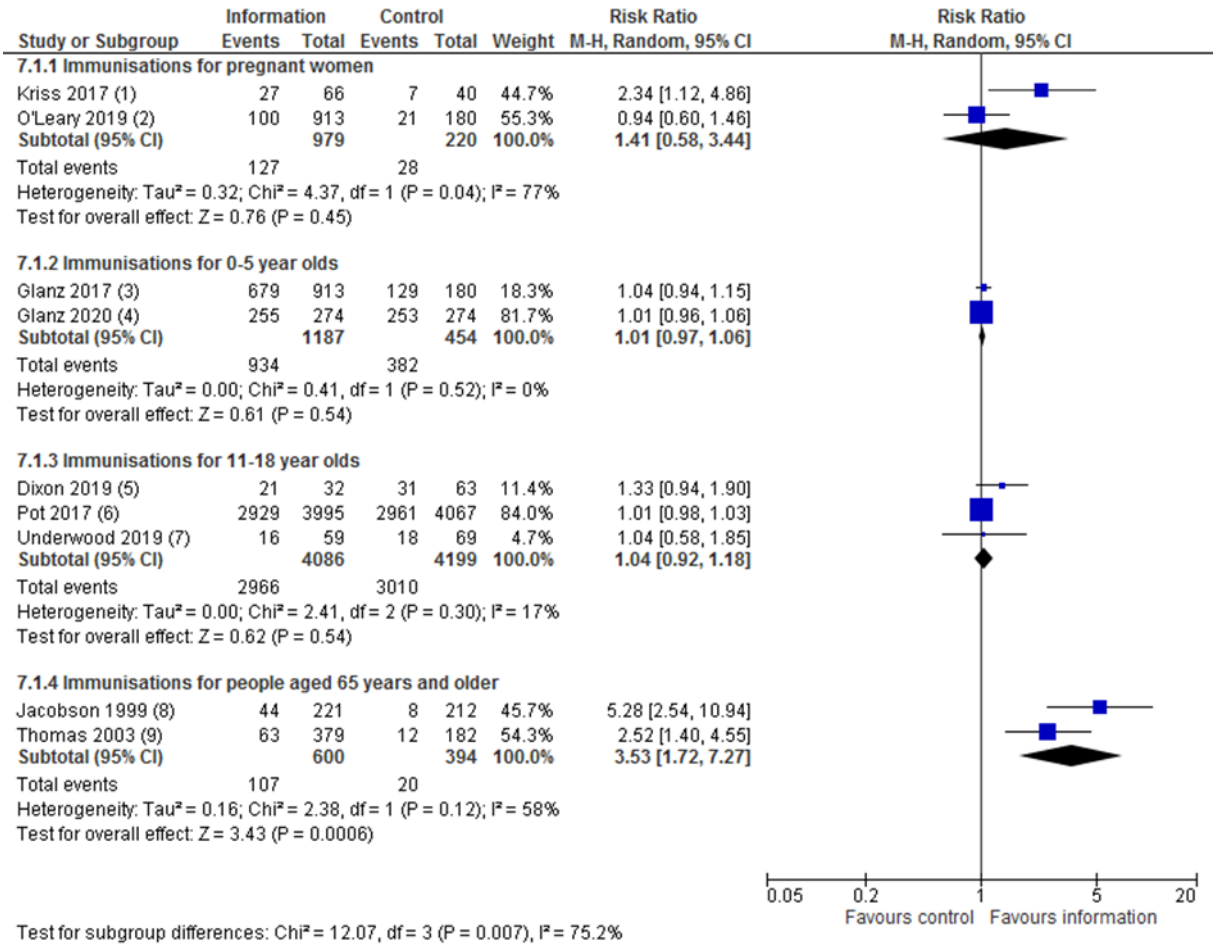


Footnotes

1) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
2) Telephone call by nurse with advice.
3) cRCT data adjusted for clustering. Face-to-face education with study personnel and a nurse. Leaflet was in both arms.
4) 1st HPV dose. Face-to-face education by a health educator to mother versus control.

5) cRCT data adjusted for clustering. Face-to-face education was by midwives.
6) cRCT data adjusted for clustering. Face-to-face education was by midwives.
7) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator' at a perinatal clinic.
8) Website was for mothers of teenage girls. Likely to be arranged by health authority because the Dutch National Immunisation Register was used.
9) 2 arms combined for intervention: website with tailored information plus website with untailored information.
10) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by study personnel in a health clinic.
11) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
12) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers and information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
13) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
14) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with trained lay health educators in groups and one-to-one in migrant's language. The education took place at unspecified locations.
15) 1st HPV dose. Intervention was interactive computer delivered media presentation. Delivered in a health clinic waiting room.
16) cRCT data adjusted for clustering. Video for parent(s) and the adolescent.
17) Easy to read leaflet on vaccines versus easy-to-read leaflet on nutrition.
18) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines.
19) Website. This is a substudy of Glanz 2017 and has the same pregnant women/mothers.
20) 2 arms combined for intervention: video and brochure, and video.

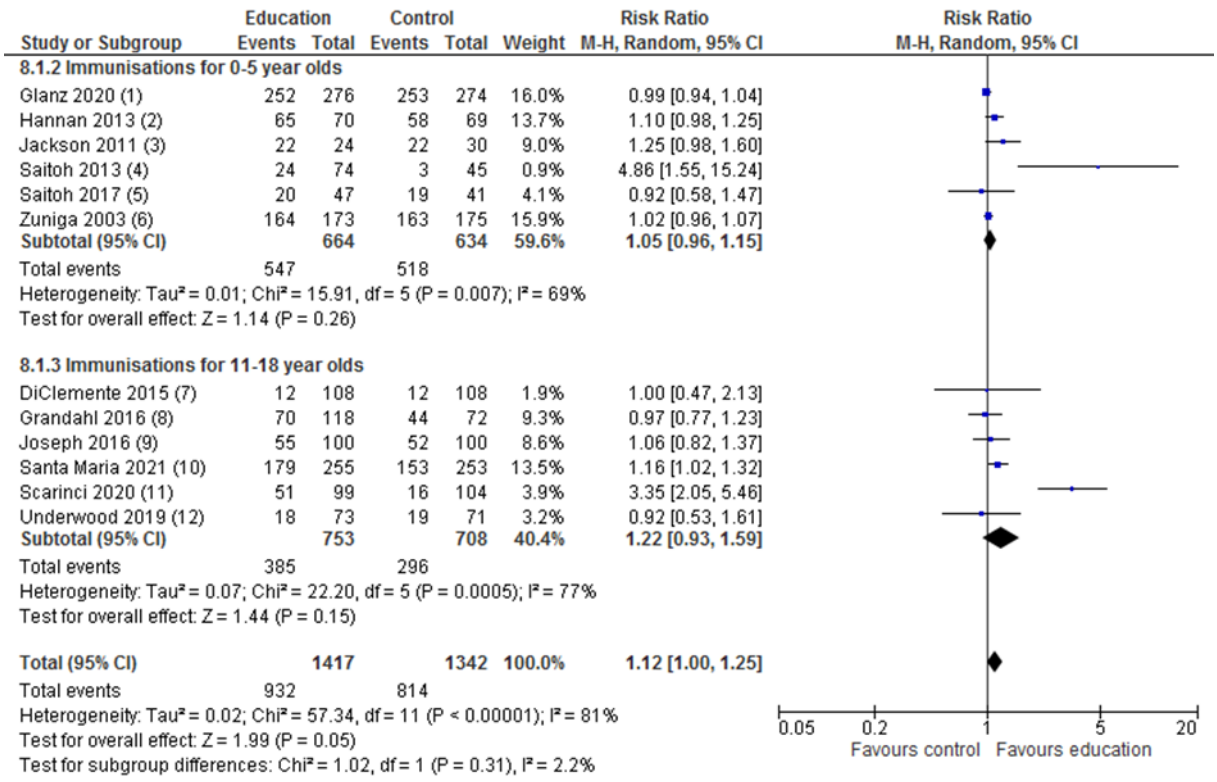
Information versus control (summary)



Footnotes

1) 2 arms combined for intervention: electronic book, and video education versus written CDC advice about vaccines in general but not specific to relevant vaccines.
2) 2 arms combined for intervention: website with social media plus arm with website alone. This is a sub-study of Glanz 2017 and has the same women.
3) 2 arms combined for intervention: website with social media plus arm with website alone. Glanz 2017 and O'Leary involved the same women.
4) Website with untailored information. This meta-analysis has no total to avoid double-counting the control arm in Glanz 2020.
5) cRCT data adjusted for clustering. Video for parents.
6) Website was for mothers of teenage girls.
7) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants.
8) Easy to read leaflet on vaccines versus easy-to-read leaflet on nutrition.
9) 2 arms combined for intervention: video and brochure, and video.

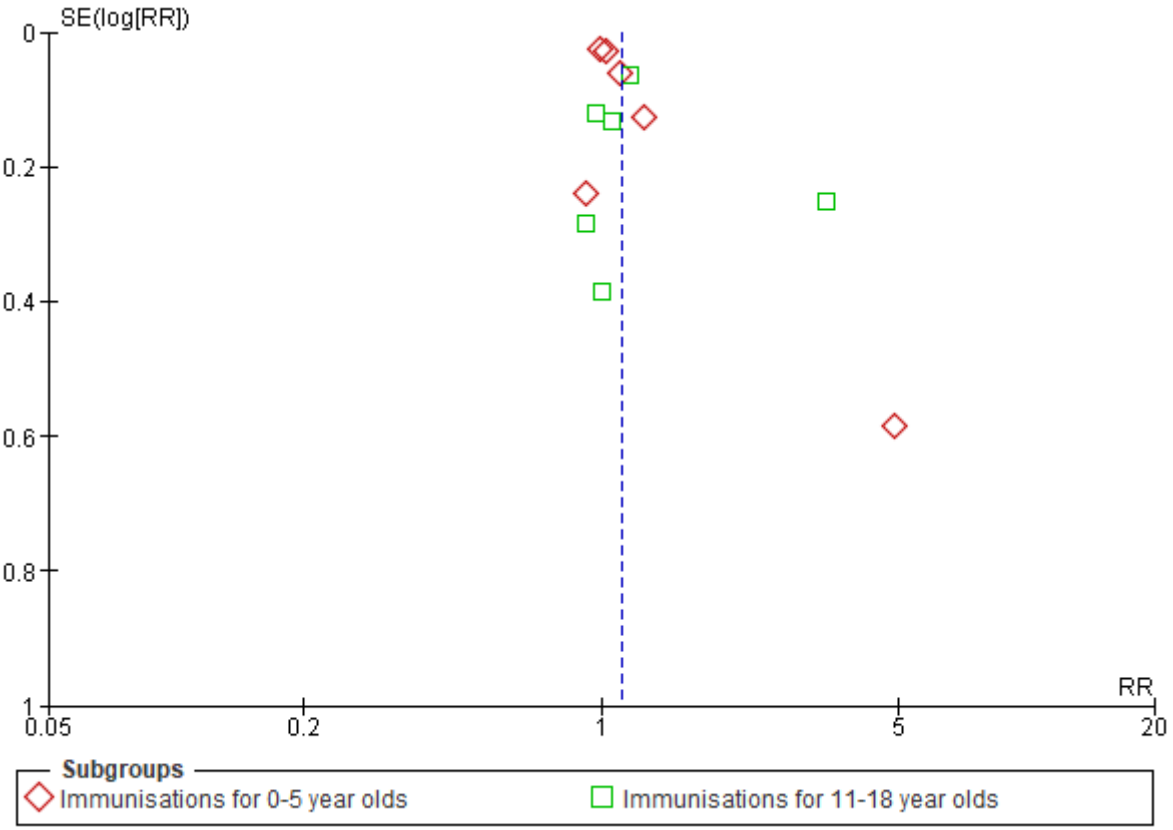
Education versus control (summary)



Footnotes

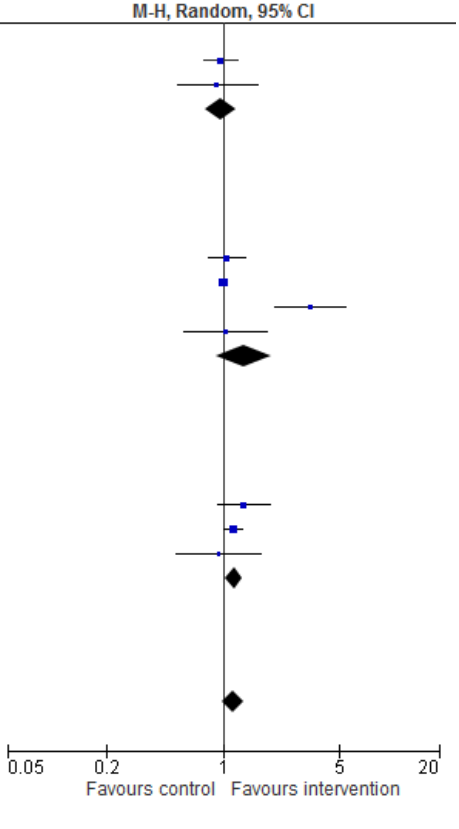
1) Website with tailored information. This meta-analysis has no total to avoid double-counting the control arm in Glanz 2020.
2) Telephone call by nurse with advice.
3) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
4) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
5) cRCT data adjusted for clustering. Face-to-face education was by the investigators.
6) Face-to-face education, video and vaccination calendar. Face-to-face education was delivered by a 'perinatal health educator'.
7) 1st HPV dose. Intervention was interactive computer delivered media presentation.
8) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
9) 1st HPV dose. Face-to-face education by provider to mother versus control.
10) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
11) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
12) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.

Funnel plot for education versus control (summary)



Vaccinations for adolescents aged 11-18 years, education versus control, adolescents and parents as different subgroups

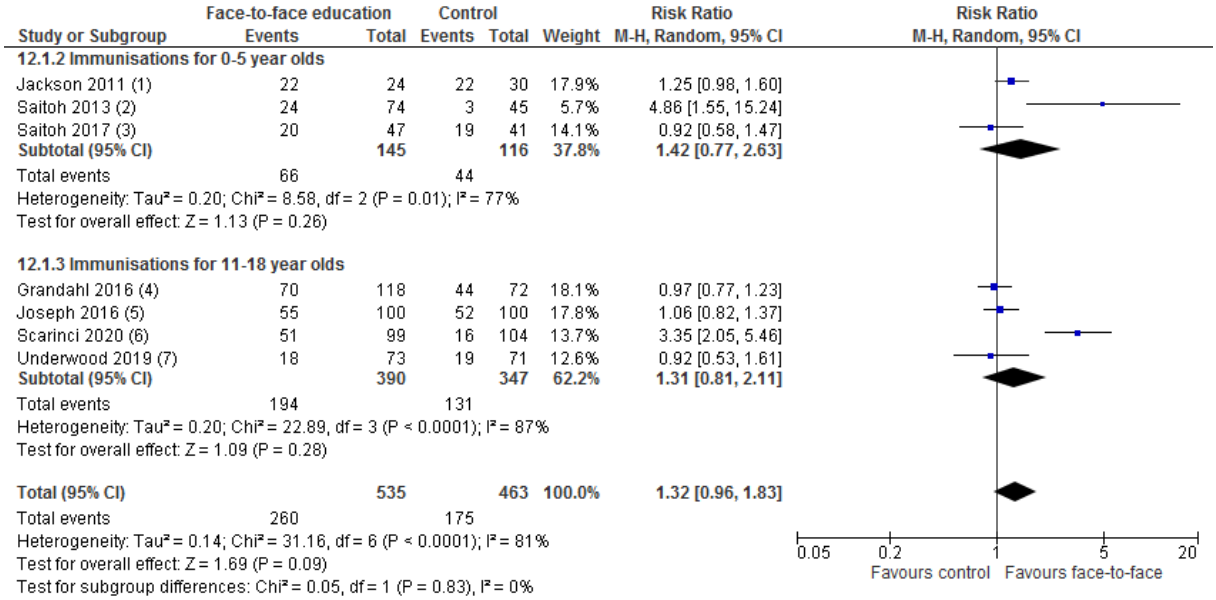
Study or Subgroup	Education Events	Education Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
11.1.1 Interventions aimed at 11-18 year olds						
Grandahl 2016 (1)	70	118	44	72	14.1%	0.97 [0.77, 1.23]
Underwood 2019 (2)	18	73	19	71	5.5%	0.92 [0.53, 1.61]
Subtotal (95% CI)		**191**		**143**	**19.6%**	**0.96 [0.77, 1.20]**
Total events	88		63			
Heterogeneity: Tau² = 0.00; Chi² = 0.03, df = 1 (P = 0.86); I² = 0%						
Test for overall effect: Z = 0.34 (P = 0.73)						
11.1.2 Interventions aimed at parents						
Joseph 2016 (3)	55	100	52	100	13.3%	1.06 [0.82, 1.37]
Pot 2017 (4)	2929	3995	2961	4067	21.7%	1.01 [0.98, 1.03]
Scarinci 2020 (5)	51	99	16	104	6.6%	3.35 [2.05, 5.46]
Underwood 2019 (6)	16	59	18	69	5.2%	1.04 [0.58, 1.85]
Subtotal (95% CI)		**4253**		**4340**	**46.7%**	**1.33 [0.90, 1.96]**
Total events	3051		3047			
Heterogeneity: Tau² = 0.12; Chi² = 23.64, df = 3 (P < 0.0001); I² = 87%						
Test for overall effect: Z = 1.42 (P = 0.16)						
11.1.3 Interventions aimed at both parents and 11-18 year olds						
Dixon 2019 (7)	21	32	31	63	9.8%	1.33 [0.94, 1.90]
Santa Maria 2021 (8)	179	255	153	253	18.9%	1.16 [1.02, 1.32]
Underwood 2019 (9)	15	60	18	68	5.0%	0.94 [0.52, 1.71]
Subtotal (95% CI)		**347**		**384**	**33.7%**	**1.17 [1.04, 1.32]**
Total events	215		202			
Heterogeneity: Tau² = 0.00; Chi² = 1.06, df = 2 (P = 0.59); I² = 0%						
Test for overall effect: Z = 2.60 (P = 0.009)						
Total (95% CI)		**4791**		**4867**	**100.0%**	**1.14 [0.99, 1.33]**
Total events	3354		3312			
Heterogeneity: Tau² = 0.03; Chi² = 30.60, df = 8 (P = 0.0002); I² = 74%						
Test for overall effect: Z = 1.77 (P = 0.08)						
Test for subgroup differences: Chi² = 3.03, df = 2 (P = 0.22), I² = 34.0%						



Footnotes

1) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
2) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
3) 1st HPV dose. Face-to-face education by provider to mother versus control.
4) Website was for mothers of teenage girls.
5) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education with parents was with educator in groups and one-to-one in migrant's language.
6) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.
7) cRCT data adjusted for clustering. Video for parent(s) and adolescent.
8) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
9) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers and information for parents. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.

Face-to-face education versus control

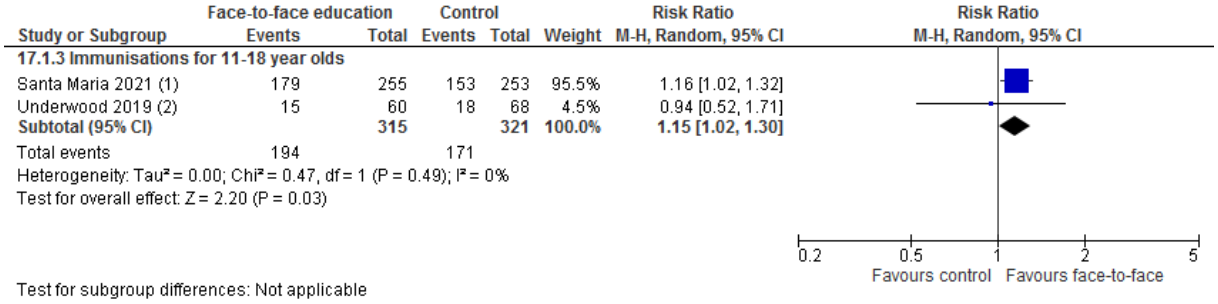


Footnotes

1) cRCT data adjusted for clustering. Face-to-face education with investigator. Leaflet was in both arms.
2) 2 arms combined for intervention: prenatal face-to-face education and postpartum face-to-face education. Education was delivered by investigator.
3) cRCT data adjusted for clustering. Face-to-face education was by midwives.
4) cRCT data adjusted for clustering. Face-to-face education of adolescents by school nurses.
5) 1st HPV dose. Face-to-face education by provider to mother versus control.
6) cRCT data adjusted for clustering. 1st HPV dose. Face-to-face education of parents was with educator in groups and one-to-one in migrant's language.

7) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers. Written information for parents was in both arms. The MenACWY data was not included here to avoid double-counting of participants. This meta-analysis has no pooled total to avoid double-counting Underwood 2019.

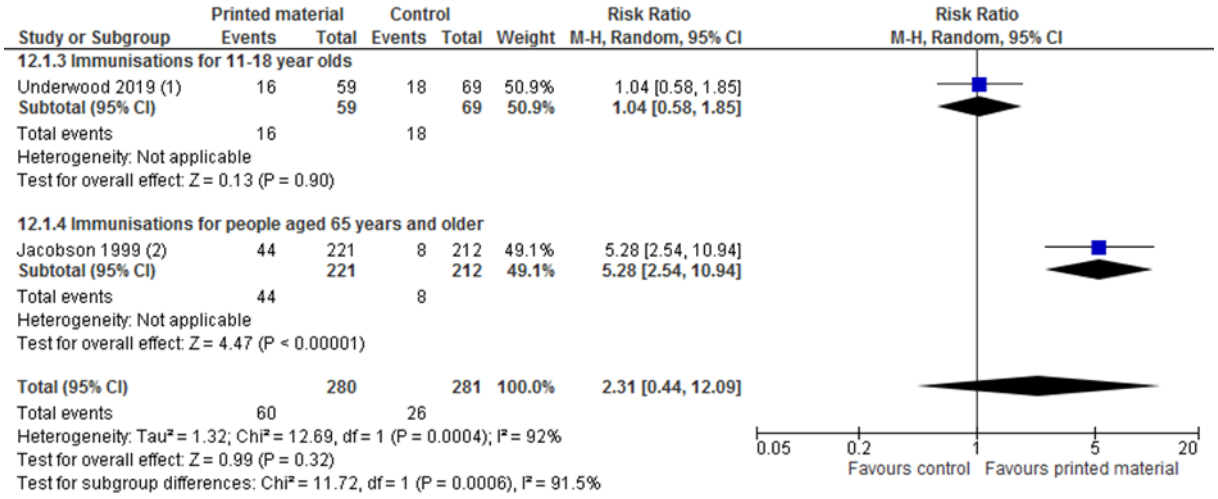
Face-to-face education and printed educational material versus control



Footnotes

1) 1st HPV dose. Parental and adolescent education by nurse. Written information by parents. The investigators wrote that the data could not differentiate for all 3 doses.
2) cRCT data adjusted for clustering. HPV 1 dose or more. Education of adolescents by teachers and information for parents. The MenACWY data was not included here to avoid double-counting of participants. The MenACWY data is shown in the meta-analysis below.

Printed educational material versus control

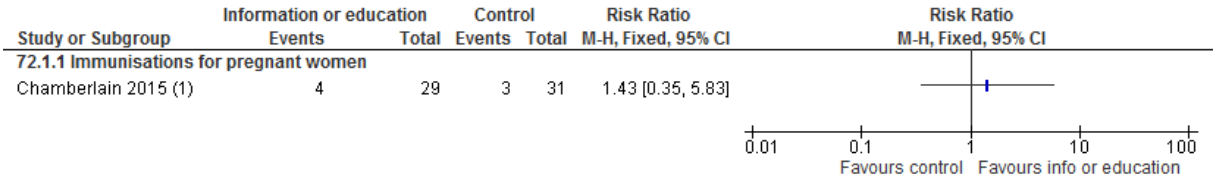


Footnotes

1) cRCT data adjusted for clustering. HPV 1 dose or more. Written information for parents. The MenACWY data was not included here to avoid double-counting of participants. The MenACWY data is shown in the meta-analysis below.
2) Easy to read leaflet on vaccines versus easy to read leaflet on nutrition.

Education interventions aimed at providers compared to control

Education versus control (summary)



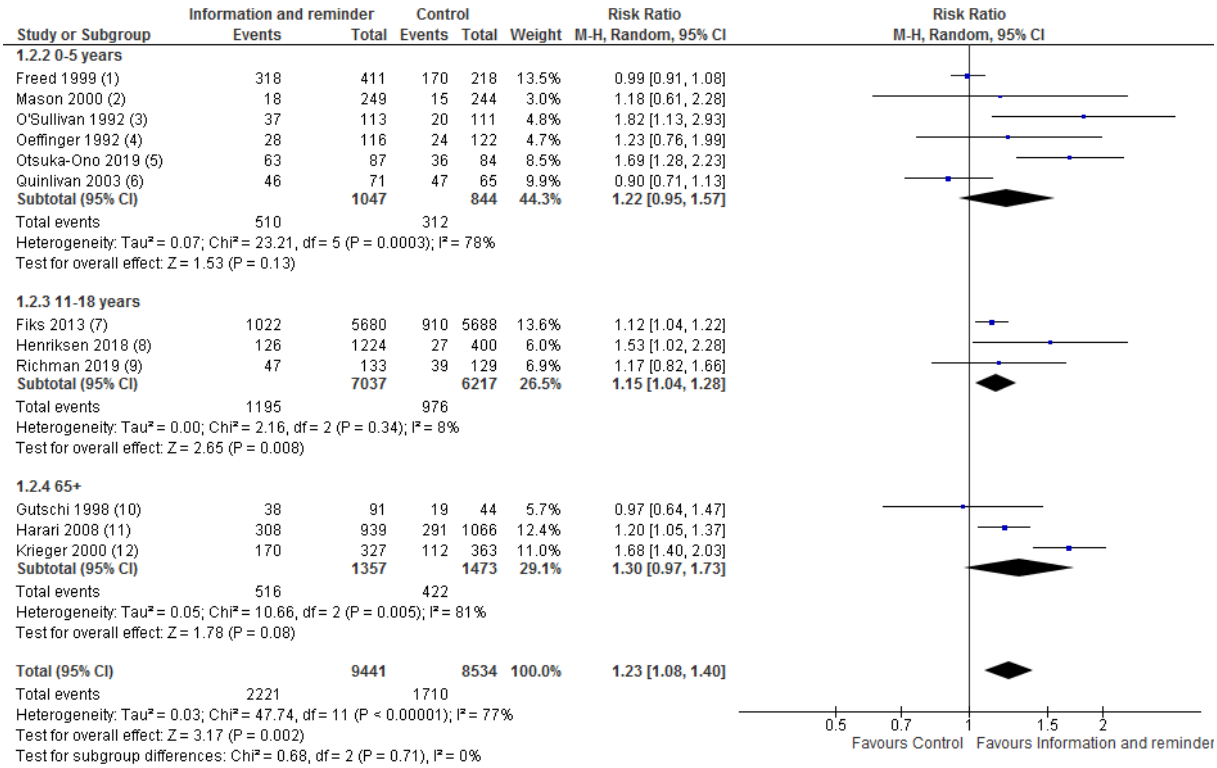
Footnotes

1) cRCT data adjusted for clustering. Face-to-face peer education was given by a physician. Brochures, posters, and the iPad tutorial were aimed at parents.

Information/education and reminder interventions

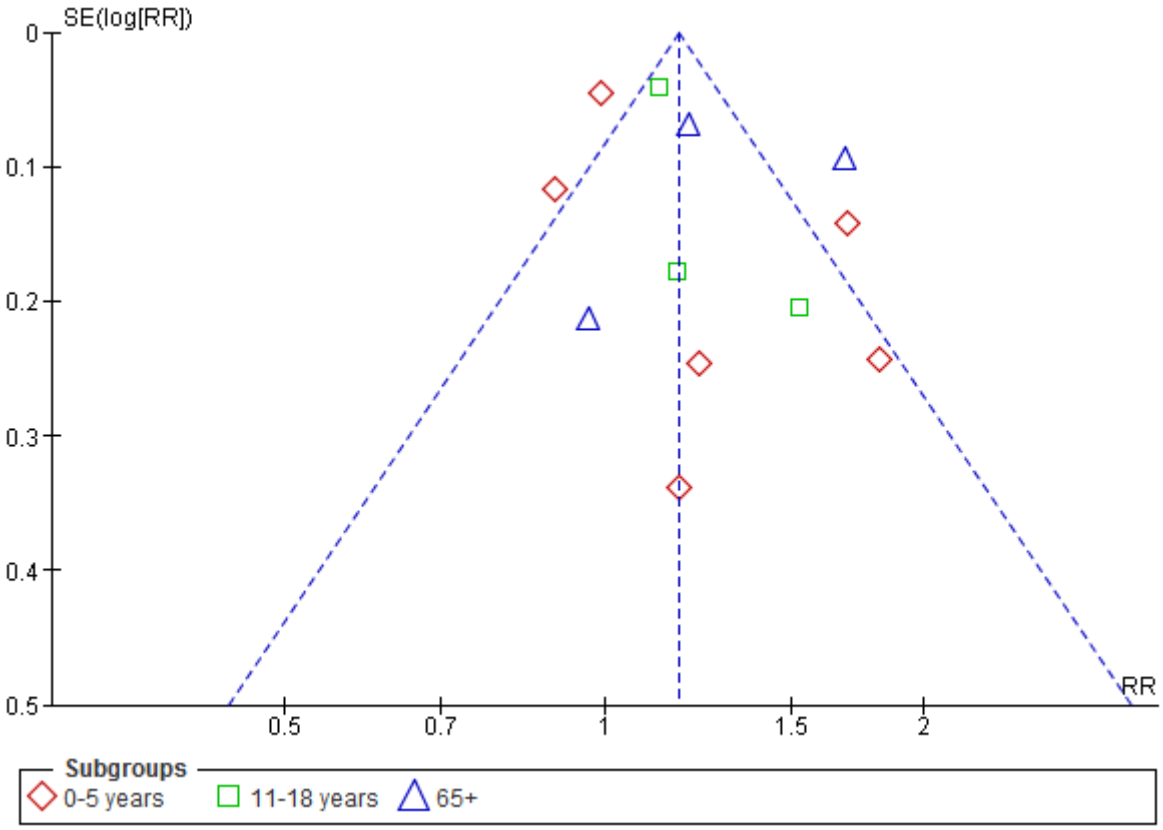
Information/education and reminder interventions aimed at individuals, parents/carers compared to control

Information and/or education plus reminders versus control by age group/ life stage



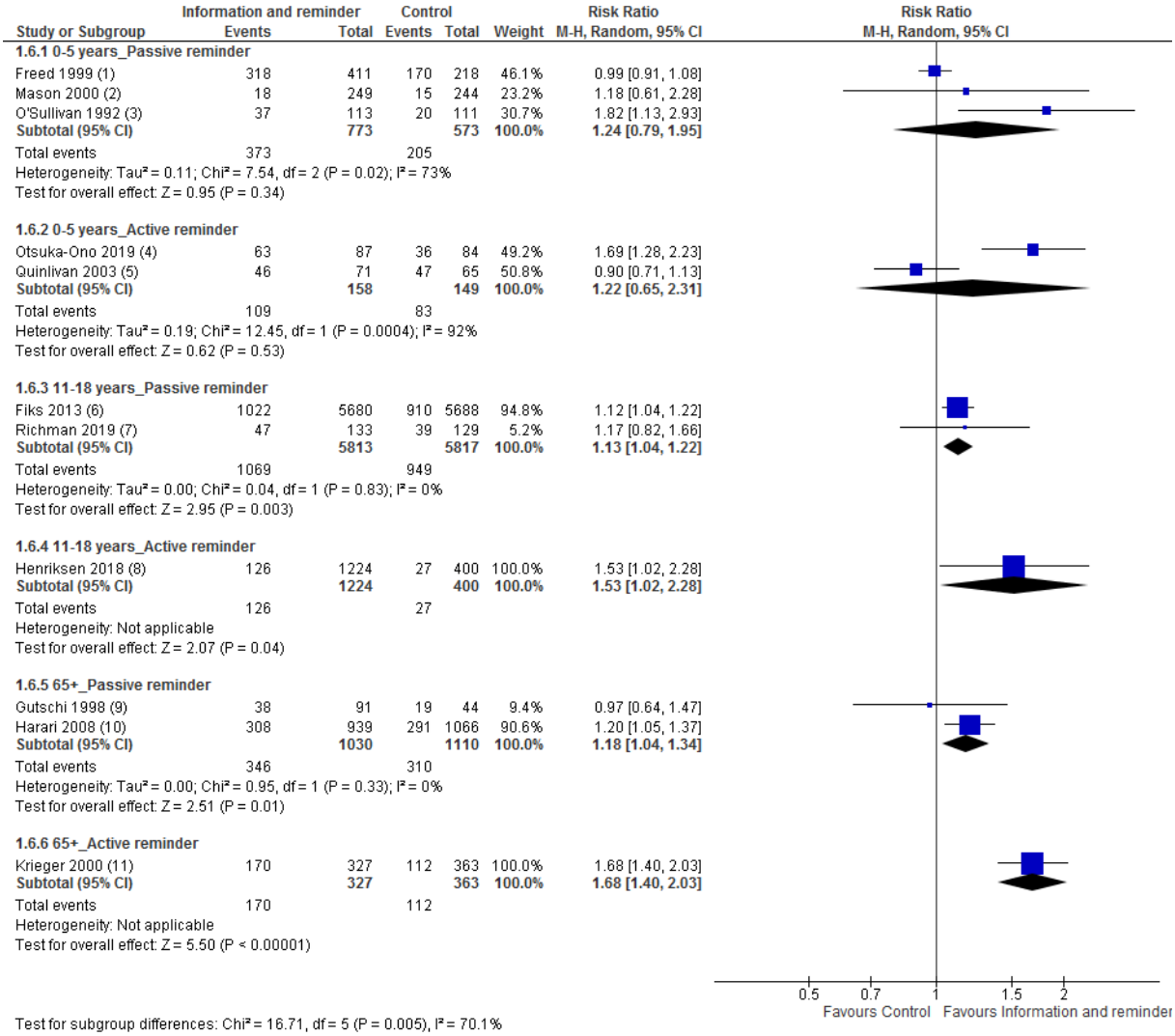
Footnotes
(1) Information
(2) Information
(3) Education
(4) Education
(5) Education
(6) Education
(7) Information. cRCT. Data was adjusted for clustering by the authors. HPV dose 1.
(8) Information
(9) Education
(10) Education. Inclusion criteria based on cardiac surgery, not age
(11) Education
(12) Information

Funnel plot for information and/or education plus reminders versus control by age group/life stage



Information and/or education plus reminders versus control by reminder type

Active reminder refers to a reminder that involves some form of interaction (e.g. home visit discussion or vaccine discussion and survey). Passive reminder refers to a reminder with no interaction (e.g. reminder letter, electronic message, or automated phone call).

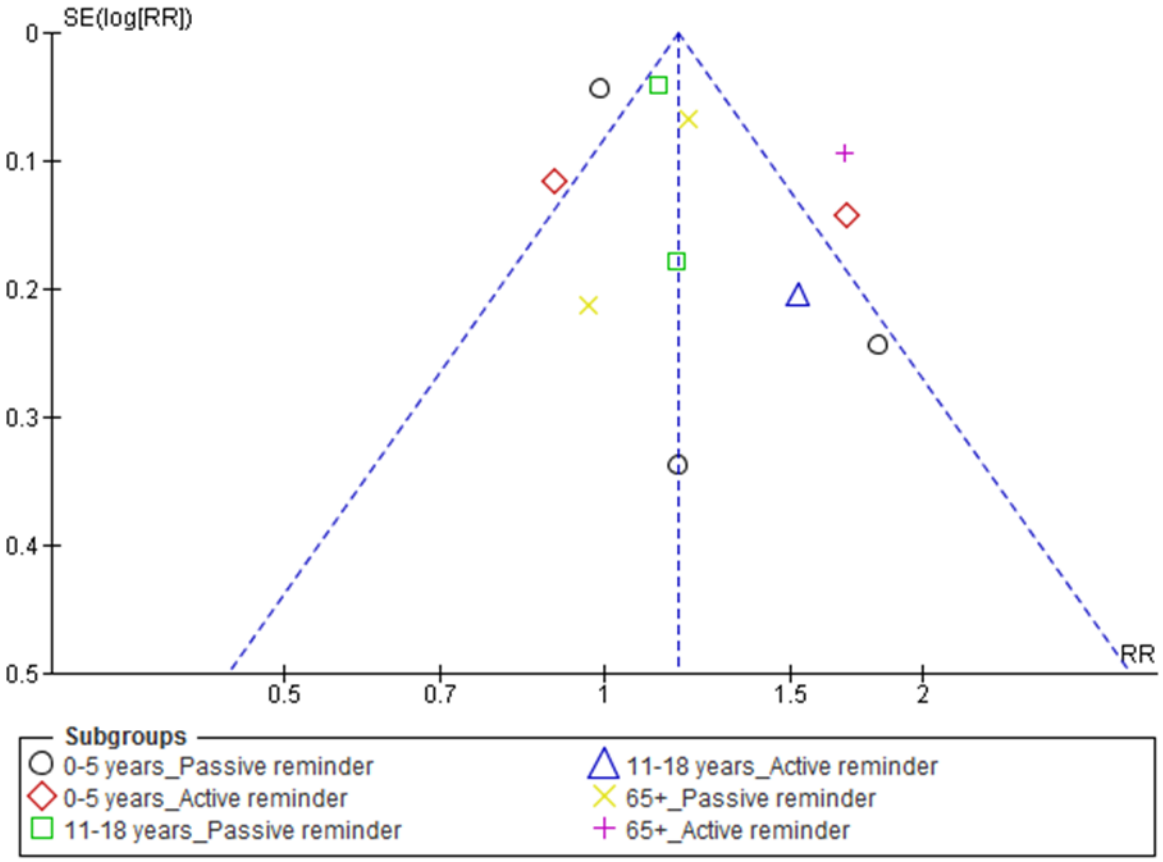


Test for subgroup differences: Chi² = 16.71, df = 5 (P = 0.005), I² = 70.1%

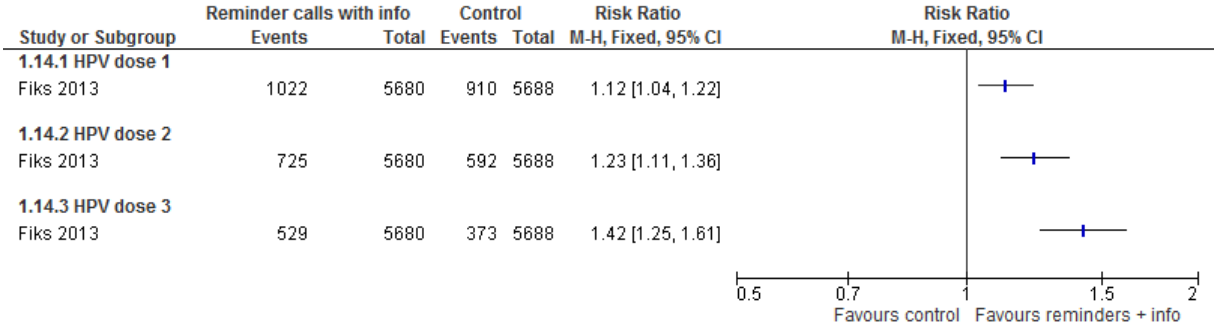
Footnotes

(1) Information delivered via mail from local healthcare system/research team
(2) Information delivered via mail from local healthcare system/research team
(3) Education delivered face-to-face by healthcare staff
(4) Education delivered face-to-face by healthcare staff
(5) Education delivered face-to-face by healthcare staff
(6) Education delivered by phone from external provider. Data was adjusted for clustering by the authors. HPV dose 1.
(7) Education delivered virtually by local healthcare system/research team
(8) Information delivered via mail from local healthcare system/research team
(9) Education delivered face-to-face by healthcare staff. Inclusion criteria based on cardiac surgery, not age
(10) Education delivered via mail with computer-generated feedback
(11) Information delivered via mail from local healthcare system/research team

Funnel plot for information and/or education plus reminders versus control by reminder type

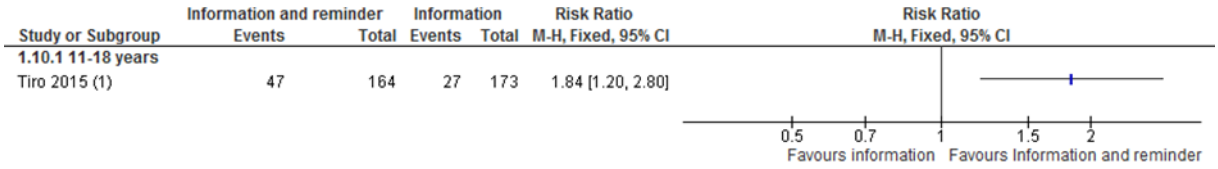


Reminder phone calls with information about vaccination versus control



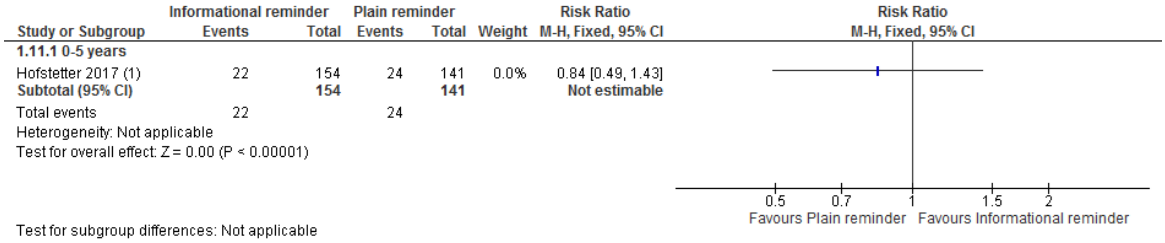
Information/education and reminder interventions aimed at individuals, parents/carers compared to other reminder and/ or education interventions

Information plus reminders versus information



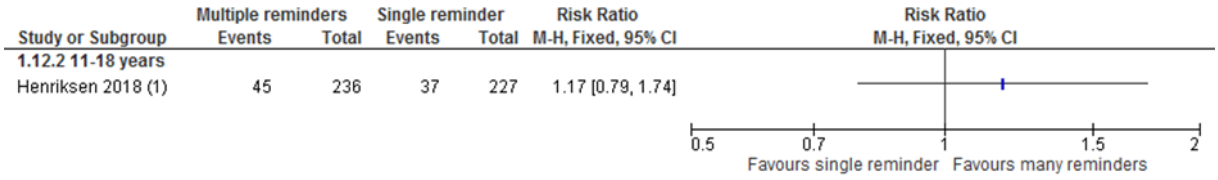
Footnotes
(1) Specific information and reminder vs specific information with no reminder. Information delivered via mail from research team. Active reminder

Informational reminder versus plain text message reminder



Test for subgroup differences: Not applicable
Footnotes
(1) Reminder with specific vaccine information vs reminder with no specific information. Active reminder

Information plus multiple reminders versus information and single reminder

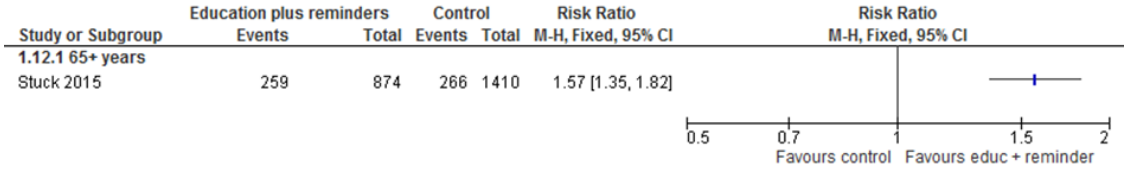


Footnotes

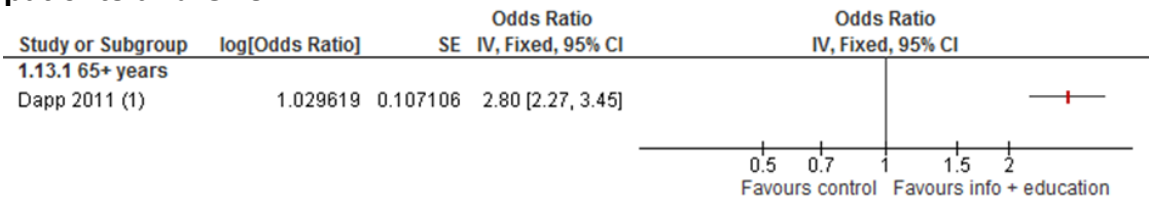
1) Information delivered via mail from local healthcare system/research team before vaccine 1 for both arms. Active reminder for all vaccines versus active reminder for vaccine 1 only

Information/education and reminder interventions aimed at individuals, parents/carers and providers compared to control

Education for patients by GPs plus 2 home visits by nurse plus ≥1 telephone reminders plus tailored information for patients and GPs



Group patient education or 2 home visits for patients + tailored reminder for patients and GPs

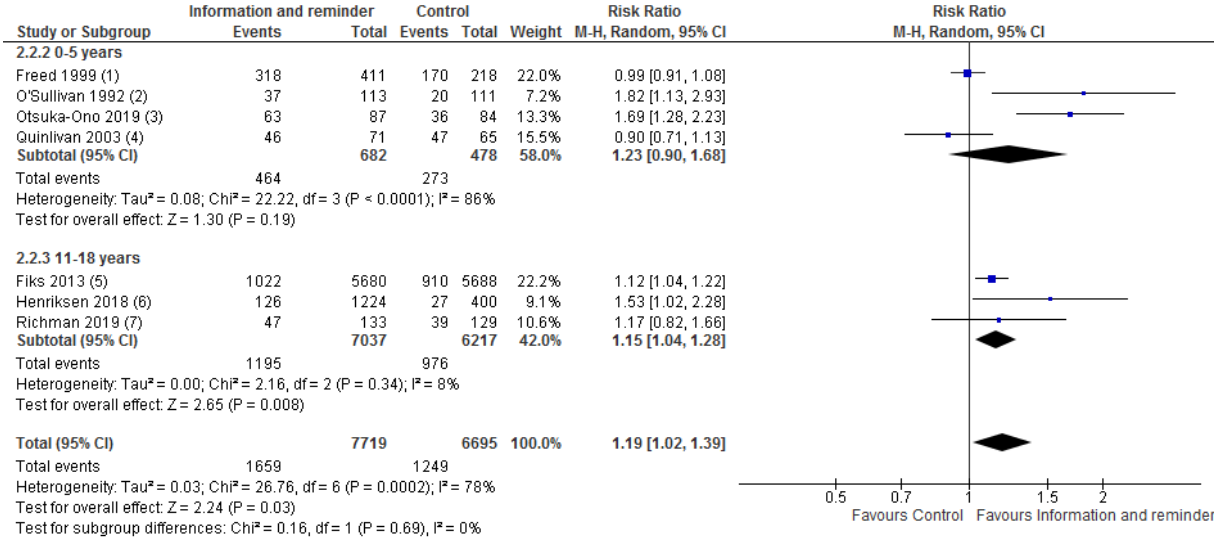


Footnotes

1) cRCT. Data was adjusted by the investigators for clustering. Group session education for patients by a geriatric team or 2 educational home visits by a nurse. Tailored written information/reminder was then sent out to patients and GPs. GP training on preventative care occurred in both arms.

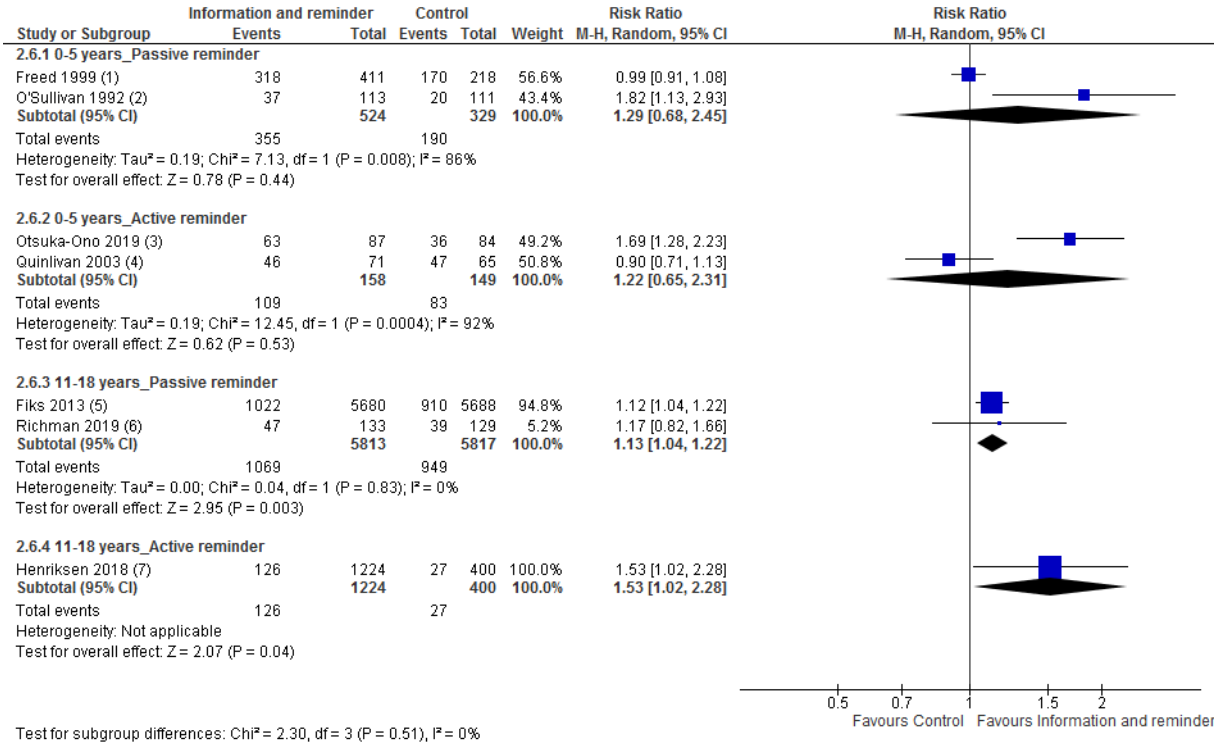
Sensitivity analyses

Information and/or education plus reminders versus control by age group/life stage



Footnotes
(1) Information
(2) Education
(3) Education
(4) Education
(5) Information. cRCT. Data adjusted for clustering by the investigators. HPV dose 1.
(6) Information
(7) Education

Information and/or education plus reminders versus control by reminder type



Test for subgroup differences: Chi² = 2.30, df = 3 (P = 0.51), I² = 0%

Footnotes

(1) Information delivered via mail from local healthcare system/research team
(2) Education delivered face-to-face by healthcare staff
(3) Education delivered face-to-face by healthcare staff
(4) Education delivered face-to-face by healthcare staff
(5) Education delivered by phone from external provider. cRCT. Data adjusted for clustering by investigators. HPV dose 1.
(6) Education delivered virtually by local healthcare system/research team
(7) Information delivered via mail from local healthcare system/research team

Appendix F – GRADE tables

Information/education interventions- uptake outcome

Information/education interventions compared to control

Table 20 GRADE table for Information/education interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information and/or education versus control (summary by age group) (subtotals but no total) (RR >1 favours intervention)										
Pregnant women										
2 (Kriss 2017, O'Leary 2019)	RCT	1199	RR 1.41 (0.58, 3.44)	13 per 100	18 per 100 (7, 44)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
0-5 year olds										
10[8]	RCT, cluster RCT	3994	RR 1.01 (0.97, 1.06)	80 per 100	81 per 100 (77, 85)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
11-18 year olds										
11[9]	RCT, cluster RCT	32174	RR 1.06 (0.99, 1.13)	61 per 100	64 per 100 (60, 69)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
65 years and older										
2 (Jacobson 1999, Thomas 2003)	RCT	994	RR 3.53 (1.72, 7.27)	5 per 100	18 per 100 (9, 37)	Not serious	Not serious	Serious[5]	Not serious	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information and/or education versus control (summary by age group) (total but no Glanz 2017 data) (RR >1 favours intervention)										
24[10]	RCT, cluster RCT	37268	RR 1.05 (1.00, 1.10)	51 per 100	54 per 100 (51, 56)	Serious[2]	Not serious	Very serious[4]	Not serious	Very low
Pregnant women										
2 (Kriss 2017, O'Leary 2019)	RCT	1199	RR 1.41 (0.58, 3.44)	13 per 100	18 per 100 (7, 44)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
0-5 year olds										
9[11]	RCT, cluster RCT	2077	RR 1.01 (0.96, 1.06)	81 per 100	82 per 100 (78, 86)	Serious[2]	Not serious	Serious[5]	Serious[7]	Very low
11-18 year olds										
11[12]	RCT, cluster RCT	32174	RR 1.06 (0.99, 1.13)	61 per 100	64 per 100 (60, 69)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
65 years and older										
2 (Jacobson 1999, Thomas 2003)	RCT	994	RR 3.53 (1.72, 7.27)	5 per 100	18 per 100 (9, 37)	Not serious	Not serious	Serious[5]	Not serious	Moderate
Education versus control (summary by age group) (Glanz 2017 separately) (RR >1 favours intervention)										
0-5 year olds										
1 (Glanz 2017)	RCT	1093	RR 1.04 (0.94, 1.15)	72 per 100	74 per 100 (67, 82)	Not serious	Not serious	N/A[6]	Serious[7]	Moderate
Information and/or education versus control by delivery method (RR >1 favours intervention)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information: video information										
3 (Dixon 2019, Kris 2017, Thomas 2003)	RCT, cluster RCT	537	RR 1.41 (1.05, 1.90)	18 per 100	25 per 100 (18, 33)	Serious[2]	Not serious	Not serious	Not serious	Moderate
Information: video and printed material										
1 (Thomas 2003)	RCT	371	RR 3.53 (1.93, 6.47)	7 per 100	23 per 100 (13, 43)	Not serious	Not serious	N/A[6]	Not serious	High
Information: social media										
1 (Chodick 2021)	RCT	21592	RR 1.01 (0.98, 1.04)	55 per 100	56 per 100 (54, 57)	Very serious[3]	Not serious	N/A[6]	Serious[7]	Very low
Information: website with or without social media										
5[13]	RCT, cluster RCT	11071	RR 1.00 (0.99, 1.02)	73 per 100	73 per 100 (73, 75)	Serious[2]	Not serious	Not serious	Serious[7]	Low
Information: printed material information, such as leaflets										
4 (Jacobson 1999, Shourie 2013, Tiro 2015, Underwood 2019)	RCT, cluster RCT	1591	RR 1.32 (0.84, 2.07)	33 per 100	44 per 100 (28, 69)	Very serious[3]	Not serious	Very serious[4]	Serious[7]	Very low
Education: face-to-face										
8[14]	RCT, cluster RCT	1006	RR 1.25 (0.92, 1.69)	35 per 100	44 per 100 (32, 60)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Education: face-to-face and printed material information										
3 (Santa Maria 2021, Underwood 2019, Winer 2016)	cluster RCT	669	RR 1.15 (1.02, 1.30)	28 per 100	33 per 100 (12, 94)	Not serious	Not serious	Not serious	Not serious	High
Education: face-to-face, video and printed material information										
1 (Zuniga 2003)	RCT	348	RR 1.02 (0.96, 1.07)	93 per 100	95 per 100 (90, 100)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
Education: telephone conversation										
1 (Hannan 2013)	RCT	139	RR 1.10 (0.98, 1.25)	84 per 100	93 per 100 (82, 105)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
Education: interactive app										
2 (DiClemente 2015, Kriss 2017)	RCT	289	RR 1.72 (0.60, 4.95)	13 per 100	22 per 100 (8, 64)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
Information and/or education versus control by whether intervention targets an individual/parent or a group (RR >1 favours intervention)										
Targets individuals or parents										
19[15]	RCT, cluster RCT	36588	RR 1.03 (0.99, 1.07)	61 per 100	62 per 100 (60, 65)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
Targets groups of people who are together										
4 (Grandahl 2016,	cluster RCT	421	RR 1.08 (0.92, 1.27)	47 per 100	51 per 100 (43, 60)	Serious[2]	Not serious	Not serious	Serious[7]	Low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Jackson 2011, Underwood 2019, Winer 2016)										
Targets both groups and individuals or parents										
2 (Scarinci 2020, Underwood 2019)	Cluster RCT	403	RR 1.83 (0.56, 6.01)	20 per 100	36 per 100 (11, 119)	Very serious[3]	Not serious	Very serious[4]	Serious[7]	Very low
Information and/or education versus control divided into tailored or generic interventions (RR >1 favours intervention)										
Tailored										
16[16]	RCT, cluster RCT	11641	RR 1.06 (1.00, 1.13)	67 per 100	71 per 100 (67, 76)	Serious[2]	Not serious	Very serious[4]	Not serious	Very low
Generic										
13[17]	RCT, cluster RCT	26263	RR 1.02 (0.96, 1.09)	53 per 100	54 per 100 (51, 58)	Very serious[3]	Not serious	Very serious[4]	Serious[7]	Very low
Information and/or education versus control by who provided the information or education (RR >1 favours intervention)										
Healthcare professionals										
10[18]	RCT, cluster RCT	23304	RR 1.03 (0.99, 1.07)	56 per 100	58 per 100 (56, 60)	Serious[2]	Not serious	Not serious	Serious[7]	Low
Government health authority organisation										
3 (Porter-Jones 2009, Pot	RCT, cluster RCT	9191	RR 0.98 (0.94, 1.03)	75 per 100	73 per 100 (70, 77)	Very serious[3]	Not serious	Serious[5]	Serious[7]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
2017, Shourie 2013)										
Study personnel										
3 (Glanz 2020, Saitoh 2013, Underwood 2019)	RCT, cluster RCT	1071	RR 1.41 (0.69, 2.90)	71 per 100	100 per 100 (49, 205)	Very serious[3]	Not serious	Very serious[4]	Serious[7]	Very low
Study personnel and school teachers										
1 (Underwood 2019)	Cluster RCT	128	RR 0.94 (0.52, 1.71)	26 per 100	25 per 100 (14, 45)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
School teachers										
1 (Underwood 2019)	cluster RCT	144	RR 0.92 (0.53, 1.61)	27 per 100	25 per 100 (14, 43)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
Lay educators										
1 (Scarinci 2020)	cluster RCT	203	RR 3.35 (2.05, 5.46)	15 per 100	52 per 100 (32, 84)	Serious[2]	Not serious	N/A[6]	Not serious	Moderate
Unspecified personnel at a health clinic										
8[19]	RCT, cluster RCT	2955	RR 1.51 (1.00, 2.29)	25 per 100	38 per 100 (25, 58)	Not serious	Not serious	Very serious[4]	Not serious	Low
Unspecified personnel at a health clinic and panel of experts on social media										
1 (O'Leary 2019)	RCT	722	RR 0.9 (0.56, 1.44)	12 per 100	11 per 100 (7, 17)	Not serious	Not serious	Not serious	Serious[7]	Moderate
Information versus control by age group/life stage (RR >1 favours intervention)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Immunisations for pregnant women										
2 (Kriss 2017, O'Leary 2019)	RCT	1199	RR 1.41 (0.58, 3.44)	13 per 100	18 per 100 (7, 44)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
0-5 year olds										
4 (Glanz 2017, Glanz 2020, Porter-Jones 2009, Shourie 2013)	RCT, cluster RCT	2770	RR 0.99 (0.95, 1.03)	87 per 100	86 per 100 (83, 90)	Serious[2]	Not serious	Serious[5]	Serious[7]	Very low
11-18 year olds										
5 (Chodick 2021, Dixon 2019, Pot 2017, Tiro 2015, Underwood 2019)	RCT, cluster RCT	30752	RR 1.01 (0.99, 1.03)	62 per 100	63 per 100 (61, 64)	Very serious[3]	Not serious	Not serious	Serious[7]	Very low
65 years and older										
2 (Jacobson 1999,	RCT	994	RR 3.53 (1.72, 7.27)	5 per 100	18 per 100 (9, 37)	Not serious	Not serious	Serious[5]	Not serious	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Thomas 2003)										
Education versus control by age group/life stage (RR >1 favours intervention)										
15[21]	RCT, cluster RCT	3062	RR 1.08 (1.00, 1.18)	60 per 100	65 per 100 (60, 71)	Serious[2]	Not serious	Very serious[4]	Not serious	Very low
0-5 year olds										
8[25]	RCT, cluster RCT	1568	RR 1.03 (0.97, 1.09)	77 per 100	79 per 100 (75, 84)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
11-18 year olds										
7[26]	RCT, cluster RCT	1494	RR 1.21 (0.94, 1.56)	41 per 100	50 per 100 (39, 65)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
Vaccinations for adolescents aged 11-18 years, Information/education versus control analysed by who the intervention was targeting (RR >1 favours intervention)										
11-18 year olds										
2 (Grandahl 2016, Underwood 2019)	Cluster RCT	334	RR 0.96 (0.77, 1.20)	44 per 100	42 per 100 (34, 53)	Serious[2]	Not serious	Not serious	Serious[7]	Low
Parents										
7[27]	RCT, cluster RCT	31093	RR 1.04 (0.97, 1.12)	61 per 100	64 per 100 (60, 69)	Very serious[3]	Not serious	Very serious[4]	Serious[7]	Very low
Both parents and 11-18 year olds										
3 (Dixon 2019,	Cluster RCT	731	RR 1.17 (1.04, 1.32)	53 per 100	62 per 100 (55, 69)	Serious[2]	Not serious	Not serious	Not serious	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Santa Maria 2021, Underwood 2019)										
Face-to-face education vs control (RR >1 favours intervention)										
8[28]	RCT, cluster RCT	1150	RR 1.25 (0.92, 1.69)	35 per 100	44 per 100 (32, 60)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
0-5 year olds										
4 (Bartu 2006, Jackson 2011, Saitoh 2013, Saitoh 2017)	RCT, cluster RCT	413	RR 1.20 (0.75, 1.93)	31 per 100	37 per 100 (23, 59)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
11-18 year olds										
4 (Grandahl 2016, Joseph 2016, Scarinci 2020, Underwood 2019)	RCT, cluster RCT	737	RR 1.31 (0.81, 2.11)	38 per 100	49 per 100 (31, 80)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
Face-to-face education versus control (MenACWY data) (RR >1 favours intervention)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Underwood 2019)	Cluster RCT	144	RR 1.05 (0.68, 1.62)	35 per 100	37 per 100 (24, 57)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
Face-to-face education versus control (HPV different doses) (RR >1 favours intervention)										
11-18 year olds, 1st dose										
3 (Joseph 2016, Scarinci 2020, Underwood 2019)	RCT, cluster RCT	547	RR 1.47 (0.69, 3.17)	32 per 100	47 per 100 (22, 100)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
11-18 year olds, 2nd dose										
2 (Joseph 2016, Scarinci 2020)	RCT, cluster RCT	403	RR 2.56 (0.66, 9.89)	12 per 100	30 per 100 (8, 116)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
11-18 year olds, 3rd dose										
2 (Joseph 2016, Scarinci 2020)	RCT, cluster RCT	403	RR 4.58 (0.35, 59.58)	4 per 100	20 per 100 (2, 263)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
Face-to-face education versus control 11-18 year olds, 3 doses (OR >1 favours intervention)										
1 (Underwood 2015)	cluster RCT	686	aOR 1.09 (0.60, 1.97)	N/A[23]	N/A[23]	Very serious[3]	Not serious	N/A[6]	Serious[7]	Very low
Face-to-face postpartum and prenatal education versus control for children aged 0-5 years (RR >1 favours intervention)										
Postpartum education										
1 (Saitoh 2013)	RCT	82	RR 5.68 (1.76, 18.26)	7 per 100	38 per 100 (12, 122)	Serious[2]	Not serious	N/A[6]	Not serious	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Prenatal education										
1 (Saitoh 2013)	RCT	82	RR 4.05 (1.20, 13.66)	7 per 100	27 per 100 (8, 91)	Serious[2]	Not serious	N/A[6]	Not serious	Moderate
Face-to-face education and printed educational material versus control (RR >1 favours intervention)										
3 (Santa Maria 2021, Underwood 2019, Winer 2016)	RCT, cluster RCT	669	RR 1.15 (1.02, 1.30)	52 per 100	60 per 100 (53, 67)	Not serious	Not serious	Not serious	Not serious	High
Face-to-face education and printed educational material versus control (MenACWY data) (RR >1 favours intervention)										
1 (Underwood 2019)	cluster RCT	128	RR 0.96 (0.61, 1.50)	38 per 100	37 per 100 (23, 57)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
Face-to-face education and printed educational material versus control (different HPV doses) (RR >1 favours intervention)										
11-18 year olds, 1st dose										
1 (Underwood 2015)	cluster RCT	686	OR 2.14 (1.33, 3.43)	N/A	N/A	Very serious[3]	Not serious	Serious[5]	Not serious	Very low
11-18 year olds, 3 doses										
1 (Underwood 2015)	cluster RCT	686	OR 1.13 (0.63, 2.03)	N/A	N/A	Very serious[3]	Not serious	N/A[6]	Serious[7]	Very low
Face-to-face education, video and vaccination calendar versus control (RR >1 favours intervention)										
0-5 year olds										
1 (Zuniga 2003)	RCT	348	RR 1.02 (0.96, 1.07)	93 per 100	95 per 100 (90, 100)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Educational telephone call versus control (RR >1 favours intervention)										
0-5 year olds										
1 (Hannan 2013)	RCT	139	RR 1.10 (0.98, 1.25)	84 per 100	93 per 100 (82, 105)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
Printed educational material versus control (RR >1 favours intervention)										
3 (Shourie 2013, Tiro 2015, Jacobson 1999, Underwood 2019)	RCT, cluster RCT	1591	RR 1.32 (0.84, 2.07)	33 per 100	44 per 100 (28, 69)	Very serious[3]	Not serious	Very serious[4]	Serious[7]	Very low
0-5 year olds										
1 (Shourie 2013)	cluster RCT	155	RR 0.92 (0.85, 0.99)	99 per 100	91 per 100 (84, 98)	Serious[2]	Not serious	N/A[6]	Not serious	Moderate
11-18 years										
2 (Tiro 2015, Underwood 2019)	RCT	1003	RR 1.02 (0.87, 1.20)	36 per 100	37 per 100 (32, 44)	Very serious[3]	Not serious	N/A[6]	Serious[7]	Very low
65 years and older										
1 (Jacobson 1999)	RCT	433	RR 5.28 (2.54, 10.94)	4 per 100	20 per 100 (10, 41)	Not serious	Not serious	N/A[6]	Not serious	High
Printed educational material versus control (MenACWY data) (RR >1 favours intervention)										
1 (Underwood 2019)	cluster RCT	128	RR 0.94 (0.60, 1.49)	38 per 100	35 per 100 (23, 56)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
Printed educational material and video education versus control (RR >1 favours intervention)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
65 years and older										
1 (Thomas 2003)	RCT	371	RR 3.53 (1.93, 6.47)	7 per 100	23 per 100 (13, 43)	Not serious	Not serious	N/A[6]	Not serious	High
Social media versus control (RR >1 favours intervention)										
11-18 years										
1 (Chodick 2021)	RCT	21592	RR 1.01 (0.98, 1.04)	55 per 100	56 per 100 (54, 57)	Very serious[3]	Not serious	N/A[6]	Serious[7]	Very low
Website and social media versus control (RR >1 favours intervention)										
Pregnant women										
1 (O'Leary 2019)	RCT	722	RR 0.90 (0.56, 1.44)	12 per 100	11 per 100 (7, 17)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
0-5 years										
1 (Glanz 2017)	RCT	722	RR 1.05 (0.95, 1.17)	72 per 100	75 per 100 (68, 84)	Not serious	Not serious	N/A[6]	Serious[7]	Moderate
Website versus control (subtotals but no total) (RR >1 favours intervention)										
Pregnant women										
1 (O'Leary 2019)	RCT	551	RR 0.99 (0.61, 1.62)	12 per 100	12 per 100 (7, 19)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
Immunisations for 0-5 year olds										
3 (Glanz 2017, Glanz 2020, Shourie 2013)	RCT, cluster RCT	1493	RR 1.01 (0.96, 1.05)	86 per 100	87 per 100 (83, 90)	Not serious	Not serious	Not serious	Serious[7]	Moderate
11-18 years										
1 (Pot 2017)	RCT	8062	RR 1.01 (0.98, 1.03)	73 per 100	74 per 100 (71, 75)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Website versus control (total but no Glanz 2017 data) (RR >1 favours intervention)										
4 (O'Leary 2019, Glanz 2020, Shourie 2013, Pot 2017)	RCT, cluster RCT	9555	RR 1.01 (0.98, 1.03)	72 per 100	73 per 100 (71, 74)	Serious[2]	Not serious	Not serious	Serious[7]	Low
Pregnant women										
1 (O'Leary 2019)	RCT	551	RR 0.99 (0.61, 1.62)	12 per 100	12 per 100 (7, 19)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
0-5 year olds										
2 (Glanz 2020, Shourie 2013)	RCT, cluster RCT	942	RR 1.00 (0.96, 1.04)	94 per 100	94 per 100 (90, 97)	Not serious	Not serious	Not serious	Serious[7]	Moderate
11-18 years										
1 (Pot 2017)	RCT	8062	RR 1.01 (0.98, 1.03)	73 per 100	74 per 100 (71, 75)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
Website versus control (Glanz 2017 separately) (RR >1 favours intervention)										
1 (Glanz 2017)	RCT	551	RR 1.02 (0.91, 1.14)	72 per 100	73 per 100 (65, 82)	Not serious	Not serious	N/A[6]	Serious[7]	Moderate
Tailored iPad information versus control (OR >1 favours intervention)										
1 (Dempsey 2019)	RCT	869	OR 1.05 (0.72, 1.54)	N/A[23]	N/A[23]	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
Untailored iPad information versus control (RR >1 favours intervention)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Dempsey 2019)	RCT	864	OR 1.10 (0.71, 1.71)	N/A[23]	N/A[23]	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
Interactive app versus control (RR >1 favours intervention)										
2 (Kriss 2017, DiClemente 2015)	RCT	289	RR 1.72 (0.60, 4.95)	13 per 100	22 per 100 (8, 64)	Serious[2]	Not serious	Very serious[4]	Serious[7]	Very low
Pregnant women										
1 (Kriss 2017)	RCT	73	RR 2.94 (1.39, 6.23)	18 per 100	51 per 100 (24, 109)	Serious[2]	Not serious	N/A[6]	Not serious	Moderate
11-18 year olds										
1 (DiClemente 2015)	RCT	216	RR 1.00 (0.47, 2.13)	11 per 100	11 per 100 (5, 24)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
Interactive app versus control (HPV doses) (RR >1 favours intervention)										
1st HPV dose										
1 (DiClemente 2015)	RCT	216	RR 1.00 (0.47, 2.13)	11 per 100	11 per 100 (5, 24)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
2nd HPV dose										
1 (DiClemente 2015)	RCT	216	RR 2.67 (0.73, 9.78)	3 per 100	7 per 100 (2, 27)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low
2nd and 3rd dose										
1 (DiClemente 2015)	RCT	216	RR 3.00 (0.62, 14.53)	2 per 100	6 per 100 (1, 27)	Serious[2]	Not serious	N/A[6]	Serious[7]	Low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Video education versus control (RR >1 favours intervention)										
3 (Kriss 2017, Dixon 2019, Thomas 2003)	RCT, cluster RCT	537	RR 1.46 (1.06, 2.01)	18 per 100	26 per 100 (19, 35)	Serious[2]	Not serious	Not serious	Not serious	Moderate
Pregnant women										
1 (Kriss 2017)	RCT	73	RR 1.73 (0.74, 4.05)	18 per 100	30 per 100 (13, 71)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
11-18 year olds										
1 (Dixon 2019)	cluster RCT	95	RR 1.33 (0.94, 1.90)	49 per 100	65 per 100 (46, 93)	Serious[2]	Not serious	N/A[6]	Very serious[1]	Very low
65 years and older										
1 (Thomas 2003)	cluster RCT	369	RR 1.54 (0.77, 3.08)	7 per 100	10 per 100 (5, 20)	Not serious	Not serious	N/A[6]	Serious[7]	Moderate
Teddy bear wearing information versus control (RR >1 favours intervention)										
0-5 year olds										
1 (Porter-Jones)	cluster RCT	974	RR 0.99 (0.95, 1.04)	88 per 100	87 per 100 (83, 92)	Very serious[3]	Not serious	N/A[6]	Serious[7]	Very low
UNADJUSTED cRCT: website and lesson versus control (HPV) (RR >1 favours intervention)										
11-18 year olds										
1 (Esposito 2018[a])	cluster RCT	636	RR 1.17 (0.61, 2.23)	5 per 100	6 per 100 (3, 11)	Very serious[3]	Not serious	N/A[6]	Serious[7]	Very low
UNADJUSTED cRCT: website and lesson versus control (MenACWY) (RR >1 favours intervention)										
11-18 year olds										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Esposito 2018 [a])	cluster RCT	636	RR 46.82 (15.06, 145.55)	1 per 100	42 per 100 (14, 100)	Very serious[3]	Not serious	N/A[6]	Not serious	Low
UNADJUSTED cRCT: website versus control (HPV) (RR >1 favours intervention)										
11-18 year olds										
1 (Esposito 2018 [a])	cluster RCT	615	RR 0.63 (0.28, 1.39)	5 per 100	3 per 100 (1, 7)	Very serious[3]	Not serious	N/A[6]	Serious[7]	Very low
UNADJUSTED cRCT: website versus control (MenACWY) (RR >1 favours intervention)										
11-18 year olds										
1 (Esposito 2018 [a])	cluster RCT	615	RR 20.60 (6.50, 65.26)	1 per 100	19 per 100 (6, 59)	Very serious[3]	Not serious	N/A[6]	Not serious	Low
UNADJUSTED cRCT: lesson versus control (HPV) (RR >1 favours intervention)										
11-18 year olds										
1 (Esposito 2018 [a])	cluster RCT	583	RR 1.86 (0.85, 4.07)	3 per 100	6 per 100 (3, 13)	Very serious[3]	Not serious	N/A6	Serious[7]	Very low
UNADJUSTED cRCT: lesson versus control (MenACWY) (RR >1 favours intervention)										
11-18 year olds										
1 (Esposito 2018 [a])	cluster RCT	583	RR 2.27 (1.72, 3.00)	19 per 100	42 per 100 (32, 56)	Very serious[3]	Not serious	N/A[6]	Not serious	Low

a. The data could not be adjusted for clustering because there was no information provided in the study about the number of clusters.
1. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and the sample size was sufficiently small (<200) that it is not plausible that any realistic effect size could have been detected.
2. Downgraded once for risk of bias: greater than 33.3% of the weight in a meta-analysis came from studies at moderate or high risk of bias
3. Downgraded twice for risk of bias: greater than 33.3% of the weight in a meta-analysis came from studies at high risk of bias
4. Downgraded twice for inconsistency: the I^2 was greater than 66.7%

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality

5. Downgraded once for inconsistency: the I^2 was between 33.3% and 66.7%
6. There was only one study so there was no inconsistency
7. Downgraded once for imprecision: the 95% confidence intervals crossed the line of no effect
8. Bartu 2006, Glanz 2017, Glanz 2020, Hannan 2013, Jackson 2011, Porter-Jones 2009, Saitoh 2013, Saitoh 2017, Shourie 2018, Zuniga 2003
9. Codick 2021, DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Pot 2017, Santa Maria 2021, Scarini 2020, Tiro 2015, Underwood 2019, Winer 2016
10. Kriss 2017, O'Leary 2019, Bartu 2006, Glanz 2020, Hannan 2013, Jackson 2011, Porter-Jones 2009, Saitoh 2013, Saitoh 2017, Shourie 2018, Zuniga 2003, Chodick 2021, DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Pot 2017, Santa Maria 2021, Scarinci 2020, Tiro 2015, Underwood 2019, Winer 2016, Jacobson 1999, Thomas 2003
11. Bartu 2006, Glanz 2020, Hannan 2013, Jackson 2011, Porter-Jones 2009, Saitoh 2013, Saitoh 2017, Shourie 2018, Zuniga 2003
12. Chodick 2021, DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Pot 2017, Santa Maria 2021, Scarini 2020, Tiro 2015, Underwood 2019, Winer 2016
13. Glanz 2020, O'Leary 2019, Porter-Jones 2009, Pot 2017, Shourie 2013
14. Bartu 2006, Grandahl 2016, Jackson 2011, Joseph 2016, Saitoh 2013, Saitoh 2017, Scarinci 2020, Underwood 2019
15. Bartu 2006, Chodick 2021, DiClemente 2015, Dixon 2019, Glanz 2020, Hannan 2013, Jacobson 1999, Joseph 2016, Kriss 2017, O'Leary 2019, Porter-Jones 2009, Pot 2017, Saitoh 2013, Saitoh 2017, Santa Maria 2021, Shourie 2013, Thomas 2003, Tiro 2015
16. Bartu 2006, DiClemente 2015, Glanz 2020, Hannan 2013, Jackson 2011, Joseph 2016, Kriss 2017, O'Leary 2019, Pot 2017, Saitoh 2013, Santa Maria 2021, Scarinci 2020, Shourie 2013, Underwood 2019, Winer 2016, Zuniga 2003
17. Chodick 2021, Dixon 2019, Glanz 2020, Grandahl 2016, Jacobson 1999, Kriss 2017, O'Leary 2019, Porter-Jones 2009, Saitoh 2017, Shourie 2013, Thomas 2003, Tiro 2015, Underwood 2019.
18. Bartu 2006, Chodick 2021, Grandhal 2016, Hannan 2013, Jackson 2011, Joseph 2016, Saitoh 2017, Santa Maria 2021, Winer 2016, Zuniga 2003
19. DiClemente 2015, Dixon 2019, Jacobson 1999, Kriss 2017, O'Leary 2019, Shourie 2013, Thomas 2003, Tiro 2015
20. Kriss 2017, O'Leary 2019, Glanz 2017, Glanz 2020, Porter-Jones 2009, Shourie 2013, Chodick 2021, Dixon 2019, Pot 2017, Tiro 2015, Underwood 2019, Jacobson 1999, Thomas 2003
21. (Bartu 2006, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Shourie 2013, Zuniga 2003, DiClemente 2015, Grandahl 2016, Joseph 2016, Scarinci 2020, Winer 2016)
23. The data in the study was provided as an odds ratio and there was insufficient data to calculate the absolute risks. In other words, there was no prevalence uptake data provided.
25. Bartu 2006, Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Shourie 2013, Zuniga 2003
26. DiClemente 2015, Grandahl 2016, Joseph 2016, Santa Maria 2021, Scarinci 2020, Underwood 2019, Winer 2016
27. Chodick 2021, Joseph 2016, Pot 2017, Scarinci 2020, Tiro 2015, Underwood 2019, Winer 2016
28. Bartu 2006, Jackson 2011, Saitoh 2013, Saitoh 2017, Grandahl 2016, Joseph 2016, Scarinci 2020, Underwood 2019

Information/education interventions compared to other Information/education interventions

Table 21 GRADE table for Information/education interventions compared to other Information/education interventions

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Easy to read printed information versus standard printed information (RR >1 favours easy to read information)										
Pregnant women										
1 (Payakachat 2016)	RCT	279	RR 1.08 (0.84, 1.39)	45 per 100	49 per 100 (38, 63)	Serious[2]	Not serious	N/A[3]	Serious[4]	Low
Website with tailored information versus website with untailored information (RR >1 favours tailored information)										
1 (Glanz 2020)	RCT	450	RR 0.98 (0.93, 1.03)	93 per 100	91 per 100 (87, 96)	Not serious	Not serious	N/A[3]	Serious[4]	Moderate
Website and social media versus website (RR >1 favours website and social media)										
Pregnant women										
1 (O'Leary 2019)	RCT	913	RR 0.91 (0.62, 1.32)	12 per 100	11 per 100 (7, 15)	Serious[2]	Not serious	N/A[3]	Serious[4]	Low
0-5 year olds										
1 (Glanz 2017)	RCT	913	RR 1.03 (0.95, 1.11)	73 per 100	75 per 100 (70, 81)	Not serious	Not serious	N/A[3]	Serious[4]	Moderate
Tailored iPad information versus untailored iPad information (RR >1 favours untailored information)										
11-18 year olds										
1 (Dempsey 2019)	RCT	855	OR 1.11 (0.82, 1.51)	N/A[6]	N/A[6]	Serious[2]	Not serious	N/A[3]	Serious[4]	Low
Interactive electronic education versus printed educational material (RR >1 favours interactive electronic information)										
0-5 year olds										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Shourie 2013)	cluster RCT	133	RR 1.10 (1.02, 1.18)	91 per 100	99 per 100 (92, 107)	Serious[2]	Not serious	N/A[3]	Not serious	Moderate
Interactive electronic education versus video education (RR >1 favours interactive electronic education)										
Pregnant women										
1 (Kriss 2017)	RCT	66	RR 1.70 (0.92, 3.14)	30 per 100	52 per 100 (28, 95)	Serious[2]	Not serious	N/A[3]	Very serious[10]	Very low
Video versus written advice (RR >1 favours video)										
11-18 year olds										
1 (Lee 2018)	RCT	19	RR 0.90 (0.16, 5.13)	22 per 100	20 per 100 (4, 114)	Serious[2]	Not serious	N/A[3]	Very serious[10]	Very low
Prenatal face-to-face education versus postpartum education (RR >1 favours prenatal education)										
0-5 year olds										
1 (Saitoh 2013)	cluster RCT	74	RR 0.71 (0.36, 1.40)	38 per 100	27 per 100 (14, 53)	Serious[2]	Not serious	N/A[3]	Very erious[10]	Very low
ADJUSTED cRCT: Face-to-face education with an immunisation specialist versus webinar with an immunisation specialist (11-12 year olds, meningococcal) (RR >1 favours face-to-face education)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	21784[7]	RR 1.04 (0.95, 1.14)	60 per 100	62 per 100 (57, 68)	Very serious[9]	Not serious	N/A[3]	Serious[4]	Very low
ADJUSTED cRCT: Face-to-face education with an immunisation specialist versus webinar with an immunisation specialist (13-18 year olds catch-up, meningococcal) (RR >1 favours face-to-face education)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	49844[8]	RR 1.1 (1.02, 1.19)	66 per 100	73 per 100 (67, 78)	Very serious[9]	Not serious	N/A[3]	Not serious	Low
ADJUSTED cRCT: Face-to-face education with an immunisation specialist versus webinar with an immunisation specialist (11-12 year olds, HPV 1 dose or more) (RR >1 favours face-to-face education)										
11-18 year olds										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Gilkey 2014)	cluster RCT	21784[7]	RR 0.93 (0.78, 1.11)	31 per 100	29 per 100 (24, 35)	Very serious[9]	Not serious	N/A[3]	Serious[4]	Very low
ADJUSTED cRCT: Face-to-face education with an immunisation specialist versus webinar with an immunisation specialist (13-18 year olds catch-up, HPV 1 dose or more) (RR >1 favours face-to-face education)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	49844[8]	RR 1.06 (0.96, 1.22)	39 per 100	41 per 100 (37, 47)	Very serious[9]	Not serious	N/A[3]	Serious[4]	Very low

1. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and the sample size was sufficiently small (<200) that it is not plausible that any realistic effect size could have been detected
2. Downgraded once for risk of bias: greater than 33.3% of the weight in a meta-analysis came from studies at moderate or high risk of bias
3. There was only one study so there was no inconsistency
4. Downgraded once for imprecision: the 95% confidence intervals crossed the line of no effect
5. The data from the cluster RCT was unadjusted for clustering and provided as a percentage. The n-numbers were not provided. Therefore, this is the relative risk of the percentage uptakes
6. The data in the study was provided as an odds ratio and there was insufficient data to calculate the absolute risks. In other words, there was no prevalence uptake data provided.
7. Gilkey 2014 does not say how many participants were in each arm. Because participants were randomised, it is probable that roughly 10,892 participants were in each arm for the 11-12 years age group. The data has been synthesised accordingly and adjusted for clustering.
8. Gilkey 2014 does not say how many participants were in each arm. Because participants were randomised, it is probable that roughly 24,922 participants were in each arm for the 13-18 years age catch-up group. The data has been synthesised accordingly and adjusted for clustering.
9. Downgraded twice for risk of bias: greater than 33.3% of the weight in a meta-analysis came from studies at high risk of bias
10. Downgraded twice for imprecision: the 95% confidence intervals crossed the line of no effect and the number of participants was <200.

Education interventions aimed at providers compared to control

Table 22 GRADE table for education interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Fact sheet attached to all patient notes versus control (RR >1 favours intervention)										
65 years and older										
1 (Cowan 1992)	cluster RCT	49	RR 5.75 (0.31, 105.70)	Not calculable [9]	Not calculable[9]	Very serious[3]	Not serious	N/A[5]	Very serious[1]	Very low
ADJUSTED cRCT: face-to-face education with an immunisation specialist versus control (11-12 year olds, meningococcal) (RR >1 favours intervention)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	21784[a]	RR 1.15 (1.04, 1.27)	54 per 100	62 per 100 (56, 68)	Very serious[3]	Not serious	N/A[5]	Not serious	Moderate
ADJUSTED cRCT: face-to-face education with an immunisation specialist versus control (13-18 year olds catch-up, meningococcal) (RR >1 favours intervention)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	49844[b]	RR 1.01 (0.94, 1.09)	71 per 100	72 per 100 (67, 78)	Very serious[3]	Not serious	N/A[5]	Serious[10]	Very low
ADJUSTED cRCT: face-to-face education with an immunisation specialist versus control (11-12 year olds, HPV 1 dose or more) (RR >1 favours intervention)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	21784[a]	RR 0.9 (0.75, 1.07)	32 per 100	29 per 100 (24, 35)	Very serious[3]	Not serious	N/A[5]	Serious[10]	Very low
ADJUSTED cRCT: face-to-face education with an immunisation specialist versus control (13-18 year olds catch-up, HPV 1 dose or more) (RR >1 favours intervention)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	49844[b]	RR 1.03 (0.94, 1.13)	60 per 100	62 per 100 (56, 68)	Very serious[3]	Not serious	N/A[5]	Serious[10]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
ADJUSTED cRCT: webinar with an immunisation specialist versus control (11-12 year olds, meningococcal) (RR >1 favours intervention)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	21784[a]	RR 1.11 (1.00, 1.22)	54 per 100	60 per 100 (54, 66)	Very serious[3]	Not serious	N/A[5]	Not serious	Low
ADJUSTED cRCT: webinar with an immunisation specialist versus control (13-18 year olds catch-up, meningococcal) (RR >1 favours intervention)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	49844[b]	RR 0.92 (0.85, 1.00)	71 per 100	66 per 100 (61, 71)	Very serious[3]	Not serious	N/A[5]	Serious[10]	Very low
ADJUSTED cRCT: webinar with an immunisation specialist versus control (11-12 year olds, HPV 1 dose or more) (RR >1 favours intervention)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	21784[a]	RR 0.96 (0.81, 1.14)	32 per 100	31 per 100 (26, 37)	Very serious[3]	Not serious	N/A[5]	Serious[10]	Very low
ADJUSTED cRCT: webinar with an immunisation specialist versus control (13-18 year olds catch-up, HPV 1 dose or more) (RR >1 favours intervention)										
11-18 year olds										
1 (Gilkey 2014)	cluster RCT	49844[b]	RR 0.97 (0.88, 1.06)	60 per 100	58 per 100 (53, 63)	Very serious[3]	Not serious	N/A[5]	Serious[10]	Very low

1. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and the sample size was sufficiently small (<200) that it is not plausible that any realistic effect size could have been detected.
2. Downgraded once for risk of bias: greater than 33.3% of the weight in a meta-analysis came from studies at moderate or high risk of bias.
3. Downgraded twice for risk of bias: greater than 33.3% of the weight in a meta-analysis came from studies at high risk of bias.
4. Downgraded once for directness: greater than 33.3% of the weight in a meta-analysis came from partially direct or indirect studies.
5. There was only one study so there was no inconsistency.
6. Downgraded once for inconsistency: the I^2 was between 33.3% and 66.7%
7. Downgraded once for imprecision: the 95% confidence intervals crossed the line of no effect.
8. The data from the cluster RCT was unadjusted for clustering and provided as a percentage. The n-numbers were not provided. Therefore, this is the relative risk of the percentage uptakes.
9. Not calculable because there were 0 events in the control arm.
10. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
a. Gilkey 2014 does not say how many participants were in each arm but provides participant numbers per age group. Because participants were randomised, it is probable that roughly 10,892 participants were in each arm for the 11-12 years age group. The data has been analysed accordingly and adjusted for clustering using these numbers. b. Gilkey 2014 does not say how many participants were in each arm but provides participant numbers per age group. Because participants were randomised, it is probable that roughly 24,922 participants were in each arm for the 13-18 years age catch-up group. The data has been analysed accordingly and adjusted for clustering using these numbers.										

Education interventions aimed at providers and individuals and parents compared to control

Table 23 GRADE table for education interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Providers: face-to-face education for providers, printed educational material. Parents and individuals: printed educational material, website, disease images versus control, 11-18 year olds (RR >1 favours intervention)										
1 or more HPV doses										
1 (Dempsey 2018)	cluster RCT	153	RR 1.11 (0.76, 1.63)	39 per 100	43 per 100 (30, 63)	Not serious	Not serious	N/A	Very serious[1]	Low
3 or more HPV doses										
1 (Dempsey 2018)	cluster RCT	104	RR 1.05 (0.82, 1.35)	69 per 100	72 per 100 (56, 93)	Not serious	Not serious	N/A	Very serious[1]	Low
Face-to-face education, printed educational material and interactive multimedia to show parents versus control (RR >1 favours intervention)										
Pregnant women										
1 (Chamberlain 2015)	cluster RCT	60	RR 1.43 (0.35, 5.83)	10 per 100	14 per 100 (3, 56)	Serious[2]	Not serious	N/A[5]	Very serious[1]	Very low
1. Downgraded twice for imprecision: the 95% confidence intervals crossed the line of no effect and the number of participants was <200.										

Sensitivity analyses: education or information interventions

The table below only presents the outcomes that changed when studies at high risk of bias were removed from the meta-analyses.

Education interventions aimed at individuals, parents/ carers compared to control

Table 24 GRADE table for reminders interventions compared to control without studies at high risk of bias

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information and/or education versus control (subtotals but no total) (summary by age group) (RR>1 favours information or education)										
0-5 year olds										
7[a]	RCT cluster RCT	2044	RR 1.04 (0.98, 1.12)	79 per 100	83 per 100 (78, 89)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
11-18 year olds										
8[b]	RCT cluster RCT	9674	RR 1.16 (0.99, 1.36)	68 per 100	79 per 100 (67, 92)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Education versus control (total but no Glanz 2017 data) (summary by age group) (RR>1 favours information or education)										
0-5 year olds										
6[c]	RCT cluster RCT	1572	RR 1.05 (0.97, 1.14)	82 per 100	86 per 100 (79, 93)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
11-18 year olds										
8[d]	RCT cluster RCT	9674	RR 1.16 (0.99, 1.36)	68 per 100	79 per 100 (67, 92)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Pooled result										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
18[e]	RCT cluster RCT	13439	RR 1.13 (1.05, 1.23)	63 per 100	72 per 100 (66, 78)	Serious[5]	Not serious	Very serious[1]	Not serious	Very low
Information and/or education versus control (subtotals but no total) (summary by delivery method) (RR>1 favours information or education)										
Information: website with or without social media										
3 (Glanz 2017, O'Leary 2019, Pot 2017)	RCT cluster RCT	9979	RR 1.00 (0.98, 1.03)	72 per 100	72 per 100 (70, 74)	Serious[5]	Not serious	Not serious	Serious[4]	Low
Information: printed material information, such as leaflets										
2 (Jacobson 1999, Underwood 2019)	RCT cluster RCT	561	RR 2.31 (0.44, 12.09)	9 per 100	21 per 100 (4, 112)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Education: face-to-face										
7[f]	RCT cluster RCT	998	RR 1.32 (0.96, 1.83)	38 per 100	50 per 100 (36, 69)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Information and/or education versus control (subtotals but no total) (summary by whether intervention targets an individual/parent or a group) (RR>1 favours information or education)										
Targets individuals or parents										
14[g]	RCT cluster RCT	12756	RR 1.09 (1.02, 1.18)	65 per 100	70 per 100 (66, 76)	Serious[5]	Not serious	Very serious[1]	Not serious	Very low
Targets groups of people who are together										
3 (Grandahl 2016,	cluster RCT	388	RR 1.07 (0.87, 1.33)	49 per 100	53 per 100 (43, 65)	Serious[6]	Not serious	Serious[2]	Serious[4]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Jackson 2011, Underwood 2019)										
Information and/or education versus control (subtotals but no total) (summary by tailored or generic interventions) (RR>1 favours information or education)										
Tailored										
13[h]	RCT cluster RCT	11338	RR 1.09 (1.01, 1.18)	68 per 100	74 per 100 (68, 80)	Serious[5]	Not serious	Very serious[1]	Not serious	Very low
Generic										
9[i]	RCT cluster RCT	2667	RR 1.35 (0.98, 1.86)	36 per 100	49 per 100 (36, 68)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Information and/or education versus control (subtotals but no total) (summary by who provided the information or education) (RR>1 favours information or education)										
Healthcare professionals										
6[j]	RCT cluster RCT	1527	RR 1.07 (1.00, 1.14)	69 per 100	74 per 100 (69, 100)	Serious[5]	Not serious	Not serious	Not serious	Moderate
Government health authority organisation										
1 (Pot 2017)	RCT cluster RCT	8217	RR 1.01 (0.98, 1.03)	73 per 100	71 per 100 (64, 78)	Serious[5]	Not serious	Very serious[1]	Not serious	Very low
Unspecified personnel at a health clinic										
6[k]	RCT cluster RCT	1962	RR 1.80 (1.11, 2.92)	12 per 100	21 per 100 (13, 34)	Serious[5]	Not serious	Very serious[1]	Not serious	Very low
Information versus control (summary) (RR>1 favours information or education)										
0-5 year olds										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
2 (Glanz 2017, Glanz 2020)	RCT cluster RCT	1641	RR 1.01 (0.97, 1.06)	84 per 100	85 per 100 (82, 89)	Serious[6]	Not serious	Very serious[1]	Serious[4]	Very low
11-18 year olds										
3 (Dixon 2019, Pot 2017, Underwood)	RCT cluster RCT	8285	RR 1.04 (0.92, 1.18)	72 per 100	75 per 100 (66, 85)	Serious[6]	Not serious	Serious[2]	Serious[4]	Very low
Education versus control (summary) (RR>1 favours information or education)										
0-5 year olds										
6[l]	RCT cluster RCT	1298	RR 1.05 (0.96, 1.15)	82 per 100	86 per 100 (78, 94)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
11-18 year olds										
6[m]	RCT cluster RCT	1461	RR 1.22 (0.93, 1.59)	42 per 100	51 per 100 (39, 66)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Pooled result										
10 (see subgroups above)	RCT cluster RCT	2759	RR 1.12 (1.00, 1.25)	61 per 100	68 per 100 (61, 76)	Serious[5]	Not serious	Very serious[1]	Not serious	Very low
Vaccinations for adolescents aged 11-18 years, education versus control, adolescents and parents as different subgroups (RR>1 favours information or education)										
Interventions aimed at parents										
4 (Joseph 2016,	RCT cluster RCT	8593	RR 1.33 (0.90, 1.96)	70 per 100	93 per 100 (63, 100)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Pot 2017, Scarinici 2020, Underwood 2019)										
Pooled result										
7[n]	RCT cluster RCT	9658	RR 1.14 (0.99, 1.33)	68 per 100	78 per 100 (67, 91)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Face-to-face education versus control (RR>1 favours information or education)										
0-5 year olds										
3 (Jackson 2011, Saitoh 2013, Saitoh 2017)	RCT cluster RCT	261	RR 1.42 (0.77, 2.63)	38 per 100	54 per 100 (29, 100)	Serious[6]	Not serious	Very serious[1]	Serious[4]	Very low
Pooled result										
7o	RCT cluster RCT	998	RR 1.32 (0.96, 1.83)	38 per 100	50 per 100 (36, 69)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Face-to-face education and printed educational material versus control (RR>1 favours information or education)										
11-18 year olds										
2 (Santa Maria 2021, Underwood 2019)	RCT cluster RCT	636	RR 1.15 (1.02, 1.30)	53 per 100	61 per 100 (54, 69)	Not serious	Not serious	Not serious	Not serious	High
Printed educational material versus control (RR>1 favours information or education)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
11-18 year olds										
1 (Underwood 2019)	cluster RCT	128	RR 1.04 (0.58, 1.85)	26 per 100	27 per 100 (15, 48)	Serious[6]	Not serious	N/A[3]	Very serious[7]	Very low
Pooled result										
2 (Jacobson 1999, Underwood 2019)	RCT cluster RCT	561	RR 2.31 (0.44, 12.09)	9 per 100	21 per 100 (4, 100)	Serious[5]	Not serious	Very serious[1]	Serious[4]	Very low
Education interventions aimed at providers compared to control										
Pregnant women										
1 (Chamberlain 2015)	cluster RCT	60	RR 1.43 (0.35, 5.83)	10 per 100	14 per 100 (3, 56)	Serious[6]	Not serious	N/A[3]	Very serious[7]	Very low

1. I^2 >66.7%. Quality downgraded 2 levels
2. I^2 between 33.3% - 66.7%. Quality downgraded 1 level
3. Single study. Inconsistency not applicable
4. Confidence intervals cross the line of no effect. Quality downgraded 1 level
5. >33.3% of the weight of the meta-analysis at moderate risk of bias, Quality downgraded 1 level
6. All studies in the meta-analysis at moderate risk of bias. Quality downgraded 1 level
7. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and the sample size was sufficiently small (<200) that it is not plausible that any realistic effect size could have been detected.

a. Glanz 2017, Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Zuniga 2003
b. DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Pot 2017, Santa Maria 2021, Scarinici 2020, Underwood 2019
c. Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Zuniga 2003
d. DiClemente 2015, Dixon 2019, Grandahl 2016, Joseph 2016, Santa Maria 2021, Pot 2017, Scarinici 2020, Underwood 2019
e. See c and d. Also Kriss 2017, O'Leary 2019, Jacobson 1999, Thomas 2003

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
f. Grandahl 2016, Jackson 2011, Joseph 2016, Saitoh 2013, Saitoh 2017, Scarinici 2020, Underwood 2019 g. DiClemente 2015, Dixon 2019, Glanz 2020, Hannan 2013, Jacobsen 1999, Joseph 2016, Kriss 2017, O'Leary 2019, Pot 2017, Saitoh 2013, Saitoh 2017, Santa Maria 2021, Thomas 2003, Zuniga 2003 h. DiClemente 2015, Glanz 2020, Hannan 2013, Jackson 2011, Joseph 2016, Kriss 2017, O'Leary 2019, Pot 2017, Saitoh 2013, Santa Maria 2021, Underwood 2019, Scarinici 2020, Zuniga 2003 i. Dixon 2019, Glanz 2020, Gradahl 2016, Jacobsen 1999, Kriss 2017, O'Leary 2019, Saitoh 2017, Thomas 2003, Underwood 2019 j. Grandahl 2016, Hannan 2013, Jackson 2011, Joseph 2016, Saitoh 2017, Santa Maria 2021, Zuniga 2003 k. DiClemente 2015, Dixon 2018, Jacobson 1999, Kriss 2017, O'Leary 2019, Thomas 2003 l. Glanz 2020, Hannan 2013, Jackson 2011, Saitoh 2013, Saitoh 2017, Zuniga 2003 m. DiClemente 2015, Grandahl 2016, Joseph 2016, Santa Maria 2021, Scarinici 2020, Underwood n. Grandahl 2016, Dixon 2019, Joseph 2016, Pot 2017, Scarinici 2020, Underwood 2019, Santa Maria 2021 o. Jackson 2011, Saitoh 2013, Saitoh 2017, Grandahl 2016, Joseph 2016, Scarinici 2020, Underwood 2019										

Education and reminder interventions - uptake outcome

Education or information interventions and reminders aimed at individuals or parents/carers to increase vaccine uptake compared to control

Table 25 GRADE table for Information/education and reminder interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information/education and reminders versus control (RR >1 favours intervention)										
0-5 year olds										
5 (Freed 1999, Mason 2000, O'Sullivan 1992,	RCT	1891	RR 1.22 (0.95, 1.57)	40 per 100	49 per 100 (37, 65)	Serious[1]	Not serious	Very serious[5]	Serious[4]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Otsuka-Ono 2019, Quinlivan 2003)										
11-18 year olds										
3 (Fiks 2013, Henriksen 2018, Richman 2019)	RCT cluster RCT	13254	RR 1.15 (1.04, 1.28)	16 per 100	18 per 100 (16, 20)	Serious[1]	Not serious	Very serious[5]	Serious[4]	Very low
65+ year olds										
3 (Gutschi 1998, Harari 2008, Krieger 2000)	RCT	2830	RR 1.30 (0.97, 1.73)	29 per 100	37 per 100 (28, 50)	Very serious[2]	Not serious	Very serious[5]	Serious[4]	Very low
Pooled result (all studies combined)										
11[a]	RCT cluster RCT	17737	RR 1.23 (1.08, 1.40)	20 per 100	25 per 100 (22, 28)	Very serious[3]	Not serious	Very serious[5]	Not serious	Very low

1. >33.3% of the meta-analysis from studies at moderate or high risk of bias. Quality downgraded 1 level
2. All of the meta-analysis from studies at high risk of bias. Quality downgraded 2 levels
3. >33.3% of the meta-analysis from studies at high risk of bias. Quality downgraded 2 levels
4. Confidence interval crossed the line of no effect. Quality downgraded 1 level
5. I^2 >66.7%. Quality downgraded 2 levels for inconsistency
6. I^2 >33.3%. Quality downgraded 1 level for inconsistency

a. Freed 1999, Mason 2000, O'Sullivan 1992, Otsuka-Ono 2019, Quinlivan 2003, Fiks 2013, Henriksen 2018, Richman 2019, Gutschi 1998, Harari 2008, Krieger 2000

Table 26 GRADE table for Information/education and reminder interventions compared to control, grouped by reminder type

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information/education versus control (RR >1 favours intervention)										
0-5 year olds										
Passive reminder										
3 (Freed 1999, Mason 2000, O'Sullivan 1992)	RCT	1346	RR 1.24 (0.79, 1.95)	36 per 100	44 per 100 (28, 70)	Very serious[1]	Not serious	Serious[6]	Serious[5]	Very low
Active reminder										
2 (Otsuka-Ono 2019, Quinlivan 2003)	RCT	307	RR 1.22 (0.65, 2.31)	56 per 100	68 per 100 (36, 100)	Serious[2]	Not serious	Very serious[7]	Serious[5]	Very low
11-18 year olds										
Passive reminder										
2 (Fiks 2013, Richman 2019)	RCT cluster RCT	11630	RR 1.13 (1.04, 1.22)	50 per 100	52 per 100 (46, 60)	Very serious[3]	Not serious	N/A[8]	Not serious	Low
Active reminder										
1 (Henrikse n 2018)	RCT	1624	RR 1.53 (1.02, 2.28)	7 per 100	10 per 100 (7, 15)	Serious[2]	Not serious	N/A[8]	Not serious	Moderate
65+ year olds										
Passive reminder										
2 (Gutschi 1998,	RCT	2140	RR 1.18 (1.04, 1.34)	28 per 100	33 per 100 (29, 37)	Very serious[3]	Not serious	Not serious	Not serious	Low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Harari 2008)										
Active reminder										
1 (Krieger 2000)	RCT	690	RR 1.68 (1.40, 2.03)	31 per 100	52 per 100 (43, 63)	Very serious[4]	Not serious	N/A[8]	Not serious	Low
Reminder phone calls with information about vaccination versus control (RR >1 favours intervention)										
HPV dose 1										
1 (Fiks 2013)	cluster RCT	11368	RR 1.12 (1.04, 1.22)	16 per 100	18 per 100 (17, 20)	Serious[2]	Not serious	N/A[8]	Not serious	Moderate
HPV dose 2										
1 (Fiks 2013)	cluster RCT	11368	RR 1.23 (1.11, 1.36)	10 per 100	13 per 100 (12, 14)	Serious[2]	Not serious	N/A[8]	Not serious	Moderate
HPV dose 3										
1 (Fiks 2013)	cluster RCT	11368	RR 1.42 (1.25, 1.61)	7 per 100	9 per 100 (8, 11)	Serious[2]	Not serious	N/A[8]	Not serious	Moderate

1. >33.3% of the meta-analysis from studies at high risk of bias. Quality downgraded 2 levels
2. >33.3% of the meta-analysis from studies at moderate risk of bias. Quality downgraded 1 level
3. All studies in the meta-analysis at high risk of bias. Quality downgraded 2 levels
4. Single study at high risk of bias. Quality downgraded 2 levels
5. Confidence interval crossed the line of no effect. Quality downgraded 1 level
6. I^2 >33.3%. Quality downgraded 1 level for inconsistency
7. I^2 >66.7%. Quality downgraded 2 levels for inconsistency
8. Single study. Inconsistency not applicable
9. All studies in the meta-analysis at moderate risk of bias. Quality downgraded 2 levels

Education or information plus reminder interventions aimed at individuals or parents/carers to increase vaccine uptake compared to other reminder and/ or education interventions

Table 27 GRADE table for information and reminder interventions compared to other reminder and/ or education interventions

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information and reminder intervention compared to information alone										
11-18 year olds (RR >1 favours intervention)										
1 (Tiro 2015)	RCT	337	RR 1.84 (1.20, 2.80)	16 per 100	29 per 100 (19, 44)	Not serious	Not serious	N/A[2]	Not serious	High
Educational text message reminder versus plain text message reminder										
0-5 year olds										
1 (Hofstetter 2017)	RCT	295	RR 0.84 (0.49, 1.43)	17 per 100	14 per 100 (8, 24)	Not serious	Not serious	N/A[2]	Serious[1]	Moderate
Information and reminder for all 3 vaccines versus information and reminder for 1 vaccine (RR >1 favours intervention)										
0-5 year olds										
1 (Henrikse n 2018)	RCT	463	RR 1.17 (0.79, 1.74)	16 per 100	19 per 100 (13, 28)	Serious[3]	Not serious	N/A[2]	Serious[1]	Low

1. Confidence interval crossed the line of no effect. Quality downgraded 1 level
2. Single study. Inconsistency not applicable
3. Single study at moderate risk of bias. Quality downgraded 1 level

Education or information plus reminder interventions aimed at individuals or parents/carers and providers to increase vaccine uptake compared to control

Table 28 GRADE table for education or information plus reminder interventions aimed at individuals or parents/carers and providers compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Education for patients by GPs plus 2 home visits by nurse plus ≥1 telephone reminders plus tailored information for patients and GPs (RR >1 favours intervention)										
65+ year olds										
1 (Stuck 2015)	RCT	2284	RR 1.57 (1.35, 1.82)	19 per 100	30 per 100 (25, 34)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
Group patient education or 2 home visits for patients plus tailored reminder for patients and GPs (OR >1 favours intervention)										
65+ year olds										
1 (Dapp 2011)	cluster RCT	1910	OR 2.80 (2.27, 3.45)	N/A[3]	N/A[3]	Not serious	Not serious	N/A[2]	Not serious	High

2. Single study at moderate risk of bias. Quality downgraded 1 level
3. Single study. Inconsistency not applicable
4. The data in the study was provided as an odds ratio and there was insufficient data to calculate the absolute risks (there was no prevalence uptake data provided).

Sensitivity analysis: Education or information interventions and reminders aimed at individuals or parents/carers to increase vaccine uptake compared to control

Table 29 GRADE table for Information/education and reminder interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information/education versus control (RR >1 favours intervention)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
0-5 year olds										
4 (Freed 1999, O'Sullivan 1992, Otsuka-Ono 2019, Quinlivan 2003)	RCT	1160	RR 1.23 (0.90, 1.68)	57 per 100	70 per 100 (51, 99)	Serious[1]	Not serious	Very serious[3]	Serious[2]	Very low
65+ year olds										
All studies at high risk of bias so this subgroup is removed from the analysis										
Pooled result (all studies combined)										
7 (Fiks 2013, Freed 1999, Henriksen 2018, O'Sullivan 1992, Otsuka-Ono 2019, Quinlivan 2003, Richman 2019)	RCT cluster RCT	14414	RR 1.19 (1.02, 1.39)	19 per 100	22 per 100 (19, 26)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low

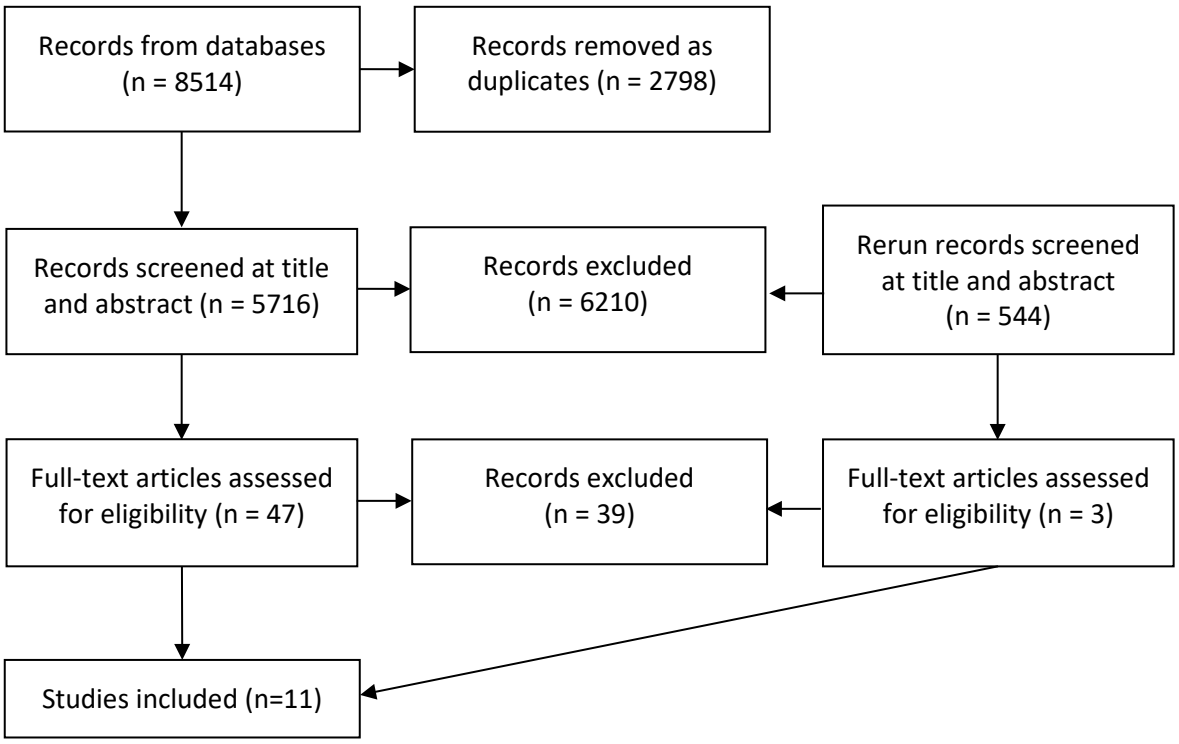
1. >33.3% of the meta-analysis from studies at moderate risk of bias. Quality downgraded 1 level
2. Confidence interval crossed the line of no effect. Quality downgraded 1 level
3. I^2 >66.7%. Quality downgraded 2 levels for inconsistency

Table 30 GRADE table for Information/education and reminder interventions compared to control, grouped by reminder type

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Information/education and reminders versus control (RR >1 favours intervention)										
0-5 year olds										
Passive reminder										
2 (Freed 1999, O'Sullivan 1992)	RCT	853	RR 1.29 (0.68, 2.45)	58 per 100	74 per 100 (39, 100)	Serious[1]	Not serious	Serious[2]	Serious[2]	Very low
65+ year olds										
All studies at high risk of bias so this subgroup is removed from the analysis										

1. >33.3% of the meta-analysis from studies at moderate risk of bias. Quality downgraded 1 level
2. Confidence interval crossed the line of no effect. Quality downgraded 1 level
3. I^2 >66.7%. Quality downgraded 2 levels for inconsistency

Appendix G – Economic evidence study selection



Appendix H – Economic evidence tables

Appendix H1 – Evidence tables

Cost-utility studies (adults)

Education and reminders

Weaver 2001

Study	Weaver et al. (2001) Cost-effectiveness of Combined Outreach for the Pneumococcal and Influenza Vaccines			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**
Economic analysis: Cost-utility analysis Study design: Decision analytic model Approach to analysis: Decision tree model, following the vaccine uptake and subsequent disease status of participants who either did or did not receive the intervention. No interaction was assumed between the two vaccines considered in the model. Perspective: US societal perspective Time horizon: Unclear Discounting: All future costs and benefits were discounted by 3%, with a scenario conducted using a 5% discount rate.	Population: People aged 65 years and older Intervention: A community-based outreach program consisting of a specially designed educational brochure, a postage-paid reply card for tracking immunity status and a follow-up phone call if the card was not returned. Comparator: No program - however other vaccine promotion activities were available at the community centre for all participants, including a volunteer nurse on site giving vaccines free of charge, and announcements in	Cost difference: As implemented (combined outreach) $22,780 (£25,363.95, 2021 GBP) As implemented (pneumococcal only) $24,724 (£27,528.46, 2021 GBP) Targeted (combined outreach) $17,267 (£19,225.61, 2021 GBP) Targeted (pneumococcal only) $24,583 (£27,371.47, 2021 GBP) Currency and cost year: USD, 1996 Costs included: Intervention costs,	QALY difference: As implemented (combined outreach) 0.64 As implemented (pneumococcal only) 0.46 Targeted (combined outreach) 1.47 Targeted (pneumococcal only) 0.65	Incremental analysis: As implemented (combined outreach) $35,486 per QALY gained (£39,511, 2021 GBP) As implemented (pneumococcal only) $53,547 per QALY gained (£59,621, 2021 GBP) Targeted (combined outreach) $11,771 per QALY gained (£13,106, 2021 GBP) Targeted (pneumococcal only) $38,030 per QALY gained (£42,344, 2021 GBP) Analysis of uncertainty: Major sources of uncertainty in the model were the effectiveness of the intervention, and of the vaccines. To address this, partial stochastic CEAs were performed, in which quasi-confidence intervals were calculated.

Study	Weaver et al. (2001) Cost-effectiveness of Combined Outreach for the Pneumococcal and Influenza Vaccines			
	newsletters and at events. The study reported results for two intervention approaches: as implemented in the trial applied to the whole population, and a targeted approach where the intervention was only aimed at seniors who had not had their vaccinations.	hospitalisation costs, illness costs, vaccine costs, participant expense costs.		A one-way sensitivity analysis was performed, in which parameter values were changed within reasonable bounds. Variables such as the cost of vaccines, frequency of influenza epidemic years and probability of a bed-disability day from influenza and pneumonia did not change the cost-effectiveness ratio by more than $1,000. Variables that did substantially change the cost-effectiveness ratio include the discount rate, the cost of intervention and the incidence and mortality rate from bacteraemia.
Data sources				
Outcomes: Primary data from an RCT was used to inform the increase in vaccination rate, and published estimates were used for the effectiveness of vaccines in preventing illness and mortality. Quality of life: The average utility in the population was estimated using the weighted average QALY for 5-year intervals as estimated by Erickson et al, where weights were number of people in each age interval in a stationary population. Disutilities were taken from the Office of Technology Assessment. Costs: The computer tracking system and materials for the intervention were valued at their purchase prices, and the cost of the computer tracking system was amortized over 5 years. Staff and volunteers kept records of the amount of time spent on the project. Staff time was valued at their salary plus benefits, and the estimates also included a 7% mark-up for general overhead, which is the overhead rate for Public Health.			
Comments				
Source of funding: Funded by the US Centers for Disease Control and Prevention, Atlanta, Ga, cooperative agreement U50/CCU011820-02 (Urban Research Centers), and United Way of King Count, Seattle, Wash.				
Overall applicability: Partially applicable				
The study looked at uptake of both the pneumococcal vaccine and the influenza vaccine, however the results were presented separately. The study setting was a US senior centre. A 3% discount rate was used for costs and outcomes, which does not match the NICE reference case.				
Overall quality: Minor limitations				
It was unclear whether an SLR had been performed. There was no mention of any potential financial conflicts of interest. A probabilistic sensitivity analysis had not been performed.				

Non-QALY outcome studies (children and adolescents)

Education

Tubeuf 2014

Study	Tubeuf et al (2014) Cost effectiveness of a web-based decision aid for parents deciding about MMR vaccination: a three-arm cluster randomised controlled trial in primary care			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**
Economic analysis: Cost-effectiveness analysis Study design: Randomised controlled trial Approach to analysis: Data from an RCT was used to compare vaccination status across two interventions and a control arm, and the costs associated with each arm. Perspective: NHS perspective (societal perspective was also considered - including parents' costs) Time horizon: 12 months Discounting: No discounting was applied	Population: First time parents whose first child was offered the first MMR vaccine (aged 3-12 months) Intervention: MMR decision aid + usual practice, or MMR leaflet + usual practice Comparator: Usual practice	Cost difference: Incremental cost of decision aid versus: Leaflet: -£7.17 (-£8.83 2021 GBP) Usual practice: -£9.20 (-£11.32 2021 GBP) (The decision aid had lower total costs than the leaflet and usual practice) Currency and cost year: GBP, 2008-2009 Costs included: Intervention and delivery costs, MMR related NHS resource use (nurse time, health visitor, GP costs etc), private expenses (societal perspective only)	Difference in outcomes: Incremental uptake (proportion) of MMR for decision aid versus: Leaflet: 0.10 Usual practice: 0.02	Incremental analysis: The decision aid intervention was dominant when compared with both the leaflet intervention and usual care - i.e. it was less costly and more effective at increasing MMR uptake. Analysis of uncertainty: There were different numbers of patients with low (<2) and high (≥2) baseline decisional conflict in each arm so patients within each arm were randomly selected to achieve the same mix in each arm. To account for potential sampling bias, this random selection was repeated 10 000 times to build up distributions for mean incremental costs and vaccine uptake. Where no value was placed on additional vaccinations, the decision aid was ~72% likely to be cost-effective, in the NHS perspective. In comparison, the leaflet and usual practice arms had only a 22% and 8% chance of being cost-effective, respectively. The decision aid had an 88% chance of being cost effective when vaccinating

Study	Tubeuf et al (2014) Cost effectiveness of a web-based decision aid for parents deciding about MMR vaccination: a three-arm cluster randomised controlled trial in primary care			
				an additional child is valued at £100. If the value placed on vaccinating an additional child is not negative, the decision aid appears to be the most cost-effective option.
Data sources				
Outcomes: Data on uptake of first-dose MMR was collected from GP practices 9 months after trial recruitment. Missing data in baseline characteristics was imputed using a multiple imputation method. Quality of life: Quality of life was not included as an outcome Costs: Resource use was collected in the post-intervention questionnaire, with parents reporting the intended and actual number of MMR-related contacts with a health professional. GP, nurse, and health visitor costs were taken from the PSSRU Unit costs of health and social care. Missing cost data was imputed using a multiple imputation method.				
Comments				
The study was funded by the Research for Patient Benefit Programme of the National Institute for Health Research (NIHR) (reference number: PB-PG-0107-12048).				
Overall applicability: Partially applicable				
The study was a cost-effectiveness analysis, using increase in MMR vaccine uptake as an outcome rather than QALYs.				
Overall quality: Potentially serious limitations				
The analysis was conducted on the results of the RCT, so long-term outcomes and costs were not considered. To account for potential sampling bias, patients in each arm were randomly selected to ensure the same mix of different levels of decisional conflict. No other sensitivity analysis was completed.				

Zhou 2003

Study	Zhou et al (2003) Economic Analysis of Promotion of Hepatitis B Vaccinations Among Vietnamese-American Children and Adolescents in Houston and Dallas			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**
Economic analysis: Cost-effectiveness and cost-benefit analysis Study design: Controlled program evaluation	Population: Vietnamese-American children born between 1984-1993 Intervention: (1) a media intervention campaign	Cost difference: Total cost of the media intervention including (excluding) vaccination costs: $313,904	Difference in outcomes: Media intervention arm, years of life saved at varied	Incremental analysis: Cost per LY saved, media intervention: 3% (5%) discounting, 30% infection rate: $19,909 ($45,035) [£20,778 (£47,000) 2021 GBP]

Study	Zhou et al (2003) Economic Analysis of Promotion of Hepatitis B Vaccinations Among Vietnamese-American Children and Adolescents in Houston and Dallas			
Approach to analysis: Costs and outcomes from the two interventions were recorded and analysed against a control to determine cost per additional child vaccinated, cost per life-year saved, and the benefit-cost ratio. Perspective: Societal perspective Time horizon: Lifetime Discounting: 3% and 5% discount rates were considered	(Houston) - consisting of billboards, radio and print adverts, news articles, brochures etc. (2) community mobilization interventions (Dallas) - consisting of representatives from health-care, public health, education, business, community organisations, press, veterans, seniors and researchers. These representatives conducted outreach, provided information, distributed educational brochures and pamphlets etc. Comparator: A control site in Washington DC Metropolitan area received no uptake intervention	($153,323) [£327,598 (£160,012) 2021 GBP] N=8,692, cost per person ~$36.11 ($17.64) [£37.69 (£18.41) 2021 GBP] Total cost of the community mobilization intervention including (excluding) vaccination costs: $169,561 ($106,276) [£176,958 (£110,912) 2021 GBP] N=5,657, cost per person ~$29.97 ($18.79) [£31.28 (£19.61) 2021 GBP] Currency and cost year: USD, 2000 Costs included: vaccine and administration costs, intervention related costs, personnel costs, parent time lost.	infection rates: 30%: 65 45%: 98 60%: 131 75%: 163 Community mobilization intervention arm, years of life saved at varied infection rates: 30%: 30 45%: 45 60%: 60 75%: 75	3% (5%) discounting, 45% infection rate: $13,272 ($34,591) [£13,851 (£36,100) 2021 GBP] 3% (5%) discounting, 60% infection rate: $9,954 ($22,517) [£10,388 (£23,499) 2021 GBP] 3% (5%) discounting, 75% infection rate: $7,963 ($18,014) [£8,282 (£18,800) 2021 GBP] Cost per LY saved, community mobilization intervention: 3% (5%) discounting, 30% infection rate: $23,519 ($53,583) [£24,545 (£55,921) 2021 GBP] 3% (5%) discounting, 45% infection rate: $15,679 ($35,722) [£16,363 (£37,280) 2021 GBP] 3% (5%) discounting, 60% infection rate: $11,759 ($26,792) [£12,272 (£27,961) 2021 GBP] 3% (5%) discounting, 75% infection rate: $9,407 ($21,433) [£9,817 (£22,368) 2021 GBP] Benefit-cost ratio, media intervention: 3% (5%) discounting, 30% infection rate: 2.63 (1.32) 3% (5%) discounting, 45% infection rate: 3.94 (1.72) 3% (5%) discounting, 60% infection rate: 5.26 (2.64) 3% (5%) discounting, 75% infection rate: 6.57 (3.30) Benefit-cost ratio, community mobilization intervention: 3% (5%) discounting, 30% infection

Study	Zhou et al (2003) Economic Analysis of Promotion of Hepatitis B Vaccinations Among Vietnamese-American Children and Adolescents in Houston and Dallas			
				rate: 2.23 (1.11) 3% (5%) discounting, 45% infection rate: 3.35 (1.67) 3% (5%) discounting, 60% infection rate: 4.47 (2.23) 3% (5%) discounting, 75% infection rate: 5.59 (2.78) Analysis of uncertainty: Sensitivity analyses were conducted to explore the effect of the assumptions for discount rate and infection rate. Benefit-cost ratios and incremental cost-effectiveness were calculated for all combinations of 3% and 5% discount rates and 30% to 75% rates of infection, at increments of 15%. The broad range of infection rates was used to account for the potential variability resulting from differences in baseline vaccination levels, risk levels, and different ages at immigration.
Data sources				
Outcomes: The estimate of coverage was conservative, with children whose parents/providers did not have a written vaccination record with dates for HepB vaccination were counted as not having received the vaccine. These estimates were taken directly from the study data. Outcomes data was taken directly from the study. Quality of life: Quality of life was not included as an outcome Costs: The costs associated with the intervention were informed directly from those costs incurred during the study. Some assumptions were made around informal caregiver time and wages.				
Comments				
The research was supported by funds provided by the CDC under Cooperative Agreement U66/CCU915175.				
Overall applicability: Partially applicable				

Study	Zhou et al (2003) Economic Analysis of Promotion of Hepatitis B Vaccinations Among Vietnamese-American Children and Adolescents in Houston and Dallas
The population was an under-vaccinated group, and the whole-life infection rate was assumed to be very high (60%). The study was a cost-effectiveness and cost-benefit analysis, using non-QALY outcomes. Some societal costs were included, and the study was conducted in a US media/community system. Discount rates of 3% and 5% were considered.	
Overall quality: Potentially serious limitations	
No probabilistic sensitivity analyses were conducted.	

Appendix H2 – Study quality tables

Cost-utility studies (Adults)

Education and reminders

Weaver 2001

Study Identification: Weaver 2001, Cost-effectiveness of combined outreach for the pneumococcal and influenza vaccines.		
Guidance topic: Vaccines in the general population		**Question no: 2**
Checklist completed by: Hannah Lomax		
Section 1: Applicability (relevance to specific review questions and the NICE reference case as described in section 7.5) This checklist should be used first to filter out irrelevant studies.	**Yes/partly/no/unclear/NA**	**Comments**
1.1 Is the study population appropriate for the review question?	Yes	People aged 65+ only - receiving influenza and pneumococcal vaccines with results reported separately Pneumococcal vaccine is routine for 65+ years
1.2 Are the interventions appropriate for the review question?	Yes	Educational brochure with reply card and follow-up phone call Uptake of pneumococcal vaccine and influenza vaccine were targeted - influenza is not relevant to the review

Study Identification: Weaver 2001, Cost-effectiveness of combined outreach for the pneumococcal and influenza vaccines.		
		question but results are reported separately.
1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	Partly	US senior centre, vaccines provided in the senior centre with no cost to the patient
1.4 Is the perspective for costs appropriate for the review question?	Partly	Societal perspective - all costs included were healthcare-related costs with the addition of "participant expenses"
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	Societal perspective - all outcomes included were health-related
1.6 Are all future costs and outcomes discounted appropriately?	Partly	Discounted at 3%
1.7 Are QALYs, derived using NICE's preferred methods, or an appropriate social care-related equivalent used as an outcome? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.5 above).	Yes	
1.8 Overall judgement: **Partially applicable** There is no need to use section 2 of the checklist if the study is considered 'not applicable'		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the guideline	**Yes/partly/no/unclear/NA**	**Comments**
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Unclear	Time horizon was not mentioned in the paper
2.3 Are all important and relevant outcomes included?	Yes	QALYs, LYs saved, proportion of individuals receiving vaccines
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	RCT and case-control study
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	RCT
2.6 Are all important and relevant costs included?	Yes	Costs of intervention, hospitalisation, expenses, outpatient visits and vaccines

Study Identification: Weaver 2001, Cost-effectiveness of combined outreach for the pneumococcal and influenza vaccines.		
2.7 Are the estimates of resource use from the best available source?	Unclear	It was unclear whether the resource use had been identified in an SLR or not
2.8 Are the unit costs of resources from the best available source?	Yes	Various sources but relevant to the US perspective
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Partly	Probabilistic analysis was not done but a one-way sensitivity analysis was included
2.11 Has no potential financial conflict of interest been declared?	Unclear	No mention
2.12 Overall assessment: **Minor limitations**		

Non-QALY outcome studies (Children and adolescents)

Education

Tubeuf 2014

Study Identification: Tubeuf et al (2014) Cost effectiveness of a web-based decision aid for parents deciding about MMR vaccination: a three-arm cluster randomised controlled trial in primary care		
Guidance topic: Vaccines in the general population		**Question no: 2**
Checklist completed by: Hannah Lomax		
Section 1: Applicability (relevance to specific review questions and the NICE reference case as described in section 7.5) This checklist should be used first to filter out irrelevant studies.	**Yes/partly/no/unclear/NA**	**Comments**
1.1 Is the study population appropriate for the review question?	Yes	
1.2 Are the interventions appropriate for the review question?	Yes	
1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	Yes	
1.4 Is the perspective for costs appropriate for the review question?	Yes	
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	

Study Identification: Tubeuf et al (2014) Cost effectiveness of a web-based decision aid for parents deciding about MMR vaccination: a three-arm cluster randomised controlled trial in primary care		
1.6 Are all future costs and outcomes discounted appropriately?	Yes	No discounting was applied as the model assumed all expenditures occurred within the first year
1.7 Are QALYs, derived using NICE's preferred methods, or an appropriate social care-related equivalent used as an outcome? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.5 above).	No	Non-QALY outcomes were considered (increase in uptake of the MMR vaccine)
1.8 Overall judgement: **Partially applicable** There is no need to use section 2 of the checklist if the study is considered 'not applicable'		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the guideline	**Yes/partly/no/unclear/NA**	**Comments**
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Partly	The analysis was conducted on the results of the RCT, so long-term outcomes and costs were not considered
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	
2.3 Are all important and relevant outcomes included?	Yes	
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	Baseline outcomes from the control arm of the study
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	Relative effects were taken from the study
2.6 Are all important and relevant costs included?	Yes	All costs of the intervention and the NHS resource use were included
2.7 Are the estimates of resource use from the best available source?	Yes	Data collected in the post-intervention questionnaire
2.8 Are the unit costs of resources from the best available source?	Yes	
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	No	To account for potential sampling bias, patients in each arm were randomly

Study Identification: Tubeuf et al (2014) Cost effectiveness of a web-based decision aid for parents deciding about MMR vaccination: a three-arm cluster randomised controlled trial in primary care		
		selected to ensure the same mix of different levels of decisional conflict. No other sensitivity analysis was completed
2.11 Has no potential financial conflict of interest been declared?	Yes	The authors declared no financial conflicts.
2.12 Overall assessment: **Potentially serious limitations**		

Zhou 2003

Study Identification: Zhou et al (2003) Economic Analysis of Promotion of Hepatitis B Vaccinations Among Vietnamese-American Children and Adolescents in Houston and Dallas		
Guidance topic: Vaccines in the general population		**Question no: 2**
Checklist completed by: Hannah Lomax		
Section 1: Applicability (relevance to specific review questions and the NICE reference case as described in section 7.5) This checklist should be used first to filter out irrelevant studies.	**Yes/partly/no/unclear/NA**	**Comments**
1.1 Is the study population appropriate for the review question?	Partly	An under vaccinated group - Vietnamese-American children and adolescents (60% whole-life infection rate was assumed which is very high)
1.2 Are the interventions appropriate for the review question?	Yes	Intervention promoting uptake of catch-up campaigns
1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	Partly	US media/community led programme
1.4 Is the perspective for costs appropriate for the review question?	Partly	Some societal costs were included
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	
1.6 Are all future costs and outcomes discounted appropriately?	Partly	Costs and outcomes were discounted at both 3% and 5%
1.7 Are QALYs, derived using NICE's preferred methods, or an appropriate social care-related equivalent used as an outcome? If	No	Non-QALY outcomes were considered (LYs saved and benefit-cost ratios)

Study Identification: Zhou et al (2003) Economic Analysis of Promotion of Hepatitis B Vaccinations Among Vietnamese-American Children and Adolescents in Houston and Dallas		
not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.5 above).		
1.8 Overall judgement: **Partially applicable** There is no need to use section 2 of the checklist if the study is considered 'not applicable'		
Section 2: Study limitations (the level of methodological quality) **This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the guideline**	**Yes/partly/no/unclear/NA**	**Comments**
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	Lifetime time horizon
2.3 Are all important and relevant outcomes included?	Yes	
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	Baseline outcomes were taken from the populations before the interventions were introduced
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	Yes, from the study
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Yes	As reported in the study
2.8 Are the unit costs of resources from the best available source?	Yes	As reported in the study
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	Partly	Scenarios around first dose seroprotection rate, discount rate and infection rate assumptions were explored, but no probabilistic analysis was conducted
2.11 Has no potential financial conflict of interest been declared?	Unclear	No mention of conflicts
2 Overall assessment: **Potentially serious limitations**		

Appendix I – Health economic model

Original health economic modelling was not prioritised for this review question.

Appendix J – Excluded studies

Clinical studies

Excluded from the original search

Study	Reason for exclusion
Abdullahi, L.H., Kagina, B.M., Ndze, V.N. et al. (2020) Improving vaccination uptake among adolescents. Cochrane Database of Systematic Reviews 2020(1): cd011895	- Systematic review used as source of primary studies
Abuelenen, T., Khalil, S., Simoneit, E. et al. (2020) Prevent and Protect: A Vaccination Initiative for Uninsured Patients at a Student-Run Free Clinic. Journal of community health	- The intervention is a free vaccine- not in scope *Also, the comparator is the US national vaccine uptake.*
Achat, H; McIntyre, P; Burgess, M (1999) Health care incentives in immunisation. Australian and New Zealand journal of public health 23(3): 285-8	- Systematic review used as source of primary studies
Acosta, J., Benages, C., Diaz, M.A. et al. (2016) Preventing pertussis in the early infant: Development and results of a prenatal vaccination program. Acta Medica International 3(2): 78-81	- Does not contain an outcome of relevance to this review *This study looks at infants who have had whooping cough and compares the outcomes of vaccinated vs unvaccinated participants.*
Adams, Jean, Bateman, Belinda, Becker, Frauke et al. (2015) Effectiveness and acceptability of parental financial incentives and quasi-mandatory schemes for increasing uptake of vaccinations in preschool children: systematic review, qualitative study and discrete choice experiment. Health technology assessment (Winchester, England) 19(94): 1-176	- Systematic review used as source of primary studies
Adams, Jean, McNaughton, Rebekah J, Wigham, Sarah et al. (2016) Acceptability of Parental Financial Incentives and Quasi-Mandatory Interventions for Preschool Vaccinations: Triangulation of Findings from Three Linked Studies. PloS one 11(6): e0156843	- Not a relevant study design
Adjei Boakye, Eric, Tobo, Betelihem B, Osazuwa-Peters, Nosayaba et al. (2017) A Comparison of Parent- and Provider-Reported Human Papillomavirus Vaccination of Adolescents. American journal of preventive medicine 52(6): 742-752	- Study does not contain an intervention aimed at increasing vaccine uptake *This study looks at reporting vaccine uptake in terms of*

Study	Reason for exclusion
	provider records vs parental recall.
Afzal, Muhammad, Yaqub, Asma, Khalid, Sobia et al. (2017) An effective and doable interventional strategy to enhance vaccination coverage - are we ready to change?. JPMA. The Journal of the Pakistan Medical Association 67(11): 1719-1722	- Study took place in a non-OECD country
Albert, S.M., Nowalk, M.P., Yonas, M.A. et al. (2012) Standing orders for influenza and pneumococcal polysaccharide vaccination: correlates identified in a national survey of U.S. Primary care physicians. BMC family practice 13: 22	- Does not contain an outcome of relevance to this review
Alemi, F, Alemagno, SA, Goldhagen, J et al. (1996) Computer reminders improve on-time immunization rates. Medical care 34(10suppl): OS45-51	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Amirian, I, Huston, S, Ha, D et al. (2017) Results of immunization delivery enhancement intervention on pneumococcal and herpes zoster immunization planning in alabama and california community pharmacies. Journal of the american pharmacists association 57(3)	- Conference abstract
Andrews, R.M. (2005) Assessment of vaccine coverage following the introduction of a publicly funded pneumococcal vaccine program for the elderly in Victoria, Australia. Vaccine 23(21): 2756-2761	- Not a relevant study design *This is a survey. Furthermore, there is no intervention to increase uptake beyond making a vaccine freely available.*
Andrews, Ross M, Skull, Susan A, Byrnes, Graham B et al. (2005) Influenza and pneumococcal vaccine coverage among a random sample of hospitalised persons aged 65 years or more, Victoria. Communicable diseases intelligence quarterly report 29(3): 283-8	- The intervention is a free vaccine- not in scope
Anonymous (1979) AAP immunization schedules. IMJ. Illinois medical journal 155(5): 310-1	- Full text paper or book article is unavailable *This is probably the 1979 edition of the immunisation schedule published by the American Academy of Pediatrics*

Study	Reason for exclusion
Anonymous (2013) Nursing interventions help protect older adults. Nursing 43(4): 26	- Not a review of published literature *Brief commentary about a review article.*
Anonymous. (2005) Automated standing orders to nurses increase influenza and pneumococcal vaccination rates among inpatients compared with reminders to physicians. Evidence-Based Healthcare and Public Health 9(3): 211-212	- Duplicate reference *This is a summary of Dexter 2004*
Arslan I, Beyazova U, Aksakal N et al. (2012) New opportunity for vaccinating older people: well-child clinic visits. Pediatrics international : official journal of the Japan Pediatric Society 54(1): 45-51	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Ashton-Key M and Jorge E (2003) Does providing social services with information and advice on immunisation status of "looked after children" improve uptake?. Archives of disease in childhood 88(4): 299-301	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Atkins K, van Hoek AJ, Watson C et al. Seasonal influenza vaccination delivery through community pharmacists in England: evaluation of the London pilot. BMJ open 6(2): e009739	- Data not reported in an extractable format *This is a before-and-after study but no patient numbers are provided for before 2013/2014 when the intervention was introduced. Therefore, the data is not in an extractable format.*
Atkinson, K.M., Wilson, K., Murphy, M.S.Q. et al. (2019) Effectiveness of digital technologies at improving vaccine uptake and series completion - A systematic review and meta-analysis of randomized controlled trials. Vaccine 37(23): 3050-3060	- Systematic review used as source of primary studies
Au, L; Tso, A; Chin, K (1997) Asian-American adolescent immigrants: the New York City schools experience. The Journal of school health 67(7): 277-9	- Vaccine on UK routine schedule but wrong context for administration

Study	Reason for exclusion
	In the UK, HepB vaccine is given to 0-1 year olds, not 7-13 year olds
Averhoff, F., Linton, L., Peddecord, K.M. et al. (2004) A middle school immunization law rapidly and substantially increases immunization coverage among adolescents. American Journal of Public Health 94(6): 978-984	- Vaccine on UK routine schedule but wrong context for administration *The intervention is for HepB and MMR. In the UK, these are relevant for 0-4 years. However, the study looks at interventions specific to 10-12 year olds at school.*
Bacci, Jennifer L, Hansen, Ryan, Ree, Christina et al. (2019) The effects of vaccination forecasts and value-based payment on adult immunizations by community pharmacists. Vaccine 37(1): 152-159	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Bach, A.T., Kang, A.Y., Lewis, J. et al. (2019) Addressing common barriers in adult immunizations: a review of interventions. Expert Review of Vaccines 18(11): 1167-1185	- Systematic review used as source of primary studies
Bakare, Mobolaji, Shrivastava, Rakesh, Jeevanantham, Vinodh et al. (2007) Impact of two different models on influenza and pneumococcal vaccination in hospitalized patients. Southern medical journal 100(2): 140-4	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Balzarini, F., Frascella, B., Oradini-Alacreu, A. et al. (2020) Does the use of personal electronic health records increase vaccine uptake? A systematic review. Vaccine 38(38): 5966-5978	- Systematic review used as source of primary studies
Bangure, Donewell, Chirundu, Daniel, Gombe, Notion et al. (2015) Effectiveness of short message services reminder on childhood immunization programme in Kadoma, Zimbabwe - a randomized controlled trial, 2013. BMC public health 15: 137	- Study took place in a non-OECD country
Bardenheier, Barbara, Shefer, Abigail, Tiggle, Ronald et al. (2005) Nursing home resident and facility characteristics associated with pneumococcal vaccination: national nursing home survey, 1995-1999. Journal of the American Geriatrics Society 53(9): 1543-51	- The study did not report any of the outcomes specified in the protocol

Study	Reason for exclusion
Baroy, Justin, Chung, Danny, Frisch, Ryan et al. (2016) The impact of pharmacist immunization programs on adult immunization rates: A systematic review and meta-analysis. Journal of the American Pharmacists Association : JAPhA 56(4): 418-26	- Systematic review used as source of primary studies
Bassani, Diego G, Arora, Paul, Wazny, Kerri et al. (2013) Financial incentives and coverage of child health interventions: a systematic review and meta-analysis. BMC public health 13suppl3: 30	- Systematic review of non-OECD countries
Baumann, A., Andersen, B., Ostergaard, L. et al. (2019) Sense & sensibility: Decision-making and sources of information in mothers who decline HPV vaccination of their adolescent daughters. Vaccine: X 2: 100020	- Not a relevant study design
Baxter D (2013) Approaches to the vaccination of pregnant women: experience from Stockport, UK, with prenatal influenza. Human vaccines & immunotherapeutics 9(6): 1360-1363	- Data not reported in an extractable format *The number of participants in each arm was not provided.*
Becker DM, Gomez EB, Kaiser DL et al. (1989) Improving preventive care at a medical clinic: how can the patient help?. American journal of preventive medicine 5(6): 353-359	- Study published before 1990 date limit set in review protocol
Bedford, H. (2014) Randomised controlled trial: Pro-vaccine messages may be counterproductive among vaccine-hesitant parents. Evidence-Based Medicine 19(6): 219	- Does not contain an outcome of relevance to this review *This study measures intention, not uptake.*
Bedwick, Brian W; Garofoli, Gretchen K; Elswick, Betsy M (2017) Assessment of targeted automated messages on herpes zoster immunization numbers in an independent community pharmacy. Journal of the American Pharmacists Association : JAPhA 57(3s): 293-s297e1	- Does not contain an outcome of relevance to this review
Beggs, Ashton E, Morrical-Kline, Karie A, Wilhoite, Jessica E et al. (2013) Effect of an intervention on medical resident knowledge and adult immunization rates. Family medicine 45(2): 118-21	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Belmaker, I, Dukhan, L, Elgrici, M et al. (2006) Reduction of vaccine-preventable communicable diseases in a Bedouin population: summary of a community-based intervention programme. Lancet (London, England) 367(9515): 987-91	- Study took place in a non-OECD country
Benabbas, R., Shan, G., Akindutire, O. et al. (2019) The Effect of Pay-for-Performance Compensation Model Implementation on Vaccination Rate: A Systematic Review. Quality management in health care 28(3): 155-162	- Systematic review used as source of primary studies
Berenson, Abbey B, Rahman, Mahbubur, Hirth, Jacqueline M et al. (2015) A brief educational intervention increases providers' human papillomavirus vaccine knowledge. Human vaccines & immunotherapeutics 11(6): 1331-6	- Study does not contain an intervention aimed at increasing vaccine uptake
Berg GD, Fleegler E, vanVonno CJ et al. (2005) A matched-cohort study of health services utilization outcomes for a heart failure disease management program. Disease management : DM 8(1): 35-41	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Berg, Gregory D, Thomas, Eileen, Silverstein, Steven et al. (2004) Reducing medical service utilization by encouraging vaccines: randomized controlled trial. American journal of preventive medicine 27(4): 284-8	- Study does not contain an intervention aimed at increasing vaccine uptake *The 2 marketing pieces were identical and aimed at increasing influenza vaccine uptake - not pneumonia vaccine uptake. Pneumonia vaccine uptake was measured coincidentally.*
Betsch, Cornelia, Rossmann, Constanze, Pletz, Mathias W et al. (2018) Increasing influenza and pneumococcal vaccine uptake in the elderly: study protocol for the multi-methods prospective intervention study Vaccination60. BMC public health 18(1): 885	- Protocol for a future study
Bigham, M., Remple, V.P., Pielak, K. et al. (2006) Uptake and behavioural and attitudinal determinants of immunization in an expanded routine infant hepatitis B vaccination program in British Columbia. Canadian Journal of Public Health 97(2): 90-95	- Study does not contain an intervention aimed at increasing vaccine uptake *The intervention is nothing more than a free vaccine.*

Study	Reason for exclusion
Bitton, A., Baughman, A.W., Carlini, S. et al. (2016) Enhanced primary care and impact on quality of care in Massachusetts. American Journal of Managed Care 22(5): e169-e174	- Not a relevant study design
Bloom, H.G.; Wheeler, D.A.; Linn, J. (1999) A managed care organization's attempt to increase influenza and pneumococcal immunizations for older adults in an acute care setting. Journal of the American Geriatrics Society 47(1): 106-110	- Does not contain an outcome of relevance to this review *This study does not have a comparator*
Bloom, HG, Bloom, JS, Krasnoff, L et al. (1988) Increased utilization of influenza and pneumococcal vaccines in an elderly hospitalized population. Journal of the American Geriatrics Society 36(10): 897-901	- Study published before 1990 date limit set in review protocol
Bonafide, Katherine E and Vanable, Peter A (2015) Male human papillomavirus vaccine acceptance is enhanced by a brief intervention that emphasizes both male-specific vaccine benefits and altruistic motives. Sexually transmitted diseases 42(2): 76-80	- Does not contain an outcome of relevance to this review
Bond, L., Davie, G., Carlin, J.B. et al. (2002) Increases in vaccination coverage for children in child care, 1997 to 2000: An evaluation of the impact of government incentives and initiatives. Australian and New Zealand Journal of Public Health 26(1): 58-64	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Boom JA, Nelson CS, Kohrt AE et al. (2010) Utilizing peer academic detailing to improve childhood immunization coverage levels. Health promotion practice 11(3): 377-386	- Does not contain an outcome of relevance to this review *Study does not measure uptake. It measures "coverage" and explains this is not uptake but does not fully explain what the criteria are for adequate coverage.*
Boom, Julie A, Nelson, Cynthia S, Laufman, Larry E et al. (2007) Improvement in provider immunization knowledge and behaviors following a peer education intervention. Clinical pediatrics 46(8): 706-17	- Does not contain an outcome of relevance to this review

Study	Reason for exclusion
	The data is a survey of opinions and attitudes.
Borgiel, Alexander E M, Williams, J Ivan, Davis, David A et al. (1999) Evaluating the effectiveness of 2 educational interventions in family practice: CMAJ. Canadian Medical Association. Journal 161(8): 965-70	- Does not contain an outcome of relevance to this review *Does not measure vaccine uptake*
Bouchez, M., Ward, J.K., Bocquier, A. et al. (2021) Physicians' decision processes about the HPV vaccine: A qualitative study. Vaccine 39(3): 521-528	- Not a relevant study design *Qualitative study - considered for the qualitative review*
Brabin, Loretta, Roberts, Stephen A, Stretch, Rebecca et al. (2008) Uptake of first two doses of human papillomavirus vaccine by adolescent schoolgirls in Manchester: prospective cohort study. BMJ (Clinical research ed.) 336(7652): 1056-8	- Does not contain an outcome of relevance to this review *There is no comparator*
Brackett, Amber; Butler, Michell; Chapman, Liza (2015) Using motivational interviewing in the community pharmacy to increase adult immunization readiness: A pilot evaluation. Journal of the American Pharmacists Association : JAPhA 55(2): 182-6	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Bradshaw, C., DiFrisco, E., Schweizer, W. et al. (2020) Improving birth dose hepatitis B vaccination rates: A quality improvement intervention. Hospital Pediatrics 10(5): 430-437	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Braeckman, T., Van Herck, K., Raes, M. et al. (2011) Rotavirus vaccines in Belgium: Policy and impact. Pediatric Infectious Disease Journal 30(suppl1): 21-s24	- Does not contain an outcome of relevance to this review
Brewer, NT, Gilkey, MB, Malo, TL et al. (2018) Efficient and participatory strategies for recommending HPV vaccination: a randomized controlled trial. Pediatrics 141(1)	- Conference abstract

Study	Reason for exclusion
Brewer, NT, Hall, ME, Malo, TL et al. (2017) Announcements Versus Conversations to Improve HPV Vaccination Coverage: a Randomized Trial. Pediatrics 139(1)	- Data not reported in an extractable format *Data was given as percentages without participant numbers*
Brigham, Kathryn S, Woods, Elizabeth R, Steltz, Sarah K et al. (2012) Randomized controlled trial of an immunization recall intervention for adolescents. Pediatrics 130(3): 507-14	- Data not reported in an extractable format *The study reports combined uptake data for 3 vaccinations but chickenpox vaccination is not on the UK routine schedule.*
Brimberry, R (1988) Vaccination of high-risk patients for influenza. A comparison of telephone and mail reminder methods. The Journal of family practice 26(4): 397-400	- Study published before 1990 date limit set in review protocol - The study did not report any of the outcomes specified in the protocol *Focused on flu vaccination which is out of scope*
Brink SG (1989) Provider reminders. Changing information format to increase infant immunizations. Medical care 27(6): 648-653	- Study published before 1990 date limit set in review protocol
Briss P A, Rodewald L E, Hinman A R, Shefer A M, Strikas R A, Bernier R R, Carande-Kulis V G, Yusuf H R, Ndiaye S M, Williams S M (2000) Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. American Journal of Preventive Medicine 18(1 Supplement): 97-140	- Review article but not a systematic review
Briss, P A, Rodewald, L E, Hinman, A R et al. (2000) Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. The Task Force on Community Preventive Services. American journal of preventive medicine 18(1suppl): 97-140	- Duplicate reference
Briss, P.A., Rodewald, L.E., Hinman, A.R. et al. (2000) Reviews of evidence regarding interventions to improve vaccination coverage in	- Duplicate reference

Study	Reason for exclusion
children, adolescents, and adults. American Journal of Preventive Medicine 18(1suppl1): 97-140	
Britto, Maria T, Schoettker, Pamela J, Pandzik, Geralyn M et al. (2007) Improving influenza immunisation for high-risk children and adolescents. Quality & safety in health care 16(5): 363-8	- The study did not report any of the outcomes specified in the protocol
Brousseau, Nicholas, Sauvageau, Chantal, Ouakki, Manale et al. (2010) Feasibility and impact of providing feedback to vaccinating medical clinics: evaluating a public health intervention. BMC public health 10: 750	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Bryan AR; Liu Y; Kuehl PG (2013) Advocating zoster vaccination in a community pharmacy through use of personal selling. Journal of the American Pharmacists Association : JAPhA 53(1): 70-77	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Burka, A.T., Fann, J.P., Lamb, K.D. et al. (2019) Evaluation of a novel discharge reminder tool on pneumococcal vaccination in hospitalized elderly veterans. JACCP Journal of the American College of Clinical Pharmacy 2(5): 462-467	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Burns, Ilene Timko; Zimmerman, Richard Kent; Santibanez, Tammy A (2002) Effectiveness of chart prompt about immunizations in an urban health center. The Journal of family practice 51(12): 1018	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Burson, Randall C, Buttenheim, Alison M, Armstrong, Allison et al. (2016) Community pharmacies as sites of adult vaccination: A systematic review. Human vaccines & immunotherapeutics 12(12): 3146-3159	- Systematic review used as source of primary studies
Calihan, Jessica B, MD, MS, Tomaszewski, Kathy, RN, Wheeler, Noah, MPH et al. (2020) USING REPRODUCTIVE HEALTH VISITS TO ENGAGE ADOLESCENT AND YOUNG ADULT WOMEN IN PRIMARY CARE. Journal of Adolescent Health 66(2s)	- Conference abstract

Study	Reason for exclusion
Calo, William A, Gilkey, Melissa B, Leeman, Jennifer et al. (2019) Coaching primary care clinics for HPV vaccination quality improvement: Comparing in-person and webinar implementation. Translational behavioral medicine 9(1): 23-31	- Does not contain an outcome of relevance to this review
Cardozo LJ, Steinberg J, Lepczyk MB et al. (1998) Delivery of preventive healthcare to older African-American patients: a performance comparison from two practice models. The American journal of managed care 4(6): 809-816	- Data not reported in an extractable format *Data in graph form with no error bars (no SD, SE or CI provided).*
Carney, Patricia A, Hatch, Brigit, Stock, Isabel et al. (2019) A stepped-wedge cluster randomized trial designed to improve completion of HPV vaccine series and reduce missed opportunities to vaccinate in rural primary care practices. Implementation science : IS 14(1): 30	- Protocol for a future study
Carolan, Kate, Verran, Joanna, Crossley, Matthew et al. (2018) Impact of educational interventions on adolescent attitudes and knowledge regarding vaccination: A pilot study. PloS one 13(1): e0190984	- Does not contain an outcome of relevance to this review
Carter, W B; Beach, L R; Inui, T S (1986) The flu shot study: using multiattribute utility theory to design a vaccination intervention. Organizational behavior and human decision processes 38(3): 378-91	- Study published before 1990 date limit set in review protocol - The study did not report any of the outcomes specified in the protocol
Caskey, R; Weiner, S; Gerber, B (2011) Exam-room based education to influence vaccination behavior among veteran patients in a primary care setting. Journal of general internal medicine 26: S271	- Conference abstract
Cassidy B, Braxter B, Charron-Prochownik D et al. (2014) A quality improvement initiative to increase HPV vaccine rates using an educational and reminder strategy with parents of preteen girls. Journal of pediatric health care : official publication of National Association of Pediatric Nurse Associates & Practitioners 28(2): 155-164	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Cataldi, J.R., Habesland, M., Anderson-Mellies, A. et al. (2020) The potential population-based impact of an HPV vaccination intervention in Colorado. Cancer Medicine 9(4): 1553-1561	- Does not contain an outcome of relevance to this review *The paper is a follow up study looking at implementing a relevant intervention in Colorado rather then the effectiveness of the intervention itself.*
Cates, Joan R, Diehl, Sandra J, Crandell, Jamie L et al. (2014) Intervention effects from a social marketing campaign to promote HPV vaccination in preteen boys. Vaccine 32(33): 4171-8	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Chamberlain, Allison T, Seib, Katherine, Ault, Kevin A et al. (2016) Impact of a multi-component antenatal vaccine promotion package on improving knowledge, attitudes and beliefs about influenza and Tdap vaccination during pregnancy. Human vaccines & immunotherapeutics 12(8): 2017-2024	- Does not contain an outcome of relevance to this review
Chan, Sophia S C, Leung, Doris Y P, Leung, Angela Y M et al. (2015) A nurse-delivered brief health education intervention to improve pneumococcal vaccination rate among older patients with chronic diseases: a cluster randomized controlled trial. International journal of nursing studies 52(1): 317-24	- Study took place in a non-OECD country
Chau, Janita Pak Chun, Lo, Suzanne Hoi Shan, Choi, Kai Chow et al. (2020) Effects of a multidisciplinary team-led school-based human papillomavirus vaccination health-promotion programme on improving vaccine acceptance and uptake among female adolescents: A cluster randomized controlled trial. Medicine 99(37): e22072	- Study took place in a non-OECD country
Chien AT; Li Z; Rosenthal MB (2010) Improving timely childhood immunizations through pay for performance in Medicaid-managed care. Health services research 45(6 Pt 2): 1934-1947	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This study was an interrupted time series.*
Closser, Svea, Rosenthal, Anat, Maes, Kenneth et al. (2016) The Global Context of Vaccine Refusal: Insights from a Systematic	- Study took place in a non-OECD country

Study	Reason for exclusion
Comparative Ethnography of the Global Polio Eradication Initiative. Medical Anthropology Quarterly 30(3): 321	
Coley, K.C., Gessler, C., McGivney, M. et al. (2020) Increasing adult vaccinations at a regional supermarket chain pharmacy: A multi-site demonstration project. Vaccine 38(24): 4044-4049	- Data not reported in an extractable format *The number of participants considered for vaccination was not provided. They only reported the number of vaccinations given.*
Collins, Brian K, Morrow, Helen E, Ramirez, Jennifer M et al. (2006) Childhood immunization coverage in US states: the impact of state policy interventions and programmatic support. Journal of health & social policy 22(1): 77-92	- Not a review of published literature *Study uses a survey to review the impact of interventions.*
Connors, John T; Slotwinski, Kate L; Hodges, Eric A (2017) Provider-parent Communication When Discussing Vaccines: A Systematic Review. Journal of pediatric nursing 33: 10-15	- Systematic review that does not include the outcomes stated in the protocol
Cooper Robbins, Spring Chenoa; Ward, Kirsten; Skinner, S Rachel (2011) School-based vaccination: a systematic review of process evaluations. Vaccine 29(52): 9588-99	- Systematic review used as source of primary studies
Cooper, S.C., Davies, C., McBride, K. et al. (2016) Development of a human papillomavirus vaccination intervention for Australian adolescents. Health Education Journal 75(5): 610-620	- The study did not report any of the outcomes specified in the protocol
Cory, L., Cha, B., Ellenberg, S. et al. (2019) Effects of Educational Interventions on Human Papillomavirus Vaccine Acceptability: A Randomized Controlled Trial. Obstetrics and Gynecology 134(2): 376-384	- Study participants are the wrong age group *The mean age of the participants was 24 years (SD 4). For HPV vaccination, the protocol is for participants aged 11-18 years.*
Costantino, C., Restivo, V., Ventura, G. et al. (2018) Increased vaccination coverage among adolescents and young adults in the	- Education non-RCT. Excluded because there

Study	Reason for exclusion
district of Palermo as a result of a public health strategy to counteract an 'epidemic panic'. International Journal of Environmental Research and Public Health 15(5): 1014	was sufficient RCT evidence for this review *This was a before-and-after information/education study.*
Costantino, Claudio, Caracci, Francesca, Brandi, Mariarosa et al. (2020) Determinants of vaccine hesitancy and effectiveness of vaccination counseling interventions among a sample of the general population in Palermo, Italy. Human vaccines & immunotherapeutics: 1-7	- Does not contain an outcome of relevance to this review
Cox, Dena S, Cox, Anthony D, Sturm, Lynne et al. (2010) Behavioral interventions to increase HPV vaccination acceptability among mothers of young girls. Health psychology : official journal of the Division of Health Psychology, American Psychological Association 29(1): 29-39	- Does not contain an outcome of relevance to this review *This study looks at vaccination intention, not uptake.*
Coyle, Christina M and Currie, Brian P (2004) Improving the rates of inpatient pneumococcal vaccination: impact of standing orders versus computerized reminders to physicians. Infection control and hospital epidemiology 25(11): 904-7	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Crawford, N.W., Barfield, C., Hunt, R.W. et al. (2014) Improving preterm infants' immunisation status: A follow-up audit. Journal of Paediatrics and Child Health 50(4): 314-318	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Crocker-Buque, Tim; Edelstein, Michael; Mounier-Jack, Sandra (2017) Interventions to reduce inequalities in vaccine uptake in children and adolescents aged <19 years: a systematic review. Journal of epidemiology and community health 71(1): 87-97	- Systematic review used as source of primary studies
Crocker-Buque, Tim and Mounier-Jack, Sandra (2018) Vaccination in England: a review of why business as usual is not enough to maintain coverage. BMC public health 18(1): 1351	- Systematic review used as source of primary studies
Cuff, R.D., Buchanan, T., Pelkofski, E. et al. (2016) Rates of human papillomavirus vaccine uptake amongst girls five years after introduction of statewide mandate in Virginia Presented as a podium presentation at the Annual Meeting of the South Atlantic Association of Obstetricians and Gynecologists, Charleston, South Carolina,	- Conference abstract

Study	Reason for exclusion
January 30-February 2, 2016. American Journal of Obstetrics and Gynecology 214(6): 752	
Cuff, Ryan D, Buchanan, Tommy, Pelkofski, Elizabeth et al. (2016) Rates of human papillomavirus vaccine uptake amongst girls five years after introduction of statewide mandate in Virginia. American journal of obstetrics and gynecology 214(6): 752e1-6	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Curran, Eileen A; Bednarczyk, Robert A; Omer, Saad B (2013) Evaluation of the frequency of immunization information system use for public health research. Human vaccines & immunotherapeutics 9(6): 1346-50	- Systematic review that does not include the outcomes stated in the protocol *Review evaluating the use of an information system in research*
Cutrona, S.L., Golden, J.G., Goff, S.L. et al. (2018) Improving Rates of Outpatient Influenza Vaccination Through EHR Portal Messages and Interactive Automated Calls: A Randomized Controlled Trial. Journal of General Internal Medicine 33(5): 659-667	- Study participants are the wrong age group *59% of the participants were younger than 50 years. This study has pneumococcal vaccine uptake data but this vaccine is routinely given to people aged 65 years and older in the UK.*
Czajka, H., Lauterbach, R., Pawlik, D. et al. (2017) Implementation of mandatory vaccinations against diphtheria, tetanus and pertussis in preterm infants as part of the Polish Immunization Programme. Pediatria Polska 92(5): 485-493	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study about mandatory vaccinations. The 2 subgroups of babies in the intervention arm all received the same intervention.*

Study	Reason for exclusion
Daku, Mark; Raub, Amy; Heymann, Jody (2012) Maternal leave policies and vaccination coverage: a global analysis. Social science & medicine (1982) 74(2): 120-4	- Not a relevant study design *This is a global survey that looks at correlations.*
Daley, Matthew F, MD, Narwaney, Komal J, MPH, PhD, Shoup, Jo Ann, PhD et al. (2018) Addressing Parents' Vaccine Concerns: A Randomized Trial of a Social Media Intervention. American Journal of Preventive Medicine 55(1): 44	- Does not contain an outcome of relevance to this review
Das, J.K., Salam, R.A., Arshad, A. et al. (2016) Systematic Review and Meta-Analysis of Interventions to Improve Access and Coverage of Adolescent Immunizations. Journal of Adolescent Health 59(2supplement): 40-s48	- Systematic review used as source of primary studies
Davies, C., Skinner, S.R., Stoney, T. et al. (2017) 'Is it like one of those infectious kind of things?' The importance of educating young people about HPV and HPV vaccination at school. Sex Education 17(3): 256-275	- Does not contain an outcome of relevance to this review
Davis TC, Fredrickson DD, Arnold C et al. (1998) A polio immunization pamphlet with increased appeal and simplified language does not improve comprehension to an acceptable level. Patient education and counseling 33(1): 25-37	- The study did not report any of the outcomes specified in the protocol
de Oliveira Bressane Lima, P., van Lier, A., de Melker, H. et al. (2020) MenACWY vaccination campaign for adolescents in the Netherlands: Uptake and its determinants. Vaccine 38(34): 5516-5524	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
deHart, M.P., Salinas, S.K., Barnette Jr., L.J. et al. (2005) Project Protect: Pneumococcal vaccination in Washington State nursing homes. Journal of the American Medical Directors Association 6(2): 91-96	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review
Dempsey AF, Maertens J, Beaty B et al. (2015) Characteristics of users of a tailored, interactive website for parents and its impact on adolescent vaccination attitudes and uptake. BMC research notes 8: 739	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Dempsey AF, Zimet GD, Davis RL et al. (2006) Factors that are associated with parental acceptance of human papillomavirus vaccines: a randomized intervention study of written information about HPV. Pediatrics 117(5): 1486-1493	- The study did not report any of the outcomes specified in the protocol
Dempsey Amanda, F, Pyrznawoski, Jennifer, Lockhart, Steven et al. (2018) Effect of a Health Care Professional Communication Training Intervention on Adolescent Human Papillomavirus Vaccination: a Cluster Randomized Clinical Trial. 172	- Duplicate reference *Dempsey 2015 was included in this evidence review.*
Dempsey, A.F., Pyrzanowski, J., Campbell, J. et al. (2020) Cost and reimbursement of providing routine vaccines in outpatient obstetrician/gynecologist settings. American Journal of Obstetrics and Gynecology 223(4): 562	- Duplicate reference *This is an economic analysis of O'Leary 2019: "Effectiveness of a multimodal intervention to increase vaccination in obstetrics/gynecology settings"*
Dempsey, A.F. and Zimet, G.D. (2015) Interventions to Improve Adolescent Vaccination: What May Work and What Still Needs to Be Tested. Vaccine 33(supplement4): d106-d113	- Review article but not a systematic review
Dempsey, Amanda F and Zimet, Gregory D (2015) Interventions to Improve Adolescent Vaccination: What May Work and What Still Needs to Be Tested. American journal of preventive medicine 49(6suppl4): 445-54	- Duplicate reference *Article published in a different journal concurrently with identical text.*
Desai, Sonali P, Lu, Bing, Szent-Gyorgyi, Lara E et al. (2013) Increasing pneumococcal vaccination for immunosuppressed patients: a cluster quality improvement trial. Arthritis and rheumatism 65(1): 39-47	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Deshmukh, Uma, Oliveira, Carlos R, Griggs, Susan et al. (2018) Impact of a clinical interventions bundle on uptake of HPV vaccine at an OB/GYN clinic. Vaccine 36(25): 3599-3605	- Vaccine on UK routine schedule but wrong context for administration *The mean age of the women receiving the HPV vaccine was 22 years.*

Study	Reason for exclusion
Dexheimer, Judith W, Jones, Ian, Waitman, Russ et al. (2006) Prospective evaluation of a closed-loop, computerized reminder system for pneumococcal vaccination in the emergency department. AMIA ... Annual Symposium proceedings. AMIA Symposium: 910	- Conference abstract
Dexheimer, Judith W, Talbot, Thomas R 3rd, Ye, Fei et al. (2011) A computerized pneumococcal vaccination reminder system in the adult emergency department. Vaccine 29(40): 7035-41	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Dexheimer, Judith W, Talbot, Thomas R, Ye, Fei et al. (2008) Implementing a computerized pneumococcal vaccination reminder system in an emergency department: a prospective study. AMIA ... Annual Symposium proceedings. AMIA Symposium: 867	- Conference abstract
Dexter LJ, Teare MD, Dexter M et al. (2012) Strategies to increase influenza vaccination rates: outcomes of a nationwide cross-sectional survey of UK general practice. BMJ open 2(3)	- Data not reported in an extractable format *The number of participants in each arm was not provided. The study mentions supplementary tables but they are not provided on the journal's website.*
Dexter, P R, Perkins, S, Overhage, J M et al. (2001) A computerized reminder system to increase the use of preventive care for hospitalized patients. The New England journal of medicine 345(13): 965-70	- Data not reported in an extractable format *Pneumonococcal vaccine uptake data reported per hospitalisation and not per person.*
Dini, E F, Chaney, M, Moolenaar, R L et al. (1996) Information as intervention: how Georgia used vaccination coverage data to double public sector vaccination coverage in seven years. Journal of public health management and practice : JPHMP 2(1): 45-9	- Review article but not a systematic review
Dini; Linkins; Sigafoos (2000) The impact of computer-generated messages on childhood immunization coverage(2)(2). American journal of preventive medicine 19(1): 68-70	- Duplicate reference

Study	Reason for exclusion
Dini; Linkins; Sigafoos (2000) The impact of computer-generated messages on childhood immunization coverage(2)(2). American journal of preventive medicine 19(1): 68-70	- Duplicate reference
Dixon, B, Downs, S, Zhang, Z et al. (2016) A mhealth intervention trial to improve HPV vaccination rates in urban primary care clinics. Sexually transmitted diseases 43(10): S199	- Conference abstract
Dixon, Brian E, Kasting, Monica L, Wilson, Shannon et al. (2017) Health care providers' perceptions of use and influence of clinical decision support reminders: qualitative study following a randomized trial to improve HPV vaccination rates. BMC medical informatics and decision making 17(1): 119	- Does not contain an outcome of relevance to this review *The quanitative study is Zimet 2018, which is detailed elsewhere. Dixon 2017 has qualitative findings.*
Djibuti, M., Gotsadze, G., Zoidze, A. et al. (2009) The role of supportive supervision on immunization program outcome - A randomized field trial from Georgia. BMC International Health and Human Rights 9(suppl1): 11	- Study took place in a non-OECD country
Dona, Daniele, Masiero, Susanna, Brisotto, Sara et al. (2018) Special Immunization Service: A 14-year experience in Italy. PloS one 13(4): e0195881	- Not a relevant study design
Donahue K, Hendrix K, Sturm L et al. (2018) Provider Communication and Mothers' Willingness to Vaccinate Against Human Papillomavirus and Influenza: A Randomized Health Messaging Trial. Academic pediatrics 18(2): 145-153	- The study did not report any of the outcomes specified in the protocol
Donnelly, Amber (2008) HPV vaccination: Parental perspectives in Omaha, Nebraska. Dissertation Abstracts International: Section B: The Sciences and Engineering 69(5b): 2941	- Full text paper or book article is unavailable *Dissertation abstract*
Dorell, Christina G, Yankey, David, Santibanez, Tammy A et al. (2011) Human papillomavirus vaccination series initiation and completion, 2008-2009. Pediatrics 128(5): 830-9	- Not a relevant study design *Survey that looks at correlations/risk factors.*

Study	Reason for exclusion
Dubowitz H., Feigelman S. LW&KJ (2009) Pediatric primary care to help prevent child maltreatment: the Safe Environment for Every Kid (SEEK) model. Pediatrics: 858-864	- Study does not contain an intervention aimed at increasing vaccine uptake *This study is about preventing child mistreatment via social work etc. There is no mention of interventions to increase vaccination uptake in the methods section.*
Dumo P, Dougherty J SM (2002) Impact of clinical pharmacists on vaccination rates in medicine, surgery, and infectious disease services: a randomized, controlled trial. Pharmacotherapy 10: 1347–8	- Conference abstract
Dylag, Andrew M and Shah, Shetal I (2008) Administration of tetanus, diphtheria, and acellular pertussis vaccine to parents of high-risk infants in the neonatal intensive care unit. Pediatrics 122(3): e550-5	- Does not contain an outcome of relevance to this review *This study does not have a comparator.*
Eason E, Naus M, Sciberras J et al. (2001) Evaluation of an institution-based protocol for postpartum rubella vaccination. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne 165(10): 1321-1323	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Eckrode, Carl; Church, Nancy; English, Woodruff J 3rd (2007) Implementation and evaluation of a nursing assessment/standing orders-based inpatient pneumococcal vaccination program. American journal of infection control 35(8): 508-15	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Eid, Deeb D; Meagher, Rebecca C; Lengel, Aaron J (2015) The Impact of Pharmacist Interventions on Herpes Zoster Vaccination Rates. The Consultant pharmacist : the journal of the American Society of Consultant Pharmacists 30(8): 459-62	- Review article but not a systematic review
Ellerbeck, Edward F, Totten, Bonnie, Markello, Samuel et al. (2003) Quality improvement in critical access hospitals: addressing immunizations prior to discharge. The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association 19(4): 433-8	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Ellis, Catherine; Roland, Damian; Blair, Mitch E (2013) Professional educational interventions designed to improve knowledge and uptake of immunisation. Community practitioner : the journal of the Community Practitioners' & Health Visitors' Association 86(6): 20-3	- More recent systematic review identified that covers the same topic
Ernst, Kimberly D (2017) Electronic Alerts Improve Immunization Rates in Two-month-old Premature Infants Hospitalized in the Neonatal Intensive Care Unit. Applied clinical informatics 8(1): 206-213	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Fadda, Marta, Galimberti, Elisa, Fiordelli, Maddalena et al. (2018) Evaluation of a Mobile Phone-Based Intervention to Increase Parents' Knowledge About the Measles-Mumps-Rubella Vaccination and Their Psychological Empowerment: Mixed-Method Approach. JMIR mHealth and uHealth 6(3): e59	- Does not contain an outcome of relevance to this review
Fairbrother, G., Friedman, S., Hanson, K.L. et al. (1997) Effect of the vaccines for children program on inner-city neighborhood physicians. Archives of Pediatrics and Adolescent Medicine 151(12): 1229-1235	- The intervention is a free vaccine- not in scope
Fiks, AG; Luan, X; Mayne, SL (2016) Improving HPV Vaccination Rates Using Maintenance-of-Certification Requirements. Pediatrics 137(3): e20150675	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Findley, Sally E, Irigoyen, Matilde, Sanchez, Martha et al. (2008) Effectiveness of a community coalition for improving child vaccination rates in New York City. American journal of public health 98(11): 1959-62	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Fishbein, DB, Willis, BC, Cassidy, WM et al. (2006) A comprehensive patient assessment and physician reminder tool for adult immunization: effect on vaccine administration. Vaccine 24(18): 3971-3983	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Fisher-Borne, Marcie, Preiss, Alexander J, Black, Molly et al. (2018) Early Outcomes of a Multilevel Human Papillomavirus Vaccination Pilot Intervention in Federally Qualified Health Centers. Academic pediatrics 18(2s): 79-s84	- Data not reported in an extractable format *The number of participants was not provided.*

Study	Reason for exclusion
Flanagan, J R, Doebbeling, B N, Dawson, J et al. (1999) Randomized study of online vaccine reminders in adult primary care. Proceedings. AMIA Symposium: 755-9	- Does not contain an outcome of relevance to this review *Study reports ordering of vaccination by physician not if it was administered.*
Flood, T., Wilson, I.M., Prue, G. et al. (2020) Impact of school-based educational interventions in middle adolescent populations (15-17yrs) on human papillomavirus (HPV) vaccination uptake and perceptions/knowledge of HPV and its associated cancers: A systematic review. Preventive Medicine 139: 106168	- Systematic review used as source of primary studies *Some studies are non-OECD*
Fogarty, Kieran J, Massoudi, Mehran S, Gallo, William et al. (2004) Vaccine coverage levels after implementation of a middle school vaccination requirement, Florida, 1997-2000. Public health reports (Washington, D.C. : 1974) 119(2): 163-9	- Does not contain an outcome of relevance to this review *This study only reports data after the intervention is implemented - there is no 'before' comparison data.*
Forbes, Thomas A, McMinn, Alissa, Crawford, Nigel et al. (2015) Vaccination uptake by vaccine-hesitant parents attending a specialist immunization clinic in Australia. Human vaccines & immunotherapeutics 11(12): 2895-903	- Does not contain an outcome of relevance to this review *This study does not have a comparator.*
Ford, A.J. and Alwan, N.A. (2018) Use of social networking sites and women's decision to receive vaccinations during pregnancy: A cross-sectional study in the UK. Vaccine 36(35): 5294-5303	- Does not contain an outcome of relevance to this review
Forster, A, Cornelius, V, Rockliffe, L et al. (2018) A cluster randomised feasibility study of an adolescent incentive intervention to increase uptake of HPV vaccination. British journal of cancer. Conference: 2018 national cancer research institute cancer conference, NCRI 2018. United kingdom 119(1): 34	- Conference abstract
Forster, Alice S, Cornelius, Victoria, Rockliffe, Lauren et al. (2017) A protocol for a cluster randomised feasibility study of an adolescent incentive intervention to increase uptake of HPV vaccination among girls. Pilot and feasibility studies 3: 13	- Protocol for a future study *This is the protocol for Forester 2018, which is also considered in this review.*

Study	Reason for exclusion
Forster, Alice S, Cornelius, Victoria, Rockliffe, Lauren et al. (2017) A cluster randomised feasibility study of an adolescent incentive intervention to increase uptake of HPV vaccination. British journal of cancer 117(8): 1121-1127	- Does not contain an outcome of relevance to this review *Vaccine uptake may have been recorded during the study but the data was not included in the results section.*
Frame, P S, Zimmer, J G, Werth, P L et al. (1994) Computer-based vs manual health maintenance tracking. A controlled trial. Archives of family medicine 3(7): 581-8	- Vaccine on UK routine schedule but wrong context for administration *Study is about adult tetanus boosters in the USA.*
Francis, Diane B, Cates, Joan R, Wagner, Kyla P Garrett et al. (2017) Communication technologies to improve HPV vaccination initiation and completion: A systematic review. Patient education and counseling 100(7): 1280-1286	- More recent systematic review identified that covers the same topic
Franco, M., Mazzucca, S., Padek, M. et al. (2019) Going beyond the individual: how state-level characteristics relate to HPV vaccine rates in the United States. BMC public health 19(1): 246	- Not a relevant study design *This is a snap-shot of a national survey.*
Franzini, Luisa; Boom, Julie; Nelson, Cynthia (2007) Cost-effectiveness analysis of a practice-based immunization education intervention. Ambulatory pediatrics : the official journal of the Ambulatory Pediatric Association 7(2): 167-75	- Study includes data on a vaccine that is not on the UK routine vaccination schedule *This study does not separate out the data on varicella vaccine uptake, which is not on the UK routine vaccination schedule.*
Frascella, B., Oradini-Alacreu, A., Balzarini, F. et al. (2020) Effectiveness of email-based reminders to increase vaccine uptake: a systematic review. Vaccine 38(3): 433-443	- Systematic review used as source of primary studies

Study	Reason for exclusion
Free, Caroline, Phillips, Gemma, Felix, Lambert et al. (2010) The effectiveness of M-health technologies for improving health and health services: a systematic review protocol. BMC research notes 3: 250	- Review article but not a systematic review
Frew PM, Owens LE, Saint-Victor DS et al. (2014) Factors associated with maternal influenza immunization decision-making. Evidence of immunization history and message framing effects. Human vaccines & immunotherapeutics 10(9): 2576-2583	- Does not contain an outcome of relevance to this review *The outcome is intention to vaccinate, not vaccine uptake.*
Frew, Paula M and Lutz, Chelsea S (2017) Interventions to increase pediatric vaccine uptake: An overview of recent findings. Human vaccines & immunotherapeutics 13(11): 2503-2511	- Systematic review used as source of primary studies
Fried, Bruce J, Keyes-Elstein, Lynette, Lannon, Carole M et al. (2004) Practice based education to improve delivery systems for prevention in primary care: randomised trial. British Medical Journal 328(7436): 388-392	- Duplicate reference *This study is the same as Margolis 2004, which was excluded because the vaccine uptake data is only presented in a chart. This abstract entry has a different order of authors. It is otherwise identical.*
Frère J, De Wals P, Ovetchkine P et al. (2013) Evaluation of several approaches to immunize parents of neonates against B. pertussis. Vaccine 31(51): 6087-6091	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Fu, Linda Y, Bonhomme, Lize-Anne, Cooper, Spring Chenoa et al. (2014) Educational interventions to increase HPV vaccination acceptance: a systematic review. Vaccine 32(17): 1901-20	- More recent systematic review identified that covers the same topic
Fu, LY, Zook, K, Gingold, JA et al. (2016) Strategies for Improving Vaccine Delivery: a Cluster-Randomized Trial. Pediatrics 137(6)	- Study includes data on a vaccine that is not on the UK routine vaccination schedule *Varicella vaccine is not on the UK routine vaccination schedule and it is not*

Study	Reason for exclusion
	possible to separate this data out from other vaccines' uptake data.
Fujiwara, Hiroyuki, Takei, Yuji, Ishikawa, Yoshiki et al. (2013) Community-based interventions to improve HPV vaccination coverage among 13- to 15-year-old females: measures implemented by local governments in Japan. PloS one 8(12): e84126	- Not a relevant study design *This is a survey that analyses interventions as if they were 'risk factors' increasing uptake.*
Gaglani, M, Riggs, M, Kamenicky, C et al. (2001) A computerized reminder strategy is effective for annual influenza immunization of children with asthma or reactive airway disease. The Pediatric infectious disease journal 20(12): 1155-60	- The study did not report any of the outcomes specified in the protocol
Gagneur, Arnaud, Lemaitre, Thomas, Gosselin, Virginie et al. (2018) A postpartum vaccination promotion intervention using motivational interviewing techniques improves short-term vaccine coverage: PromoVac study. BMC public health 18(1): 811	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Gamble, George R; Goldstein, Adam O; Bearman, Rachel S (2008) Implementing a standing order immunization policy: a minimalist intervention. Journal of the American Board of Family Medicine : JABFM 21(1): 38-44	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Gannon M, Qaseem A, Snooks Q et al. (2012) Improving adult immunization practices using a team approach in the primary care setting. American journal of public health 102(7): e46	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Gargano, Lisa M, Herbert, Natasha L, Painter, Julia E et al. (2014) Development, theoretical framework, and evaluation of a parent and teacher-delivered intervention on adolescent vaccination. Health promotion practice 15(4): 556-67	- Does not contain an outcome of relevance to this review

Study	Reason for exclusion
Gates, A., Gates, M., Rahman, S. et al. (2021) A systematic review of factors that influence the acceptability of vaccines among Canadians. Vaccine 39(2): 222-236	- Not a relevant study design
Gazibara, T.; Jia, H.; Lubetkin, E.I. (2017) Trends in HPV vaccine initiation and completion among girls in Texas: Behavioral risk factor surveillance system data, 2008-2010. Puerto Rico Health Sciences Journal 36(3): 152-158	- Study does not contain an intervention aimed at increasing vaccine uptake
Gellert, Paul; Bethke, Norma; Seybold, Joachim (2019) School-based educational and on-site vaccination intervention among adolescents: study protocol of a cluster randomised controlled trial. BMJ open 9(1): e025113	- Protocol for a future study
Ghadieh, A.S., Hamadeh, G.N., Mahmassani, D.M. et al. (2015) The effect of various types of patients' reminders on the uptake of pneumococcal vaccine in adults: A randomized controlled trial. Vaccine 33(43): 5868-5872	- Study took place in a non-OECD country *Lebanon*
Gidengil, Courtney, Chen, Christine, Parker, Andrew M et al. (2019) Beliefs around childhood vaccines in the United States: A systematic review. Vaccine 37(45): 6793-6802	- Not a relevant study design *Qualitative study - considered for the qualitative review*
Giles EL, Robalino S, McColl E, Sniehotta FF, Adams J (2014) The effectiveness of financial incentives for health behaviour change: systematic review and meta-analysis. PLOS ONE 9(3): e90347	- Systematic review that does not include the outcomes stated in the protocol *Review focuses on financial incentives for behaviour change and covers changes in vaccination, but included references are not for routine vaccinations included in our protocol.*
Gilkey, Melissa B and McRee, Annie-Laurie (2016) Provider communication about HPV vaccination: A systematic review. Human vaccines & immunotherapeutics 12(6): 1454-68	- Systematic review that does not include relevant study types *Review of surveys and qualitative studies*

Study	Reason for exclusion
Gindler, J.S., Cutts, F.T., Barnett-Antinori, M.E. et al. (1993) Successes and failures in vaccine delivery: Evaluation of the immunization delivery system in Puerto Rico. Pediatrics 91(2): 315-320	- Not a relevant study design *Survey snapshot of Puerto Rico.*
Girard, Dorota Zdanowska (2012) Recommended or mandatory pertussis vaccination policy in developed countries: does the choice matter?. Public health 126(2): 117-22	- Review article but not a systematic review
Gleeson S; Kelleher K; Gardner W (2016) Evaluating a Pay-for-Performance Program for Medicaid Children in an Accountable Care Organization. JAMA pediatrics 170(3): 259-266	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before and after study.*
Glenton, Claire, Scheel, Inger B, Lewin, Simon et al. (2011) Can lay health workers increase the uptake of childhood immunisation? Systematic review and typology. Tropical medicine & international health : TM & IH 16(9): 1044-53	- Systematic review used as source of primary studies
Goebel, LJ (1997) A peer review feedback method of promoting compliance with preventive care guidelines in a resident ambulatory care clinic. Joint Commission journal on quality improvement 23(4): 196-202	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Golden, Shelley D, Moracco, Kathryn E, Feld, Ashley L et al. (2014) Process evaluation of an intervention to increase provision of adolescent vaccines at school health centers. Health education & behavior : the official publication of the Society for Public Health Education 41(6): 625-32	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Gordon, Louisa G, Holden, Libby, Ware, Robert S et al. (2012) Comprehensive health assessments for adults with intellectual disability living in the community: Weighing up the costs and benefits. Australian Family Physician 41(12): 969-72	- Vaccine on UK routine schedule but wrong context for administration *The mean age of participants was 36 years (SD 13). For the pneumonia vaccine. This is younger than the committee's cut-off mean age of 50 years.*

Study	Reason for exclusion
Gori, D., Costantino, C., Odone, A. et al. (2020) The impact of mandatory vaccination law in Italy on mmr coverage rates in two of the largest italian regions (Emilia-romagna and sicily): An effective strategy to contrast vaccine hesitancy. Vaccines 8(1): 57	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Gosselin Boucher, Vincent, Colmegna, Ines, Gemme, Claudia et al. (2019) Interventions to improve vaccine acceptance among rheumatoid arthritis patients: a systematic review. Clinical rheumatology 38(6): 1537-1544	- Systematic review used as source of primary studies
Gottlieb, N H, Huang, P P, Blozis, S A et al. (2001) The impact of Put Prevention into Practice on selected clinical preventive services in five Texas sites. American journal of preventive medicine 21(1): 35-40	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Grant, C.C., Turner, N.M., York, D.G. et al. (2010) Factors associated with immunisation coverage and timeliness in New Zealand. British Journal of General Practice 60(572): 180-186	- Not a relevant study design *Survey snapshot of New Zealand.*
Green, D., Labriola, G., Smeaton, L. et al. (2017) Prevention of neonatal whooping cough in England: The essential role of the midwife. British Journal of Midwifery 25(4): 224-228	- Review article but not a systematic review
Greyson, Devon; Vriesema-Magnuson, Chris; Bettinger, Julie A (2019) Impact of school vaccination mandates on pediatric vaccination coverage: a systematic review. CMAJ open 7(3): e524-e536	- Systematic review used as source of primary studies
Groom, Holly C, Irving, Stephanie A, Caldwell, Jessica et al. (2017) Implementing a Multipartner HPV Vaccination Assessment and Feedback Intervention in an Integrated Health System. Journal of public health management and practice : JPHMP 23(6): 589-592	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Groom, Holly, Hopkins, David P, Pabst, Laura J et al. (2015) Immunization information systems to increase vaccination rates: a	- Systematic review used as source of primary studies

Study	Reason for exclusion
community guide systematic review. Journal of public health management and practice : JPHMP 21(3): 227-48	
Gruber, T and Marada, R (2000) Improving pneumococcal vaccination rates for elderly patients. New Jersey medicine : the journal of the Medical Society of New Jersey 97(2): 35-9	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review *This was a before-and-after study.*
Guo, J.-L.; Gottlieb, N.H.; Huang, C.-M. (2002) Effects of office system and educational interventions in increasing the delivery of preventive health services: A meta-analysis. Taiwan Journal of Public Health 21(1): 36-51	- More recent systematic review identified that covers the same topic *SR is not specific to increasing vaccination and other more relevant and up to date SRs identified.*
Gust, Deborah A, Kennedy, Allison, Weber, Deanne et al. (2009) Parents questioning immunization: evaluation of an intervention. American journal of health behavior 33(3): 287-98	- Does not contain an outcome of relevance to this review
Haesebaert J, Lutringer-Magnin D, Kalecinski J et al. (2012) French women's knowledge of and attitudes towards cervical cancer prevention and the acceptability of HPV vaccination among those with 14 - 18 year old daughters: a quantitative-qualitative study. BMC public health 12: 1034	- The study did not report any of the outcomes specified in the protocol
Haji, Adam, Lowther, S, Ngan'ga, Z et al. (2016) Reducing routine vaccination dropout rates: evaluating two interventions in three Kenyan districts, 2014. BMC public health 16: 152	- Study took place in a non-OECD country
Hajizadeh, Mohammad, Heymann, Jody, Strumpf, Erin et al. (2015) Paid maternity leave and childhood vaccination uptake: Longitudinal evidence from 20 low-and-middle-income countries. Social science & medicine (1982) 140: 104-17	- Systematic review of non-OECD countries
Hakim, Hina, Provencher, Thierry, Chambers, Christine T et al. (2019) Interventions to help people understand community immunity: A systematic review. Vaccine 37(2): 235-247	- Systematic review used as source of primary studies
Hansen, P.R.; Schmidtblaicher, M.; Brewer, N.T. (2020) Resilience of HPV vaccine uptake in Denmark: Decline and recovery. Vaccine 38(7): 1842-1848	- Education non-RCT. Excluded because there

Study	Reason for exclusion
	was sufficient RCT evidence for this review
Harper, P and Madlon-Kay, D J (1994) Adolescent measles vaccination. Response rates to mailings addressed to patients vs parents. Archives of family medicine 3(7): 619-22	- Study participants are the wrong age group *This study is a measles catch-up campaign for adolescents aged 12 to 18 years. MMR is on the routine schedule for children aged 0-5 years. Catch-up campaigns are out of scope.*
Harvey, Hannah; Reissland, Nadja; Mason, James (2015) Parental reminder, recall and educational interventions to improve early childhood immunisation uptake: A systematic review and meta-analysis. Vaccine 33(25): 2862-80	- Systematic review used as source of primary studies
Hastings, Tessa J, Hohmann, Lindsey A, Huston, Sally A et al. (2020) Enhancing pharmacy personnel immunization-related confidence, perceived barriers, and perceived influence: The We Immunize program. Journal of the American Pharmacists Association : JAPhA 60(2): 344-351e2	- Does not contain an outcome of relevance to this review
Hayles, Elizabeth Helen, Cooper, Spring Chenoa, Wood, Nicholas et al. (2015) What predicts postpartum pertussis booster vaccination? A controlled intervention trial. Vaccine 33(1): 228-36	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Healy CM, Ng N, Taylor RS et al. (2015) Tetanus and diphtheria toxoids and acellular pertussis vaccine uptake during pregnancy in a metropolitan tertiary care center. Vaccine 33(38): 4983-4987	- Data not reported in an extractable format *The number of participants in each cohort was not provided.*
Hechter, Rulin C, Qian, Lei, Luo, Yi et al. (2019) Impact of an electronic medical record reminder on hepatitis B vaccine initiation and completion rates among insured adults with diabetes mellitus. Vaccine 37(1): 195-201	- Vaccine on UK routine schedule but wrong context for administration *This study is about HepB vaccination for adults.*

Study	Reason for exclusion
Hempstead, K., Bresnitz, E., Howell-White, S. et al. (2004) Use of a state regulation for adult vaccination. American Journal of Preventive Medicine 26(4): 311-314	- Does not contain an outcome of relevance to this review
Henninger, Michelle L, Mcmullen, Carmit K, Firemark, Alison J et al. (2017) User-Centered Design for Developing Interventions to Improve Clinician Recommendation of Human Papillomavirus Vaccination. The Permanente journal 21: 16-191	- Not a relevant study design
Henrikson, N, Zhu, W, Nguyen, M et al. (2017) Health system-based HPV vaccine reminders: randomized trial results. Cancer epidemiology biomarkers and prevention 26(3): 435	- Conference abstract
Henry SL, Shen E, Ahuja A et al. (2016) The Online Personal Action Plan: A Tool to Transform Patient-Enabled Preventive and Chronic Care. American journal of preventive medicine 51(1): 71-77	- Not a relevant study design *Use of a website for education is treated as a risk factor for vaccine uptake. All participants had access to the same website.*
Herbert, N (2014) Parental attitudes and beliefs about human papillomavirus (HPV) vaccination and vaccine receipt among adolescents in richmond county, Georgia. Journal of adolescent health 54(2): S82	- Conference abstract
Herman, C.J.; Speroff, T.; Cebul, R.D. (1994) Improving compliance with immunization in the older adult: Results of a randomized cohort study. Journal of the American Geriatrics Society 42(11): 1154-1159	- Does not contain an outcome of relevance to this review *This study has data for vaccinations offered. This is not the same thing as uptake.*
Hicks, Paul; Tarr, Gillian A M; Hicks, Ximena Prieto (2007) Reminder cards and immunization rates among Latinos and the rural poor in Northeast Colorado. Journal of the American Board of Family Medicine : JABFM 20(6): 581-6	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Higginbotham, Suzanne; Stewart, Autumn; Pfalzgraf, Andrea (2012) Impact of a pharmacist immunizer on adult immunization rates. Journal of the American Pharmacists Association : JAPhA 52(3): 367-71	- Study participants are the wrong age group *The participants for all 3 arms have a mean age of*

Study	Reason for exclusion
	45 years (SD 12.1). This is the wrong age group for vaccines on the UK routine vaccination schedule.
Ho, Hanley J, Chan, Yin Ying, Ibrahim, Muhamad Alif Bin et al. (2017) A formative research-guided educational intervention to improve the knowledge and attitudes of seniors towards influenza and pneumococcal vaccinations. Vaccine 35(47): 6367-6374	- Does not contain an outcome of relevance to this review
Hofstetter, Annika M, Vargas, Celibell Y, Camargo, Stewin et al. (2015) Impacting delayed pediatric influenza vaccination: a randomized controlled trial of text message reminders. American journal of preventive medicine 48(4): 392-401	- The study did not report any of the outcomes specified in the protocol
Hohmann, L.A., Hastings, T.J., Ha, D.R. et al. (2019) Impact of a multi-component immunization intervention on pneumococcal and herpes zoster vaccinations: A randomized controlled trial of community pharmacies in 2 states. Research in social & administrative pharmacy : RSAP 15(12): 1453-1463	- The study did not report any of the outcomes specified in the protocol *And unable to determine what proportion of individuals were over 65 years of age*
Hohmann, L, Hastings, T, Garza, K et al. (2018) Impact of a multicomponent immunization intervention on pneumococcal and herpes zoster vaccinations: a randomized controlled trial of community pharmacies in two states. Journal of the american pharmacists association 58(3): e71	- Conference abstract
Holloway, Ginger L (2019) Effective HPV Vaccination Strategies: What Does the Evidence Say? An Integrated Literature Review. Journal of pediatric nursing 44: 31-41	- Review article but not a systematic review
Holzman, GS, Harwell, TS, Johnson, EA et al. (2005) A media campaign to promote pneumococcal vaccinations: is a telephone survey an effective evaluation strategy?. Journal of public health management and practice 11(3): 228-234	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Hopfer S, Ray AE, Hecht ML et al. Taking an HPV vaccine research-tested intervention to scale in a clinical setting. Translational behavioral medicine 8(5): 745-752	- The study did not report any of the outcomes specified in the protocol

Study	Reason for exclusion
Houle, Sherilyn K D, McAlister, Finlay A, Jackevicius, Cynthia A et al. (2012) Does performance-based remuneration for individual health care practitioners affect patient care?: a systematic review. Annals of internal medicine 157(12): 889-99	- Systematic review used as source of primary studies
Hui, Charles, Dunn, Jessica, Morton, Rachael et al. (2018) Interventions to Improve Vaccination Uptake and Cost Effectiveness of Vaccination Strategies in Newly Arrived Migrants in the EU/EEA: A Systematic Review. International journal of environmental research and public health 15(10)	- Systematic review used as source of primary studies
Hull, Sally, Hagdrup, Nicola, Hart, Ben et al. (2002) Boosting uptake of influenza immunisation: a randomised controlled trial of telephone appointing in general practice. The British journal of general practice : the journal of the Royal College of General Practitioners 52(482): 712-6	- The study did not report any of the outcomes specified in the protocol
Hutchinson, A.F. and Smith, S.M. (2020) Effectiveness of strategies to increase uptake of pertussis vaccination by new parents and family caregivers: A systematic review. Midwifery 87: 102734	- Systematic review used as source of primary studies
Ibikunle-Salami, Tawa B (2016) Educational intervention to impact parental decisions to consent to Human Papillomavirus vaccine. Dissertation Abstracts International: Section B: The Sciences and Engineering 77(2be): no-specified	- Not a peer-reviewed publication
Ibáñez-Jiménez, A, Pairet-Jofre, G, Prat-González, I et al. (2007) Randomized clinical trial on the effectiveness of a postal reminder to increase tetanus-diphtheria vaccination coverage in the young adult population. Enfermeria clinica 17(4): 171-176	- Study not reported in English
Interaminense, I.N.C.S., de Oliveira, S.C., Leal, L.P. et al. (2016) Educational technologies to promote vaccination against human papillomavirus: Integrative literature review. Texto e Contexto Enfermagem 25(2): e2300015	- More recent systematic review identified that covers the same topic
Irigoyen, M M, Findley, S, Earle, B et al. (2000) Impact of appointment reminders on vaccination coverage at an urban clinic. Pediatrics 106(4suppl): 919-23	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Irigoyen, M., Findley, S.E., Chen, S. et al. (2004) Early continuity of care and immunization coverage. Ambulatory Pediatrics 4(3): 199-203	- Does not contain an outcome of relevance to this review *This study does not compare one arm against another. Continuity of care*

Study	Reason for exclusion
	is analysed like a risk factor for vaccination.
Irving, S.A.; Salmon, D.A.; Curbow, B.A. (2007) Vaccine risk communication interventions in the United States, 1996-2006: A review. Current Pediatric Reviews 3(3): 238-247	- More recent systematic review identified that covers the same topic
Isaac, Michael R, Chartier, Mariette, Brownell, Marni et al. (2015) Can opportunities be enhanced for vaccinating children in home visiting programs? A population-based cohort study. BMC Public Health 15(620)	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Isenor, J E, Edwards, N T, Alia, T A et al. (2016) Impact of pharmacists as immunizers on vaccination rates: A systematic review and meta-analysis. Vaccine 34(47): 5708-5723	- Systematic review used as source of primary studies
Isenor, J.E., Kervin, M.S., Halperin, D.M. et al. (2020) Pharmacists as immunizers to Improve coverage and provider/recipient satisfaction: A prospective, Controlled Community Embedded Study with vaccineS with low coverage rates (the Improve ACCESS Study): Study summary and anticipated significance. Canadian Pharmacists Journal 153(2): 88-94	- Protocol for a future study
ISRCTN20165116 (2003) Randomised trial of pre-pregnancy information and counselling in inner urban Melbourne. http://www.who.int/trialsearch/Trial2.aspx?TrialID=ISRCTN20165116	- Does not contain an outcome of relevance to this review *This is a study registration. They went on to look at birth weight but not vaccine uptake.*
Ito, Tomoko, Takenoshita, Remi, Narumoto, Keiichiro et al. (2014) A community-based intervention in middle schools to improve HPV vaccination and cervical cancer screening in Japan. Asia Pacific family medicine 13(1): 13	- Does not contain an outcome of relevance to this review
Jaca, Anelisa, Mathebula, Lindi, Iweze, Arthur et al. (2018) A systematic review of strategies for reducing missed opportunities for vaccination. Vaccine 36(21): 2921-2927	- Systematic review used as source of primary studies
Jacob, Verughese, Chattopadhyay, Sajal K, Hopkins, David P et al. (2016) Increasing Coverage of Appropriate Vaccinations: A	- Systematic review used as source of primary studies

Study	Reason for exclusion
Community Guide Systematic Economic Review. American journal of preventive medicine 50(6): 797-808	
Jacobs-Wingo, Jasmine L; Jim, Cheyenne C; Groom, Amy V (2017) Human Papillomavirus Vaccine Uptake: Increase for American Indian Adolescents, 2013-2015. American journal of preventive medicine 53(2): 162-168	- Not a relevant study design *This is a survey that looks for associations / risk factors that appear to increase or decrease vaccine uptake.*
Jarrett, Caitlin, Wilson, Rose, O'Leary, Maureen et al. (2015) Strategies for addressing vaccine hesitancy - A systematic review. Vaccine 33(34): 4180-90	- Systematic review used as source of primary studies
Jeannot, Emilien; Petignat, Patrick; Sudre, Philippe (2015) Successful Implementation and Results of an HPV Vaccination Program in Geneva Canton, Switzerland. Public Health Reports 130(3): 202-206	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Joffe, M.D. and Luberti, A. (1994) Effect of emergency department immunization on compliance with primary care. Pediatric Emergency Care 10(6): 317-319	- The intervention is a free vaccine- not in scope
Johnson, Elizabeth A, Harwell, Todd S, Donahue, Peg M et al. (2003) Promoting pneumococcal immunizations among rural Medicare beneficiaries using multiple strategies. The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association 19(4): 506-10	- Does not contain an outcome of relevance to this review *Does not state number or % vaccinated*
Johnston, Jennifer Cyne, McNeil, Deborah, Lee, Germaeline et al. (2017) Piloting CenteringParenting in Two Alberta Public Health Well-Child Clinics. Public Health Nursing 34(3): 229-237	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Jordan, Elizabeth T, Bushar, Jessica A, Kendrick, Juliette S et al. (2015) Encouraging Influenza Vaccination Among Text4baby Pregnant Women and Mothers. American journal of preventive medicine 49(4): 563-72	- The study did not report any of the outcomes specified in the protocol

Study	Reason for exclusion
Jung, Jesse J, Elkin, Zachary P, Li, Xiaochun et al. (2013) Increasing use of the vaccine against zoster through recommendation and administration by ophthalmologists at a city hospital. American journal of ophthalmology 155(5): 787-95	- The study did not report any of the outcomes specified in the protocol
Juon, Hee-Soon, Strong, Carol, Kim, Frederic et al. (2016) Lay Health Worker Intervention Improved Compliance with Hepatitis B Vaccination in Asian Americans: Randomized Controlled Trial. PloS one 11(9): e0162683	- Study participants are the wrong age group *In the UK, HepB routine vaccination is for infants. Participants in this study are all adults.*
Kamath, Geetanjali (2018) Hepatitis-B vaccination, behavioral cognitions, and changing risk behaviors among a drug using population: Findings from a cluster randomized controlled trial. Dissertation Abstracts International: Section B: The Sciences and Engineering 78(10be): no-specified	- Conference abstract
Katz ML, Oldach BR, Goodwin J et al. (2014) Development and initial feedback about a human papillomavirus (HPV) vaccine comic book for adolescents. Journal of cancer education : the official journal of the American Association for Cancer Education 29(2): 318-324	- The study did not report any of the outcomes specified in the protocol
Kaufman, Jessica, Ryan, Rebecca, Walsh, Louisa et al. (2018) Face-to-face interventions for informing or educating parents about early childhood vaccination. The Cochrane database of systematic reviews 5: cd010038	- Duplicate reference
Kaufman, Jessica, Ryan, Rebecca, Walsh, Louisa et al. (2018) Face-to-face interventions for informing or educating parents about early childhood vaccination. The Cochrane database of systematic reviews 5: cd010038	- Duplicate reference
Kaufman, Jessica, Ryan, Rebecca, Walsh, Louisa et al. (2018) Face-to-face interventions for informing or educating parents about early childhood vaccination. The Cochrane database of systematic reviews 5: cd010038	- Duplicate reference
Kaufman, Jessica, Synnot, Anneliese, Ryan, Rebecca et al. (2013) Face to face interventions for informing or educating parents about early childhood vaccination. The Cochrane database of systematic reviews: cd010038	- More recent systematic review identified that covers the same topic
Kempe, Allison, Saville, Alison, Dickinson, L Miriam et al. (2013) Population-based versus practice-based recall for childhood	- Study includes data on a vaccine that is not on the

Study	Reason for exclusion
immunizations: a randomized controlled comparative effectiveness trial. American journal of public health 103(6): 1116-23	UK routine vaccination schedule *Varicella vaccine uptake was incorporated into the data and could not be separated.*
Kendrick, D, Hewitt, M, Dewey, M et al. (2002) The effect of home visiting programmes on uptake of childhood immunization: a systematic review and meta-analysis. British Journal of Clinical Governance 7(1): 51-52	- Duplicate reference *This is a reprint of Kendrick 2000, which has been considered in this evidence review.*
Kendrick, D, Hewitt, M, Dewey, M et al. (2000) The effect of home visiting programmes on uptake of childhood immunization: a systematic review and meta-analysis. Journal of public health medicine 22(1): 90-8	- Systematic review used as source of primary studies
Kim, C S, Kristopaitis, R J, Stone, E et al. (1999) Physician education and report cards: do they make the grade? results from a randomized controlled trial. The American journal of medicine 107(6): 556-60	- Does not contain an outcome of relevance to this review
Kim, J (2020) The impact of narrative strategy on promoting HPV vaccination among college students in korea: the role of anticipated regret. Vaccines 8(2)	- The study did not report any of the outcomes specified in the protocol - Vaccine on UK routine schedule but wrong context for administration *Vaccination of university students for HPV is not on the UK routine schedule.*
Kim, M, Lee, H, Aronowitz, T et al. (2018) An online-based storytelling video intervention on promoting Korean American female college students' HPV vaccine uptake. Cancer epidemiology biomarkers and prevention 27(7)	- Conference abstract
Kim, MinJin (2018) "I want to know more about the HPV vaccine": Stories by Korean American college women. Dissertation Abstracts International: Section B: The Sciences and Engineering 79(4be): no-specified	- Not a peer-reviewed publication

Study	Reason for exclusion
Kim, Sujin; Hughes, Christine A; Sadowski, Cheryl A (2014) A review of acute care interventions to improve inpatient pneumococcal vaccination. Preventive medicine 67: 119-27	- Systematic review used as source of primary studies
Klein, R S and Adachi, N (1983) Pneumococcal vaccine in the hospital. Improved use and implications for high-risk patients. Archives of internal medicine 143(10): 1878-81	- Study published before 1990 date limit set in review protocol
Klein, RS and Adachi, N (1986) An effective hospital-based pneumococcal immunization program. Archives of internal medicine 146(2): 327-329	- Study published before 1990 date limit set in review protocol
Kolasa, M S, Petersen, T J, Brink, E W et al. (2001) Impact of multiple injections on immunization rates among vulnerable children. American journal of preventive medicine 21(4): 261-6	- Study looks at intervention in the context of introducing a new vaccine
Kolasa, M.S., Chilkatowsky, A.P., Stevenson, J.M. et al. (2003) Do laws bring children in child care centers up to date for immunizations?. Ambulatory Pediatrics 3(3): 154-157	- The study did not report any of the outcomes specified in the protocol
Koniak-Griffin D, Anderson NL, Brecht ML et al. (2002) Public health nursing care for adolescent mothers: impact on infant health and selected maternal outcomes at 1 year postbirth. The Journal of adolescent health : official publication of the Society for Adolescent Medicine 30(1): 44-54	- Duplicate reference *These are the preliminary findings of Koniak-Griffin 2003, which has also been considered in this review.*
Korn, Lars, Betsch, Cornelia, Bohm, Robert et al. (2018) Social nudging: The effect of social feedback interventions on vaccine uptake. Health psychology : official journal of the Division of Health Psychology, American Psychological Association 37(11): 1045-1054	- Does not contain an outcome of relevance to this review
Krantz, Landon, Ollberding, Nicholas J, Beck, Andrew F et al. (2018) Increasing HPV Vaccination Coverage Through Provider-Based Interventions. Clinical pediatrics 57(3): 319-326	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This is a before-and-after study.*

Study	Reason for exclusion
Kreuter, Matthew W, Caburnay, Charlene A, Chen, John J et al. (2004) Effectiveness of individually tailored calendars in promoting childhood immunization in urban public health centers. American journal of public health 94(1): 122-7	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Krishnaswamy, S., Wallace, E.M., Buttery, J. et al. (2018) Strategies to implement maternal vaccination: A comparison between standing orders for midwife delivery, a hospital based maternal immunisation service and primary care. Vaccine 36(13): 1796-1800	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Kruspe, Rachel, Lillis, Rebecca, Daberkow, Dayton W 2nd et al. (2003) Education does pay off: pneumococcal vaccine screening and administration in hospitalized adult patients with pneumonia. The Journal of the Louisiana State Medical Society : official organ of the Louisiana State Medical Society 155(6): 325-31	- Vaccine on UK routine schedule but wrong context for administration *This study looks at hospital vaccination in the context of managing pneumonia rather than uptake in the general population of people 65+ years old.*
Kuehne, Flora, Sanftenberg, Linda, Dreischulte, Tobias et al. (2020) Shared Decision Making Enhances Pneumococcal Vaccination Rates in Adult Patients in Outpatient Care. International journal of environmental research and public health 17(23)	- Systematic review used as source of primary studies
Kumar, Rajesh (2014) Effective messages in vaccine promotion: a randomised trial: public health viewpoint. Indian pediatrics 51(6): 493	- Not a peer-reviewed publication *This is a letter about Nyhan 2014. Nyhan 2014 was excluded because it did not have an outcome of relevance to this review.*
Kuria, Patrick; Brook, Gary; McSorley, John (2016) The effect of electronic patient records on hepatitis B vaccination completion rates at a genitourinary medicine clinic. International journal of STD & AIDS 27(6): 486-9	- Vaccine on UK routine schedule but wrong context for administration *This is an adult study on HepB vaccination.*

Study	Reason for exclusion
Lam LP and McLaws ML (1998) Hepatitis B vaccination coverage of Vietnamese children in south-western Sydney. Australian and New Zealand journal of public health 22(4): 502-504	- Vaccine on UK routine schedule but wrong context for administration
Lam, Sum and Jodlowski, Tomas Z (2009) Vaccines for older adults. The Consultant pharmacist : the journal of the American Society of Consultant Pharmacists 24(5): 380-91	- Review article but not a systematic review
Lau, Darren, Hu, Jia, Majumdar, Sumit R et al. (2012) Interventions to improve influenza and pneumococcal vaccination rates among community-dwelling adults: a systematic review and meta-analysis. Annals of family medicine 10(6): 538-46	- Systematic review used as source of primary studies
Lawrence GL, MacIntyre CR, Hull BP et al. (2004) Effectiveness of the linkage of child care and maternity payments to childhood immunisation. Vaccine 22(17-18): 2345-2350	- Does not contain an outcome of relevance to this review
Lee, Cecilia and Robinson, Joan L (2016) Systematic review of the effect of immunization mandates on uptake of routine childhood immunizations. The Journal of infection 72(6): 659-666	- Systematic review used as source of primary studies
Lee, Haeok, Kim, Minjin, Allison, Jeroan et al. (2017) Development of a theory-guided storytelling narrative intervention to improve HPV vaccination behavior: Save our daughters from cervical cancer. Applied nursing research : ANR 34: 57-61	- Protocol linked to an included study or paper
Lee, Hee Yun, Koopmeiners, Joseph S, McHugh, Jennifer et al. (2016) mHealth Pilot Study: Text Messaging Intervention to Promote HPV Vaccination. American journal of health behavior 40(1): 67-76	- Does not contain an outcome of relevance to this review *This study does not have a comparator.*
Lefevere, Eva, Hens, Niel, De Smet, Frank et al. (2016) The impact of non-financial and financial encouragements on participation in non school-based human papillomavirus vaccination: a retrospective cohort study. The European journal of health economics : HEPAC : health economics in prevention and care 17(3): 305-15	- The intervention is a free vaccine- not in scope *The financial encouragement is free vaccination. The non-financial encouragement is information, whichis in both arms of the study equally.*

Study	Reason for exclusion
Lemaitre, Thomas, Carrier, Nathalie, Farrands, Anne et al. (2019) Impact of a vaccination promotion intervention using motivational interview techniques on long-term vaccine coverage: the PromoVac strategy. Human vaccines & immunotherapeutics 15(3): 732-739	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Lieu TA, Glauber JH, Fuentes-Afflick E et al. (1994) Effects of vaccine information pamphlets on parents' attitudes. Archives of pediatrics & adolescent medicine 148(9): 921-925	- The study did not report any of the outcomes specified in the protocol
Lim, W Ting, Sears, Kim, Smith, Leah M et al. (2014) Evidence of effective delivery of the human papillomavirus (HPV) vaccine through a publicly funded, school-based program: the Ontario Grade 8 HPV Vaccine Cohort Study. BMC public health 14: 1029	- The study did not report any of the outcomes specified in the protocol *This study does not have a comparator.*
Lin, James L, Bacci, Jennifer L, Reynolds, Marci J et al. (2018) Comparison of two training methods in community pharmacy: Project VACCINATE. Journal of the American Pharmacists Association : JAPhA 58(4s): 94-s100e3	- Data not reported in an extractable format *Uptake was reported as percentages - the number of participants was not provided.*
Lin, S.-C., Tam, K.-W., Yen, J.Y.-C. et al. (2020) The impact of shared decision making with patient decision aids on the rotavirus vaccination rate in children: A randomized controlled trial. Preventive medicine: 106244	- Study took place in a non-OECD country
Linton, Leslie S, Peddecord, K Michael, Seidman, Robert L et al. (2003) Implementing a seventh grade vaccination law: school factors associated with completion of required immunizations. Preventive medicine 36(4): 510-7	- Not a relevant study design *This is a survey and does not specifically look at an intervention.*
Lopez, N., Garces-Sanchez, M., Panizo, M.B. et al. (2020) HPV knowledge and vaccine acceptance among European adolescents and their parents: A systematic literature review. Public Health Reviews 41(1): 10	- Not a relevant study design
Lu, P.-J., Yankey, D., Jeyarajah, J. et al. (2017) Impact of Provider Recommendation on Tdap Vaccination of Adolescents Aged 13-17 Years. American Journal of Preventive Medicine 53(3): 373-384	- Study does not contain an intervention aimed at increasing vaccine uptake

Study	Reason for exclusion
Lukusa, Lungeni Auguy, Ndze, Valantine Ngum, Mbeye, Nyanyiwe Masingi et al. (2018) A systematic review and meta-analysis of the effects of educating parents on the benefits and schedules of childhood vaccinations in low and middle-income countries. Human vaccines & immunotherapeutics 14(8): 2058-2068	- Systematic review of non-OECD countries
Ma, Grace X, Lee, Minsun M, Tan, Yin et al. (2018) Efficacy of a community-based participatory and multilevel intervention to enhance hepatitis B virus screening and vaccination in underserved Korean Americans. Cancer 124(5): 973-982	- Vaccine on UK routine schedule but wrong context for administration
MacDougall DM, Halperin BA, Langley JM et al. (2016) Knowledge, attitudes, beliefs, and behaviors of parents and healthcare providers before and after implementation of a universal rotavirus vaccination program. Vaccine 34(5): 687-695	- Study does not contain an intervention aimed at increasing vaccine uptake *This study compares patient and healthcare provider attitudes towards a physician-delivered programme compared to a nurse-delivered programme. However, there are no details of an intervention to increase uptake.*
Mackey, Jessica K, Thompson, Katie, Abdulwahab, Adeem et al. (2019) A Simple Intervention to Increase Human Papillomavirus Vaccination in a Family Medicine Practice. South Dakota medicine : the journal of the South Dakota State Medical Association 72(10): 438-441	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Macknin, J.; Marks, M.; Macknin, M.L. (2000) Effect of telephone follow-up on frequency of health maintenance visits among children attending free immunization clinics: A randomized, controlled trial. Clinical Pediatrics 39(11): 679-681	- Does not contain an outcome of relevance to this review *This study does not have any vaccine uptake data.*
Madlon-Kay, Diane J (2011) Effect of revised nursery orders on newborn preventive services. Journal of the American Board of Family Medicine : JABFM 24(6): 656-64	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Maertens, Julie A, Jimenez-Zambrano, Andrea M, Albright, Karen et al. (2017) Using Community Engagement to Develop a Web-Based Intervention for Latinos about the HPV Vaccine. Journal of health communication 22(4): 285-293	- Duplicate reference
Malo, Teri L, Hall, Megan E, Brewer, Noel T et al. (2018) Why is announcement training more effective than conversation training for introducing HPV vaccination? A theory-based investigation. Implementation science : IS 13(1): 57	- Does not contain an outcome of relevance to this review
Malone, Kathryn, Clark, Stephanie, Palmer, Jo Ann et al. (2016) A quality improvement initiative to increase pneumococcal vaccination coverage among children after kidney transplant. Pediatric transplantation 20(6): 783-9	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Manthey, David E; Stopyra, Jason; Askew, Kim (2004) Referral of emergency department patients for pneumococcal vaccination. Academic emergency medicine : official journal of the Society for Academic Emergency Medicine 11(3): 271-5	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Mantzari, Eleni; Vogt, Florian; Marteau, Theresa M (2012) Using financial incentives to increase initial uptake and completion of HPV vaccinations: protocol for a randomised controlled trial. BMC health services research 12: 301	- Protocol for a future study *The RCT is Mantzari 2015 and it has been considered in this review*
Margolis PA, Lannon CM, Stuart JM et al. (2004) Practice based education to improve delivery systems for prevention in primary care: randomised trial. BMJ (Clinical research ed.) 328(7436): 388	- Data not reported in an extractable format *The vaccine uptake data is only presented in a chart.*
Mayne, Stephanie L, duRivage, Nathalie E, Feemster, Kristen A et al. (2014) Effect of decision support on missed opportunities for human papillomavirus vaccination. American journal of preventive medicine 47(6): 734-44	- The study did not report any of the outcomes specified in the protocol *Reports number of vaccinations given relative to number of visits, rather than number of people vaccinated*

Study	Reason for exclusion
McCaul, Kevin D; Johnson, Rebecca J; Rothman, Alexander J (2002) The effects of framing and action instructions on whether older adults obtain flu shots. Health psychology : official journal of the Division of Health Psychology, American Psychological Association 21(6): 624-8	- The study did not report any of the outcomes specified in the protocol
McRee, A-L; Shoben, AB; Reiter, PL (2018) Effects of a pilot randomized controlled trial of a web-based HPV vaccination intervention for young gay and bisexual men: the outsmart HPV project. Journal of adolescent health 62(2): S10	- Conference abstract
Meghea, C I, Li, B., Zhu, Q et al. (2013) Infant health effects of a nurse-community health worker home visitation programme: a randomized controlled trial. Child: Care, Health and Development 39(1): 27-35	- Study does not contain an intervention aimed at increasing vaccine uptake *This study has an intervention that includes parenting education. However, there is nothing specifically about increasing vaccine uptake.*
Melman, S T, Ehrlich, E S, Klugman, D et al. (2000) Compliance with initiation of a sequential schedule for polio immunization. Clinical pediatrics 39(1): 51-3	- Not a relevant study design
Mena Cantero, Alvin (2018) Educational Intervention for Engaging Adolescents and Their Parents in HPV Vaccination. Dissertation Abstracts International: Section B: The Sciences and Engineering 79(3be): no-specified	- Does not contain an outcome of relevance to this review
Meyer, Amanda F, Borkovskiy, Nicole L, Brickley, Jennifer L et al. (2018) Impact of Electronic Point-of-Care Prompts on Human Papillomavirus Vaccine Uptake in Retail Clinics. American journal of preventive medicine 55(6): 822-829	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Michail, G, Smaili, M, Vozikis, A et al. (2014) Female students receiving post-secondary education in Greece: the results of a collaborative human papillomavirus knowledge survey. Public health 128(12): 1099-105	- Not a relevant study design *This study is a survey - there is no comparator.*
Miles, L.W., Williams, N., Luthy, K.E. et al. (2020) Adult Vaccination Rates in the Mentally Ill Population: An Outpatient Improvement	- Does not contain an outcome of relevance to this review

Study	Reason for exclusion
Project. Journal of the American Psychiatric Nurses Association 26(2): 172-180	
Mills, Brittany, Fensterheim, Leonard, Taitel, Michael et al. (2014) Pharmacist-led Tdap vaccination of close contacts of neonates in a women's hospital. Vaccine 32(4): 521-5	- Study does not include a relevant population
Minkovitz, C S, Belote, A D, Higman, S M et al. (2001) Effectiveness of a practice-based intervention to increase vaccination rates and reduce missed opportunities. Archives of pediatrics & adolescent medicine 155(3): 382-6	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review *This was a before-and-after study.*
Mohan, Pavitra (2014) Effective messages in vaccine promotion: a randomised trial: public policy viewpoint. Indian pediatrics 51(6): 492	- Not a peer-reviewed publication *This is a letter about Nyhan 2014. Nyhan 2014 was excluded because it did not have an outcome of relevance to this review.*
Mohr, J.J., Randolph, G.D., Laughon, M.M. et al. (2003) Integrating improvement competencies into residency education: A pilot project from a pediatric continuity clinic. Ambulatory Pediatrics 3(3): 131-136	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Monreal Perez, M. and Beltran Viciano, M.A. (2019) Educational intervention for achieving improvements in the vaccination coverage of meningitis C in primary care. Vacunas 20(1): 25-33	- Study not reported in English
Moretti, Manuel, Grill, Eva, Weitkunat, Rolf et al. (2003) An individualized telephone intervention to increase the immunization rates of school beginners. Zeitschrift fur Gesundheitspsychologie 11(2): 39-48	- Not a peer-reviewed publication
Morgan JL, Baggari SR, Chung W et al. (2015) Association of a Best-Practice Alert and Prenatal Administration With Tetanus Toxoid, Reduced Diphtheria Toxoid, and Acellular Pertussis Vaccination Rates. Obstetrics and gynecology 126(2): 333-337	- Comparator in study does not match that specified in protocol *The control cohort was usual care vaccinations during the post-partum period*

Study	Reason for exclusion
Morris, J, Wang, W, Wang, L et al. (2015) Comparison of reminder methods in selected adolescents with records in an immunization registry. Journal of adolescent health 56(5): S27-S32	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Moss, J.L., Gilkey, M.B., Griffith, T. et al. (2013) Organizational correlates of adolescent immunization: Findings of a state-wide study of primary care clinics in North Carolina. Vaccine 31(40): 4436-4441	- Not a relevant study design *Survey with no specific intervention.*
Moss, Jennifer L (2016) Concomitant adolescent vaccination: The influence of seasonal variation, school requirements, and patient-provider communication. Dissertation Abstracts International: Section B: The Sciences and Engineering 76(9be): no-specified	- Conference abstract
Moss, Jennifer L, Reiter, Paul L, Dayton, Amanda et al. (2012) Increasing adolescent immunization by webinar: a brief provider intervention at federally qualified health centers. Vaccine 30(33): 4960-3	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Moss, Jennifer L, Reiter, Paul L, Truong, Young K et al. (2016) School Entry Requirements and Coverage of Nontargeted Adolescent Vaccines. Pediatrics 138(6)	- Data not reported in an extractable format *Number of participants within states not provided.*
Muehleisen, Beda, Baer, Gurli, Schaad, Urs B et al. (2007) Assessment of immunization status in hospitalized children followed by counseling of parents and primary care physicians improves vaccination coverage: an interventional study. The Journal of pediatrics 151(6): 704-2	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Murphy, A W, Harrington, M, Bury, G et al. (1996) Impact of a collaborative immunisation programme in an inner city practice. Irish medical journal 89(6): 220-1	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Murray, K., Low, C., O'Rourke, A. et al. (2020) A quality improvement intervention failed to significantly increase	- Infrastructure study. Excluded because there

Study	Reason for exclusion
pneumococcal and influenza vaccination rates in immunosuppressed inflammatory arthritis patients. Clinical Rheumatology 39(3): 747-754	was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Nace DA, Perera S, Handler SM et al. (2011) Increasing influenza and pneumococcal immunization rates in a nursing home network. Journal of the American Medical Directors Association 12(9): 678-684	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Nan X; Futerfas M; Ma Z (2017) Role of Narrative Perspective and Modality in the Persuasiveness of Public Service Advertisements Promoting HPV Vaccination. Health communication 32(3): 320-328	- The study did not report any of the outcomes specified in the protocol
NCT01719679 (2012) School Located Adolescent Vaccination Study. https://clinicaltrials.gov/show/NCT01719679	- Protocol for a future study *This is the protocol for Shlay 2015, which is considered in this evidence review.*
Ndiaye, Serigne M, Hopkins, David P, Shefer, Abigail M et al. (2005) Interventions to improve influenza, pneumococcal polysaccharide, and hepatitis B vaccination coverage among high-risk adults: a systematic review. American journal of preventive medicine 28(5suppl): 248-79	- Systematic review that does not include a relevant population *Review looks at several high risk groups of adults*
Neubrand, Tara P L, Breitkopf, Carmen Radecki, Rupp, Richard et al. (2009) Factors associated with completion of the human papillomavirus vaccine series. Clinical pediatrics 48(9): 966-9	- Not a relevant study design *This is a survey of women who had an HPV vaccination.*
Niccolai, Linda M and Hansen, Caitlin E (2015) Practice- and Community-Based Interventions to Increase Human Papillomavirus Vaccine Coverage: A Systematic Review. JAMA pediatrics 169(7): 686-92	- Systematic review used as source of primary studies

Study	Reason for exclusion
Nichol, K.L. (1998) Ten-year durability and success of an organized program to increase influenza and pneumococcal vaccination rates among high-risk adults. American Journal of Medicine 105(5): 385-392	- Does not contain an outcome of relevance to this review *Vaccination numbers based on outcome of patient survey*
Nour, Rawan (2019) A Systematic Review of Methods to Improve Attitudes Towards Childhood Vaccinations. Cureus 11(7): e5067	- Systematic review used as source of primary studies
Nowalk MP, Nutini J, Raymund M et al. (2012) Evaluation of a toolkit to introduce standing orders for influenza and pneumococcal vaccination in adults: a multimodal pilot project. Vaccine 30(41): 5978-5982	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Nowalk, Mary Patricia, Moehling, Krissy K, Zhang, Song et al. (2017) Using the 4 Pillars to increase vaccination among high-risk adults: who benefits?. The American journal of managed care 23(11): 651-655	- Secondary publication of an included study that does not provide any additional relevant information
Nwanodi, Oroma; Salisbury, Helen; Bay, Curtis (2017) Multimodal Counseling Interventions: Effect on Human Papilloma Virus Vaccination Acceptance. Healthcare (Basel, Switzerland) 5(4)	- Does not contain an outcome of relevance to this review
Nyhan, Brendan, Reifler, Jason, Richey, Sean et al. (2014) Effective messages in vaccine promotion: a randomized trial. Pediatrics 133(4): e835-42	- Does not contain an outcome of relevance to this review
O'Leary, S, Pyrzanowski, J, Lockhart, S et al. (2017) Impact of a provider communication training intervention on adolescent human papillomavirus vaccination: a cluster randomized, clinical trial. Open forum infectious diseases 4: S61	- Conference abstract
O'Leary, S, Wagner, N, Narwaney, K et al. (2017) Effectiveness of a web-based intervention to increase uptake of maternal vaccines. Open forum infectious diseases 4: S457	- Conference abstract
Odone, Anna, Ferrari, Antonio, Spagnoli, Francesca et al. (2015) Effectiveness of interventions that apply new media to improve	- More recent systematic review identified that covers the same topic

Study	Reason for exclusion
vaccine uptake and vaccine coverage. Human vaccines & immunotherapeutics 11(1): 72-82	
Oeffinger, K C, Roaten, S P, Hitchcock, M A et al. (1992) The effect of patient education on pediatric immunization rates. The Journal of family practice 35(3): 288-93	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review *Participants were randomised by birth day of the week so not true randomisation.*
Ogilvie, G., Anderson, M., Marra, F. et al. (2010) A population-based evaluation of a publicly funded, school-based HPV vaccine program in British Columbia, Canada: Parental factors associated with HPV vaccine receipt. PLoS Medicine 7(5)	- Not a relevant study design *This study is a survey that looks at associations and risk factors for vaccine uptake.*
Okwo-Bele, J.M. (2012) Integrating immunization with other health interventions for greater impact: The right strategic choice. Journal of Infectious Diseases 205(suppl1): 4-s5	- Review article but not a systematic review
Oliver, Kristin; Frawley, Alean; Garland, Elizabeth (2016) HPV vaccination: Population approaches for improving rates. Human vaccines & immunotherapeutics 12(6): 1589-93	- Review article but not a systematic review *Article is assessing the evidence to support American vaccination recommendations.*
Opel, D.J., Henrikson, N., Lepere, K. et al. (2019) Previsit screening for parental vaccine hesitancy: A cluster randomized trial. Pediatrics 144(5): e20190802	- Study does not contain an intervention aimed at increasing vaccine uptake
Orefice, Roberto and Quinlivan, Julie A (2019) Small interface changes have dramatic impacts: how mandatory fields in electronic medical records increased pertussis vaccination rates in Australian obstetric patients. BMJ health & care informatics 26(1): 0	- Study does not contain an intervention aimed at increasing vaccine uptake

Study	Reason for exclusion
Ornstein, S M, Garr, D R, Jenkins, R G et al. (1991) Computer-generated physician and patient reminders. Tools to improve population adherence to selected preventive services. The Journal of family practice 32(1): 82-90	- Vaccine on UK routine schedule but wrong context for administration *This study is about tetanus immunisation that occurs every 10 years after the primary immunisation series.*
Ortega, A.N., Andrews, S.F., Katz, S.H. et al. (1997) Comparing a computer-based childhood vaccination registry with parental vaccination cards: A population-based study of Delaware children. Clinical Pediatrics 36(4): 217-221	- Study does not contain an intervention aimed at increasing vaccine uptake *This study compares the accuracy of 2 different record keeping systems.*
Ortiz, Rebecca R, Shafer, Autumn, Cates, Joan et al. (2018) Development and Evaluation of a Social Media Health Intervention to Improve Adolescents' Knowledge About and Vaccination Against the Human Papillomavirus. Global pediatric health 5: 2333794x18777918	- Does not contain an outcome of relevance to this review
Ortiz, Rebecca R; Smith, Andrea; Coyne-Beasley, Tamera (2019) A systematic literature review to examine the potential for social media to impact HPV vaccine uptake and awareness, knowledge, and attitudes about HPV and HPV vaccination. Human vaccines & immunotherapeutics 15(78): 1465-1475	- Systematic review used as source of primary studies
Pahud, B., Clark, S., Herigon, J.C. et al. (2015) A pilot program to improve vaccination status for hospitalized children. Hospital Pediatrics 5(1): 35-41	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Palmeri, S, Costantino, C, D'Angelo, C et al. (2017) HPV vaccine hesitancy among parents of female adolescents: a pre–post interventional study. Public Health 150: 84	- Does not contain an outcome of relevance to this review
Pandolfi, Elisabetta, Graziani, Maria C, Ieraci, Roberto et al. (2008) A comparison of populations vaccinated in a public service and in a private hospital setting in the same area. BMC public health 8: 278	- Study does not contain an intervention aimed at increasing vaccine uptake

Study	Reason for exclusion
Parker, Siddhartha, Chambers White, Laura, Spangler, Chad et al. (2013) A quality improvement project significantly increased the vaccination rate for immunosuppressed patients with IBD. Inflammatory bowel diseases 19(9): 1809-14	- Study does not include a relevant population *Furthermore, the age of the participants was not provided.*
Parra-Medina, Deborah, Morales-Campos, Daisy Y, Mojica, Cynthia et al. (2015) Promotora Outreach, Education and Navigation Support for HPV Vaccination to Hispanic Women with Unvaccinated Daughters. Journal of cancer education : the official journal of the American Association for Cancer Education 30(2): 353-9	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Parsons, Joanne E; Newby, Katie V; French, David P (2018) Do interventions containing risk messages increase risk appraisal and the subsequent vaccination intentions and uptake? - A systematic review and meta-analysis. British journal of health psychology 23(4): 1084-1106	- Systematic review used as source of primary studies
Patel, A., Stern, L., Unger, Z. et al. (2014) Staying on track: A cluster randomized controlled trial of automated reminders aimed at increasing human papillomavirus vaccine completion. Vaccine 32(21): 2428-2433	- Vaccine on UK routine schedule but wrong context for administration *The women in this study are aged 19 to 26 years (mean age 23 years).*
Patel, Anik R; Breck, Andrew B; Law, Michael R (2018) The impact of pharmacy-based immunization services on the likelihood of immunization in the United States. Journal of the American Pharmacists Association : JAPhA 58(5): 505-514e2	- Not a relevant study design
Paunio M, Virtanen M, Peltola H et al. (1991) Increase of vaccination coverage by mass media and individual approach: intensified measles, mumps, and rubella prevention program in Finland. American journal of epidemiology 133(11): 1152-1160	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Pereira, Jennifer A, Quach, Susan, Heidebrecht, Christine L et al. (2012) Barriers to the use of reminder/recall interventions for immunizations: a systematic review. BMC medical informatics and decision making 12: 145	- Qualitative systematic review
Perkins, Rebecca B, Legler, Aaron, Jansen, Emily et al. (2020) Improving HPV Vaccination Rates: A Stepped-Wedge Randomized Trial. Pediatrics 146(1)	- Education non-RCT. Excluded because there

Study	Reason for exclusion
	was sufficient RCT evidence for this review
Perkins, Rebecca B, Lin, Mengyun, Silliman, Rebecca A et al. (2015) Why are U.S. girls getting meningococcal but not human papilloma virus vaccines? Comparison of factors associated with human papilloma virus and meningococcal vaccination among adolescent girls 2008 to 2012. Women's health issues : official publication of the Jacobs Institute of Women's Health 25(2): 97-104	- Not a relevant study design
Perman, Sarah, Turner, Simon, Ramsay, Angus I G et al. (2017) School-based vaccination programmes: a systematic review of the evidence on organisation and delivery in high income countries. BMC public health 17(1): 252	- Systematic review that does not include the outcomes stated in the protocol
Pich, Jacqueline (2019) Patient reminder and recall interventions to improve immunization rates: A Cochrane review summary. International Journal of Nursing Studies 91: 144	- Review article but not a systematic review *Summary of a Cochrane systematic review*
Piedimonte, S, Leung, A, Zakhari, A et al. (2018) Impact of an HPV Education and Vaccination Campaign among Canadian University Students. Journal of obstetrics and gynaecology canada 40(4): 440-446	- Study participants are the wrong age group *The subjects are university students, not teenagers.*
Pierre-Victor, Dudith, Page, Timothy F, Trepka, Mary Jo et al. (2017) Impact of Virginia's School-Entry Vaccine Mandate on Human Papillomavirus Vaccination Among 13-17-Year-Old Females. Journal of women's health (2002) 26(3): 266-275	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Poole, Tracey, Goodyear-Smith, Felicity, Petousis-Harris, Helen et al. (2012) Human papillomavirus vaccination in Auckland: reducing ethnic and socioeconomic inequities. Vaccine 31(1): 84-8	- Not a relevant study design *This study is a survey*

Study	Reason for exclusion
Porter RM, Amin AB, Bednarczyk RA et al. Cancer-salient messaging for Human Papillomavirus vaccine uptake: A randomized controlled trial. Vaccine 36(18): 2494-2500	- The study did not report any of the outcomes specified in the protocol
Porter, A.M. and Fulco, P.P. (2020) Impact of a pharmacist-driven recombinant zoster vaccine administration program. Journal of the American Pharmacists Association	- Study does not include a relevant population *Furthermore, the age of the participants was not provided.*
Poscia, Andrea, Pastorino, Roberta, Boccia, Stefania et al. (2019) The impact of a school-based multicomponent intervention for promoting vaccine uptake in Italian adolescents: a retrospective cohort study. Annali dell'Istituto superiore di sanita 55(2): 124-130	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Pot, M., Paulussen, T.G., Ruiter, R.A. et al. (2020) Dose-Response Relationship of a Web-Based Tailored Intervention Promoting Human Papillomavirus Vaccination: Process Evaluation of a Randomized Controlled Trial. Journal of medical Internet research 22(7): e14822	- Duplicate reference *This is a process evaluation of Pot 2017, which has been assessed in this evidence review.*
Pot, Mirjam, Ruiter, Robert A C, Paulussen, Theo W G M et al. (2018) Systematically Developing a Web-Based Tailored Intervention Promoting HPV-Vaccination Acceptability Among Mothers of Invited Girls Using Intervention Mapping. Frontiers in public health 6: 226	- Does not contain an outcome of relevance to this review
Quinley, John C and Shih, Anthony (2004) Improving physician coverage of pneumococcal vaccine: a randomized trial of a telephone intervention. Journal of community health 29(2): 103-15	- Data not reported in an extractable format *Participant numbers were not provided.*
Rabarison, Kristina M, Li, Rui, Bish, Connie L et al. (2015) A Cost Analysis of the 1-2-3 Pap Intervention. Frontiers in public health services & systems research 4(4): 45-50	- Not a relevant study design *Cost-effectiveness analysis only*

Study	Reason for exclusion
Ramón Esparza, T; Hernando Arizaleta, L; García Calvente, MM (1990) Vaccination every time when an occasion arises: evaluation of an intervention in the Murcia Autonomous Community. Atencion primaria / Sociedad Espanola de Medicina de Familia y Comunitaria 7(10): 616-621	- Study not reported in English
Rangrej, MI (2017) IMPACT OF CLINICAL PHARMACIST INTERVENTION ON THE KNOWLEDGE OF IMMUNIZATION IN PARENTS OF PEDIATRICS IN TERTIARY CARE HOSPITAL. Value in Health : The Journal of the International Society for Pharmacoeconomics and Outcomes Research 20(5)	- Conference abstract
Rani, U., Darabaner, E., Seserman, M. et al. (2020) Public Education Interventions and Uptake of Human Papillomavirus Vaccine: A Systematic Review. Journal of public health management and practice : JPHMP	- Systematic review used as source of primary studies
Raviotta, Jonathan Marc (2020) The development testing and implementation of the 4 pillarsTM practice transformation program for immunization: Achieving public health outcomes through primary care quality improvement. Dissertation Abstracts International: Section B: The Sciences and Engineering 81(8b): no-specified	- Review article but not a systematic review
Reading, Richard (2009) Pediatric primary care to help prevent child maltreatment: the Safe Environment for Every Kid (SEEK) model. Child Care, Health and Development 35(4): 588	- Not a peer-reviewed publication *This is an editorial about Dubowitz 2009, which has been considered in this review.*
Redfield, J.R. and Wang, T.W. (2000) Improving pneumococcal vaccination rates: A three-step approach. Family Medicine 32(5): 338-341	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Reiter, Paul L, Stubbs, Brenda, Panozzo, Catherine A et al. (2011) HPV and HPV vaccine education intervention: effects on parents, healthcare staff, and school staff. Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology 20(11): 2354-61	- Does not contain an outcome of relevance to this review
Reno, Jenna E, Thomas, Jacob, Pyrzanowski, Jennifer et al. (2019) Examining strategies for improving healthcare providers' communication about adolescent HPV vaccination: evaluation of secondary outcomes in a randomized controlled trial. Human vaccines & immunotherapeutics 15(78): 1592-1598	- Duplicate reference *This is a survey following a study that has already been included: Dempsey 2018:*

Study	Reason for exclusion
	Effect of a Health Care Professional Communication Training Intervention on Adolescent Human Papillomavirus Vaccination: A Cluster Randomized Clinical Trial
Ressler KA, Orr K, Bowdler S et al. (2008) Opportunistic immunisation of infants admitted to hospital: are we doing enough?. Journal of paediatrics and child health 44(6): 317-320	- Study describes a catch up campaign following the introduction of a vaccine- out of scope of the review
Reuben, D.B., Hirsch, S.H., Frank, J.C. et al. (1996) The prevention for elderly persons (PEP) program: A model of municipal and academic partnership to meet the needs of older persons for preventive services. Journal of the American Geriatrics Society 44(11): 1394-1398	- The study did not report any of the outcomes specified in the protocol
Richman, Alice R, Maddy, LaDonna, Torres, Essie et al. (2016) A randomized intervention study to evaluate whether electronic messaging can increase human papillomavirus vaccine completion and knowledge among college students. Journal of American college health : J of ACH 64(4): 269-78	- Study participants are the wrong age group *Adults aged 18-26 for HPV vaccination*
Rickert, Donna, Deladisma, Adeline, Yusuf, Hussain et al. (2004) Adolescent immunizations. are we ready for a new wave?. American journal of preventive medicine 26(1): 22-8	- Not a relevant study design *Survey that looks at associations and risk factors for uptake.*
Rickert, Vaughn I, Auslander, Beth A, Cox, Dena S et al. (2015) School-based HPV immunization of young adolescents: effects of two brief health interventions. Human vaccines & immunotherapeutics 11(2): 315-21	- Does not contain an outcome of relevance to this review *Vaccination intent is recorded for each of the 4 arms but not uptake. Percentage uptake is recorded for all 4 arms together but not for each arm separately.*

Study	Reason for exclusion
Ridda, Iman, MacIntyre, Raina C, Lindley, Richard I et al. (2007) Predictors of pneumococcal vaccination uptake in hospitalized patients aged 65 years and over shortly following the commencement of a publicly funded national pneumococcal vaccination program in Australia. Human vaccines 3(3): 83-6	- The intervention is a free vaccine- not in scope
Righolt, Christiaan H; Bozat-Emre, Songul; Mahmud, Salaheddin M (2019) Effectiveness of school-based and high-risk human papillomavirus vaccination programs against cervical dysplasia in Manitoba, Canada. International journal of cancer 145(3): 671-677	- Does not contain an outcome of relevance to this review
Rihtarchik, Lindsey, Murphy, Claire V, Porter, Kyle et al. (2018) Utilizing pharmacy intervention in asplenic patients to improve vaccination rates. Research in social & administrative pharmacy : RSAP 14(4): 367-371	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review
Riley R; Maher C; Kolbe A (1993) Hepatitis B vaccination of high-risk neonates in the South West Region of New South Wales: evaluation of program coverage. Australian journal of public health 17(2): 171-173	- Not a relevant study design *Study does not have a comparison group.*
Riley, D.J.; Mughal, M.Z.; Roland, J. (1991) Immunisation state of young children admitted to hospital and effectiveness of a ward based opportunistic immunisation policy. British Medical Journal 302(6767): 31-33	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Rimple, Diane, Weiss, Steven J, Brett, Meghan et al. (2006) An emergency department-based vaccination program: overcoming the barriers for adults at high risk for vaccine-preventable diseases. Academic emergency medicine : official journal of the Society for Academic Emergency Medicine 13(9): 922-30	- Study does not include a relevant population
Rizzo, C. (2006) Improving immunization rates in practice settings. Pediatric Annals 35(7): 493-497	- Review article but not a systematic review
Robare, Joseph F, Bayles, Constance M, Newman, Anne B et al. (2011) The "10 Keys" to Healthy Aging: 24-Month Follow-Up Results From an Innovative Community-Based Prevention Program. Health Education & Behavior 38(4): 379-388	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Robison, Steve G (2013) Sick-visit immunizations and delayed well-baby visits. Pediatrics 132(1): 44-8	- Data not reported in an extractable format *The data that we would like was written in a narrative rather than numerical format.*
Rockliffe L, Chorley AJ, McBride E et al. Assessing the acceptability of incentivising HPV vaccination consent form return as a means of increasing uptake. BMC public health 18(1): 382	- The study did not report any of the outcomes specified in the protocol
Rosberger Z, Krawczyk A, Stephenson E et al. (2014) HPV vaccine education: enhancing knowledge and attitudes of community counselors and educators. Journal of cancer education : the official journal of the American Association for Cancer Education 29(3): 473-477	- The study did not report any of the outcomes specified in the protocol
Rosen, Brittany L, Bishop, James M, McDonald, Skye L et al. (2018) Quality of Web-Based Educational Interventions for Clinicians on Human Papillomavirus Vaccine: Content and Usability Assessment. JMIR cancer 4(1): e3	- Systematic review that does not include the outcomes stated in the protocol
Rosenberg, Karen (2019) EDUCATIONAL INTERVENTION IMPROVES VACCINATION RATES IN OLDER PATIENTS. The American Journal of Nursing 119(7): 63	- Review article but not a systematic review
Rosenberg, Karen (2014) AFIX CONSULTATIONS MAY INCREASE VACCINATION COVERAGE IN YOUNGER ADOLESCENTS. The American Journal of Nursing 114(11): 65	- Not a peer-reviewed publication *Editorial about a study that has already been considered in this review: Gilkey 2014: Increasing provision of adolescent vaccines in primary care: a randomized controlled trial*
Rosenberg, Z, Findley, S, McPhillips, S et al. (1995) Community-based strategies for immunizing the "hard-to-reach" child: the New York State immunization and primary health care initiative. American journal of preventive medicine 11(3suppl): 14-20	- Study does not contain an intervention aimed at increasing vaccine uptake

Study	Reason for exclusion
Rosser, W W; McDowell, I; Newell, C (1991) Use of reminders for preventive procedures in family medicine. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne 145(7): 807-14	- The study did not report any of the outcomes specified in the protocol *Tetanus vaccination is not on routine schedule after age 18 in UK and flu vaccination is not covered by this guideline*
Ruffin, Mack T 4th, Plegue, Melissa A, Rockwell, Pamela G et al. (2015) Impact of an Electronic Health Record (EHR) Reminder on Human Papillomavirus (HPV) Vaccine Initiation and Timely Completion. Journal of the American Board of Family Medicine : JABFM 28(3): 324-33	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Ruiz-López T, Sen S, Jakobsen E et al. (2019) FightHPV: Design and Evaluation of a Mobile Game to Raise Awareness About Human Papillomavirus and Nudge People to Take Action Against Cervical Cancer. JMIR serious games 7(2): e8540	- The study did not report any of the outcomes specified in the protocol
Russell, SL (2012) Effectiveness of text message reminders for improving vaccination appointment attendance and series completion among adolescents and adults. Value in health 15(4): A248	- Conference abstract
Sadaf A, Richards JL, Glanz J, Salmon DA, Omer SB (2013) A systematic review of interventions for reducing parental vaccine refusal and vaccine hesitancy. Vaccine 31(40): 4293-4304	- Systematic review used as source of primary studies
Saeterdal, Ingvil, Lewin, Simon, Austvoll-Dahlgren, Astrid et al. (2014) Interventions aimed at communities to inform and/or educate about early childhood vaccination. The Cochrane database of systematic reviews: cd010232	- Systematic review used as source of primary studies
Saffin K (1992) School nurses immunising without a doctor present. Health visitor 65(11): 394-396	- Does not contain an outcome of relevance to this review *This is a survey of nurses' opinions.*
Saito, A, Saitoh, A, Sato, I et al. (2016) Effectiveness of stepwise perinatal immunization education: a cluster randomized controlled trial. Open forum infectious diseases 3	- Conference abstract

Study	Reason for exclusion
Santa Maria, Diane (2020) EFFICACY OF A STUDENT-NURSE BRIEF PARENT-BASED SEXUAL HEALTH INTERVENTION TO INCREASE HPV VACCINATION AMONG ADOLESCENTS. Journal of Adolescent Health 66(2s)	- Conference abstract
Schempf, A.H.; Politzer, R.M.; Wulu, J. (2003) Immunization coverage of vulnerable children: A comparison of health center and national rates. Medical Care Research and Review 60(1): 85-100	- Study does not contain an intervention aimed at increasing vaccine uptake
Seib K, Underwood NL, Gargano LM et al. (2016) Preexisting Chronic Health Conditions and Health Insurance Status Associated With Vaccine Receipt Among Adolescents. The Journal of adolescent health : official publication of the Society for Adolescent Medicine 58(2): 148-153	- Does not contain an outcome of relevance to this review *This study does not measure uptake for each of the 3 arms.*
Seib, KG, Herbert, N, Gargano, L et al. (2014) Pre-existing chronic health conditions and health insurance status as determinants of vaccine receipt among adolescents in Richmond county, Georgia. Journal of adolescent health 54(2): S29	- Conference abstract
Sellors, J, Pickard, L, Mahony, J B et al. (1997) Understanding and enhancing compliance with the second dose of hepatitis B vaccine: a cohort analysis and a randomized controlled trial. CMAJ : Canadian Medical Association journal = journal de l'Association medicale canadienne 157(2): 143-8	- Study participants are the wrong age group *This study looks at HepB vaccination for adults.*
Sewell, M.J., Riche, D.M., Fleming, J.W. et al. (2016) Comparison of pharmacist and physician managed annual medicare wellness services. Journal of Managed Care and Specialty Pharmacy 22(12): 1412-1416	- Study does not contain an intervention aimed at increasing vaccine uptake
Shah, M.D., Glenn, B.A., Chang, L.C. et al. (2020) Reducing Missed Opportunities for Human Papillomavirus Vaccination in School-Based Health Centers: Impact of an Intervention. Academic Pediatrics	- Does not contain an outcome of relevance to this review *This study looks at missed opportunities, not vaccine uptake*
Shah, MN, Clarkson, L, Lerner, EB et al. (2006) An emergency medical services program to promote the health of older adults. Journal of the american geriatrics society 54(6): 956-962	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Shaw, J., Mader, E.M., Bennett, B.E. et al. (2018) Immunization mandates, vaccination coverage, and exemption rates in the United States. Open Forum Infectious Diseases 5(6)	- Not a relevant study design *Survey that looks at associations and risk factors for vaccination*
Shaw, J.S., Samuels, R.C., Larusso, E.M. et al. (2000) Impact of an encounter-based prompting system on resident vaccine administration performance and immunization knowledge. Pediatrics 105(4ii): 978-983	- The study did not report any of the outcomes specified in the protocol *Study looks at missed opportunities and prescribing errors, not vaccine uptake*
Shay, L Aubree, Street, Richard L Jr, Baldwin, Austin S et al. (2016) Characterizing safety-net providers' HPV vaccine recommendations to undecided parents: A pilot study. Patient education and counseling 99(9): 1452-60	- The study did not report any of the outcomes specified in the protocol *There is no intervention - this is a conversation analysis of consultations*
Sheaves, Crystal (2016) Evaluating changes in knowledge, beliefs, and behaviors associated with HPV following an educational intervention among women. Dissertation Abstracts International: Section B: The Sciences and Engineering 76(12be): no-specified	- Not a peer-reviewed publication
Shenson, D., Adams, M., Bolen, J. et al. (2011) Routine checkups don't ensure that seniors get preventive services. The Journal of family practice 60(1): e1-e10	- Not a relevant study design *This is a survey that looks for associations and risk factors for vaccination*
Shlay JC, Rodgers S, Lyons J et al. (2015) Implementing a School-Located Vaccination Program in Denver Public Schools. The Journal of school health 85(8): 536-543	- The study did not report any of the outcomes specified in the protocol
Si, Mingyu, Su, Xiaoyou, Jiang, Yu et al. (2019) Interventions to improve human papillomavirus vaccination among Chinese female	- Protocol for a future study

Study	Reason for exclusion
college students: study protocol for a randomized controlled trial. BMC public health 19(1): 1546	
Siebers, M J and Hunt, V B (1985) Increasing the pneumococcal vaccination rate of elderly patients in a general internal medicine clinic. Journal of the American Geriatrics Society 33(3): 175-8	- Study published before 1990 date limit set in review protocol
Singh, S.; Mazor, K.M.; Fisher, K.A. (2019) Positive deviance approaches to improving vaccination coverage rates within healthcare systems: A systematic review. Journal of Comparative Effectiveness Research 8(13): 1055-1065	- Systematic review that does not include relevant study types
Sinn JS; Morrow AL; Finch AB (1999) Improving immunization rates in private pediatric practices through physician leadership. Archives of pediatrics & adolescent medicine 153(6): 597-603	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review *This was a before-and-after study.*
Siriwardena, A.N., Rashid, A., Johnson, M.R.D. et al. (2002) Cluster randomised controlled trial of an educational outreach visit to improve influenza and pneumococcal immunisation rates in primary care. British Journal of General Practice 52(482): 735-740	- Study does not include a relevant population *The intervention is provider education. The ≥65 years of age population for influenza vaccine (n=27,580) was different to the populations for pneumonia vaccine. The populations for pneumonia vaccine were people with: congestive heart disease (n=6207), diabetes (n=4327) and splenectomy (n=169).*
Skedgel C, Langley JM, MacDonald NE et al. (2011) An incremental economic evaluation of targeted and universal influenza vaccination in pregnant women. Canadian journal of public health = Revue canadienne de sante publique 102(6): 445-450	- Does not contain an outcome of relevance to this review *Study does not have vaccine uptake data, it looks at whether people should be vaccinated or not.*

Study	Reason for exclusion
Skinner, S R, Imberger, A, Nolan, T et al. (2000) Randomised controlled trial of an educational strategy to increase school-based adolescent hepatitis B vaccination. Australian and New Zealand journal of public health 24(3): 298-304	- Vaccine on UK routine schedule but wrong context for administration *HepB vaccine is given to infants in the UK, not teenagers.*
Skinner, SR, Davies, C, Cooper, S et al. (2015) Randomised controlled trial of a complex intervention to improve school-based HPV vaccination for adolescents: the HPV. EDU study. Sexually transmitted infections 91: A77	- Conference abstract
Skledar SJ, Hess MM, Ervin KA et al. (2003) Designing a hospital-based pneumococcal vaccination program. American journal of health-system pharmacy : AJHP : official journal of the American Society of Health-System Pharmacists 60(14): 1471-1476	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Smith, J.M. and Craig, T.J. (2006) Strategies for improving pneumococcal vaccination in eligible patients. Current Infectious Disease Reports 8(3): 231-237	- Review article but not a systematic review
Smith, Kenneth J, Zimmerman, Richard K, Nowalk, Mary Patricia et al. (2017) Cost-Effectiveness of the 4 Pillars Practice Transformation Program to Improve Vaccination of Adults Aged 65 and Older. Journal of the American Geriatrics Society 65(4): 763-768	- Duplicate reference *This is an economic analysis of a study already considered in this review: Zimmerman 2017: Using the 4 Pillars Practice Transformation Program to Increase Pneumococcal Immunizations for Older Adults: a Cluster-Randomized Trial*
Smulian, Elizabeth A; Mitchell, Krista R; Stokley, Shannon (2016) Interventions to increase HPV vaccination coverage: A systematic review. Human vaccines & immunotherapeutics 12(6): 1566-88	- Systematic review used as source of primary studies
Sohn, M.-W., Yoo, J., Oh, E.H. et al. (2011) Welfare, maternal work, and on-time childhood vaccination rates. Pediatrics 128(6): 1109-1116	- Not a relevant study design *This study retrospectively selects factors that may increase vaccine uptake as*

Study	Reason for exclusion
	if they were 'risk factors' for vaccine uptake.
Soljak, M A and Handford, S (1987) Early results from the Northland immunisation register. The New Zealand medical journal 100(822): 244-6	- Study published before 1990 date limit set in review protocol
Soon, Reni, Sung, Stephen, Cruz, May Rose Dela et al. (2017) Improving Human Papillomavirus (HPV) Vaccination in the Postpartum Setting. Journal of community health 42(1): 66-71	- Study participants are the wrong age group *Participants were of university age, not teenagers at school.*
Srivastava, T.; Emmer, K.; Feemster, K.A. (2020) Impact of school-entry vaccination requirement changes on clinical practice implementation and adolescent vaccination rates in metropolitan Philadelphia. Human Vaccines and Immunotherapeutics 16(5): 1155-1165	- The study did not report any of the outcomes specified in the protocol
Stanwyck, C.A.; Kolasa, M.S.; Shaw, K.M. (2004) Immunization requirements for childcare programs: Are they enough?. American Journal of Preventive Medicine 27(2): 161-163	- Not a relevant study design *This study is a survey that looks at factors associated with vaccination. There is no specific intervention to increase uptake.*
Staras, S.A.S., Richardson, E., Merlo, L.J. et al. (2021) A feasibility trial of parent HPV vaccine reminders and phone-based motivational interviewing. BMC public health 21(1): 109	- Does not contain an outcome of relevance to this review *The outcome was acceptability, not uptake.*
Staras, SA, Vadaparampil, S, Livingston, IM et al. (2014) A health information technology intervention increases HPV vaccine series initiation among Florida Medicaid and CHIP adolescents. Sexually transmitted diseases 41(suppl1): S9-10	- Conference abstract
Staras, SAS, Vadaparampil, ST, Thompson, LA et al. (2020) Postcard reminders for HPV vaccination mainly primed parents for providers' recommendations. Preventive medicine reports 20	- Does not contain an outcome of relevance to this review

Study	Reason for exclusion
	This is a secondary analysis of a previous study (Staras 2015) and does not report vaccine uptake for each intervention. The previous study was quasi-experimental but this evidence review is at the RCT and cluster RCT level of evidence.
Staras, Stephanie A S, Vadaparampil, Susan T, Livingston, Melvin D et al. (2015) Increasing human papillomavirus vaccine initiation among publicly insured Florida adolescents. The Journal of adolescent health : official publication of the Society for Adolescent Medicine 56(5suppl): 40-6	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Stevens, B. and Gibbins, S. (2002) Immunizations in adulthood. Primary Care - Clinics in Office Practice 29(3): 649-665	- Review article but not a systematic review
Stevenson, K B, McMahon, J W, Harris, J et al. (2000) Increasing pneumococcal vaccination rates among residents of long-term--care facilities: provider-based improvement strategies implemented by peer-review organizations in four western states. Infection control and hospital epidemiology 21(11): 705-10	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Stille, C J, Christison-Lagay, J, Bernstein, B A et al. (2001) A simple provider-based educational intervention to boost infant immunization rates: a controlled trial. Clinical pediatrics 40(7): 365-73	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Stockwell, Melissa S, Kharbanda, Elyse Olshen, Martinez, Raquel Andres et al. (2012) Text4Health: impact of text message reminder-recalls for pediatric and adolescent immunizations. American journal of public health 102(2): e15-21	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Stone, Erin G, Morton, Sally C, Hulscher, Marlies E et al. (2002) Interventions that increase use of adult immunization and cancer screening services: a meta-analysis. Annals of internal medicine 136(9): 641-51	- More recent systematic review identified that covers the same topic *Interventions to increase adult immunisation covered by other SRs while cancer*

Study	Reason for exclusion
	screening is not within the scope of this review.
Stroffolini T and Pasquini P (1990) Five years of vaccination campaign against hepatitis B in Italy in infants of hepatitis B surface antigen carrier mothers. The Italian journal of gastroenterology 22(4): 195-197	- Study does not contain an intervention aimed at increasing vaccine uptake *This study is mostly about screening pregnant women for HBsAg. Yearly changes in HepB uptake are looked at in a coincidental way.*
Sumner, W. (1991) Brief reports. An evaluation of readable preventive health messages. Family Medicine 23(6): 463-6	- Vaccine on UK routine schedule but wrong context for administration *Mean age of participants was 35 to 38 years with SD 10.7 to 13.2 for the 3 study groups. This age group is not on the routine vaccination schedule.*
Suppli, Camilla Hiul, Rasmussen, Mette, Valentiner-Branth, Palle et al. (2017) Written reminders increase vaccine coverage in Danish children - evaluation of a nationwide intervention using The Danish Vaccination Register, 2014 to 2015. Euro surveillance : bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin 22(17)	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Suryadevara M, Bonville CA, Ferraioli F et al. (2013) Community-centered education improves vaccination rates in children from low-income households. Pediatrics 132(2): 319-325	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Szczerbinska, K., Topinkova, E., Brzyski, P. et al. (2016) Delivery of Care to Nursing Home Residents With Diabetes: Results From the SHELTER Study. Journal of the American Medical Directors Association 17(9): 807-813	- Study does not contain an intervention aimed at increasing vaccine uptake *Study looks at factors associated with vaccination*
Taddio, Anna, Alderman, Leslie, Freedman, Tamlyn et al. (2019) The CARD™ System for improving the vaccination experience at	- Study includes data on a vaccine that is not on the

Study	Reason for exclusion
school: Results of a small-scale implementation project on program delivery. Paediatrics & Child Health 24: 54-s67	UK routine vaccination schedule *Study includes HepB vaccine for adolescents and it is not possible to separate out the data for HPV vaccine.*
Taitel, M.S., Fensterheim, L.E., Cannon, A.E. et al. (2013) Improving pneumococcal and herpes zoster vaccination uptake: Expanding pharmacist privileges. American Journal of Managed Care 19(9): e309-e313	- Not a relevant study design *This study has selected characteristics of a population and has treated them as 'risk factors' for vaccine uptake.*
Takayama, J I; Iser, J P; Gandelman, A (1999) Regional differences in infant immunization against hepatitis B: did intervention work?. Preventive medicine 28(2): 160-6	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Tayfur, I.; Gunaydin, M.; Suner, S. (2019) Healthcare service access and utilization among syrian refugees in Turkey. Annals of Global Health 85(1): 42	- Not a relevant study design *This is a survey that looks at factors associated with vaccination.*
Taylor, J.A., Rietberg, K., Greenfield, L. et al. (2008) Effectiveness of a physician peer educator in improving the quality of immunization services for young children in primary care practices. Vaccine 26(33): 4256-4261	- Data not reported in an extractable format *Data was given as percentages without participant numbers*
Thomas, D R, King, J, Evans, M R et al. (1998) Uptake of measles containing vaccines in the measles, mumps, and rubella second dose catch-up programme in Wales. Communicable disease and public health 1(1): 44-7	- Study looks at intervention in the context of introducing a new vaccine
Thomas, T.L.; Stephens, D.P.; Blanchard, B. (2010) Hip Hop, Health, and Human Papilloma Virus (HPV): Using Wireless	- Does not contain an outcome of relevance to this review

Study	Reason for exclusion
Technology to Increase HPV Vaccination Uptake. Journal for Nurse Practitioners 6(6): 464-470	
Thompson, E.L., Livingston, M.D., Daley, E.M. et al. (2020) Rhode Island Human Papillomavirus Vaccine School Entry Requirement Using Provider-Verified Report. American Journal of Preventive Medicine 59(2): 274-277	- Data not reported in an extractable format *Only percentage uptake was provided. Numbers of participants were not provided for each arm.*
Trethewey, Samuel P; Patel, Neil; Turner, Alice M (2019) Interventions to Increase the Rate of Influenza and Pneumococcal Vaccination in Patients with Chronic Obstructive Pulmonary Disease: A Scoping Review. Medicina (Kaunas, Lithuania) 55(6)	- Systematic review that does not include a relevant population *People with COPD*
Trick, William E, Linn, Edward S, Jones, Zina et al. (2010) Using computer decision support to increase maternal postpartum tetanus, diphtheria, and acellular pertussis vaccination. Obstetrics and gynecology 116(1): 51-7	- Study does not include a relevant population
Tubeuf S, Edlin R, Shourie S et al. (2014) Cost effectiveness of a web-based decision aid for parents deciding about MMR vaccination: a three-arm cluster randomised controlled trial in primary care. The British journal of general practice : the journal of the Royal College of General Practitioners 64(625): e493	- Secondary publication of an included study that does not provide any additional relevant information *This is a mirror publication of Shourie 2013. We have included Shourie 2013 in the review because it is a cluster RCT and reports the Intracluster Correlation Coefficient.*
Tyler, Darlene, Nyamathi, Adeline, Stein, Judith A et al. (2014) Increasing hepatitis C knowledge among homeless adults: results of a community-based, interdisciplinary intervention. The journal of behavioral health services & research 41(1): 37-49	- Does not contain an outcome of relevance to this review
Tyler, R., Kile, S., Strain, O. et al. (2020) Impact of pharmacist intervention on completion of recombinant zoster vaccine series in a community pharmacy. Journal of the American Pharmacists Association	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Underwood, Natasha L, Gargano, Lisa M, Jacobs, Samantha et al. (2016) Influence of Sources of Information and Parental Attitudes on Human Papillomavirus Vaccine Uptake among Adolescents. Journal of pediatric and adolescent gynecology 29(6): 617-622	- Secondary publication of an included study that does not provide any additional relevant information *This is a secondary publication of Underwood 2015, which is already considered in this review. Underwood 2015 does not have any further outcomes of interest for each of the 3 arms.*
Uskun, Ersin, Uskun, Suha Basar, Uysalgenc, Meral et al. (2008) Effectiveness of a training intervention on immunization to increase knowledge of primary healthcare workers and vaccination coverage rates. Public health 122(9): 949-58	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Vacek JL (2004) Practical strategies for cardiac disease prevention. Basic steps to ensure better heart health. Postgrad Med 3	- Review article but not a systematic review
Vacek, J.L. (2004) Practice-based continuing education combined with process improvement methods improves delivery of preventive services to children. Evidence-Based Healthcare 8(4): 177-179	- Duplicate reference *This is an editorial about Vacek 2004, which is considered in this review.*
Valdez, Armando, Stewart, Susan L, Tanjasiri, Sora Park et al. (2015) Design and efficacy of a multilingual, multicultural HPV vaccine education intervention. Journal of communication in healthcare 8(2): 106-118	- Does not contain an outcome of relevance to this review
Valeri, Fabio, Hatz, Christoph, Jordan, Dominique et al. (2014) Immunisation coverage of adults: a vaccination counselling campaign in the pharmacies in Switzerland. Swiss medical weekly 144: w13955	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Vanderpool, Robin C, Cohen, Elisia, Crosby, Richard A et al. (2013) "1-2-3 Pap" Intervention Improves HPV Vaccine Series Completion among Appalachian Women. The Journal of communication 63(1): 95-115	- Study participants are the wrong age group *Participants were aged 22 years (SD 2.4). The UK routine vaccination age*

Study	Reason for exclusion
	range for HPV vaccine is 11 to 18 years.
Varman, M, Sharlin, C, Fernandez, C et al. (2018) Human Papilloma Virus Vaccination Among Adolescents in a Community Clinic Before and After Intervention. Journal of community health 43(3): 455-458	- Review article but not a systematic review
Venkatesh, Ashwin, Chia, Daphne Theresa, Tang, Anthony et al. (2020) Efficacy of text message intervention for increasing MMR uptake in light of the recent loss of UK's measles-free status. The British Journal of General Practice : The Journal of the Royal College of General Practitioners 70(692): 110	- Review article but not a systematic review
Vondracek, T G; Pham, T P; Huycke, M M (1998) A hospital-based pharmacy intervention program for pneumococcal vaccination. Archives of internal medicine 158(14): 1543-7	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Wagner, Abram L, Shrivastwa, Nijika, Potter, Rachel C et al. (2018) Pneumococcal and Meningococcal Vaccination among Michigan Children with Sickle Cell Disease. The Journal of pediatrics 196: 223-229	- Study does not contain an intervention aimed at increasing vaccine uptake *This study compares vaccine uptake between children who have sickle cell disease and those who do not.*
Wagner, Nicole Marie (2019) Assessing the value of the vaccine social media intervention through the re-aim framework implementation dimension. Dissertation Abstracts International: Section B: The Sciences and Engineering 80(11be): no-specified	- Not a peer-reviewed publication
Wallace C; Leask J; Trevena LJ (2006) Effects of a web based decision aid on parental attitudes to MMR vaccination: a before and after study. BMJ (Clinical research ed.) 332(7534): 146-149	- The study did not report any of the outcomes specified in the protocol
Wallace, A.S.; Ryman, T.K.; Dietz, V. (2012) Experiences integrating delivery of maternal and child health services with childhood immunization programs: Systematic review update. Journal of Infectious Diseases 205(suppl1): 6-s19	- Systematic review used as source of primary studies

Study	Reason for exclusion
Wallgren, S.; Berry-Caban, C.S.; Bowers, L. (2012) Impact of Clinical Pharmacist Intervention on diabetes-Related outcomes in a military treatment Facility. Annals of Pharmacotherapy 46(3): 353-357	- Study does not contain an intervention aimed at increasing vaccine uptake *The intervention is aimed at managing diabetes and related conditions. There is no mention of an intervention specifically for vaccines.*
Walling, Emily B, Benzoni, Nicole, Dornfeld, Jarrod et al. (2016) Interventions to Improve HPV Vaccine Uptake: A Systematic Review. Pediatrics 138(1)	- Systematic review used as source of primary studies
Wang, Jiangrong, Ploner, Alexander, Sparen, Par et al. (2019) Mode of HPV vaccination delivery and equity in vaccine uptake: A nationwide cohort study. Preventive medicine 120: 26-33	- Not a relevant study design *Survey looking at factors that affect vaccine uptake.*
Wang, Junling, Ford, Lindsay J, Wingate, La'Marcus et al. (2013) Effect of pharmacist intervention on herpes zoster vaccination in community pharmacies. Journal of the American Pharmacists Association : JAPhA 53(1): 46-53	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Ward, K., Chow, M.Y.K., King, C. et al. (2012) Strategies to improve vaccination uptake in Australia, a systematic review of types and effectiveness. Australian and New Zealand Journal of Public Health 36(4): 369-377	- Systematic review used as source of primary studies
Weaver, M, Krieger, J, Castorina, J et al. (2001) Cost-effectiveness of combined outreach for the pneumococcal and influenza vaccines. Archives of internal medicine 161(1): 111-20	- Duplicate reference *This is an economic analysis of a study already considered in this review: Krieger 2000: Increasing influenza and pneumococcal immunization rates: a randomized controlled study of a senior center-based intervention*

Study	Reason for exclusion
Weir, Rosy Chang, Toyoji, Mariko, McKee, Michael et al. (2018) Assessing the Impact of Electronic Health Record Interventions on Hepatitis B Screening and Vaccination. Journal of health care for the poor and underserved 29(4): 1587-1605	- Study does not include a relevant population *Study look at HBV vaccination in Asian American adults who are at higher risk of HBV. Also vaccination not provided to adults routinely in UK.*
Wells, C., Monte, S.V., Prescott, W.A. et al. (2019) A pharmacy resident-driven pneumococcal vaccination protocol increases vaccination rates in hospitalized patients over 65 years. JACCP Journal of the American College of Clinical Pharmacy 2(5): 488-493	- Infrastructure study. Excluded because there was sufficient RCT and cohort evidence for this review
Westrick, Salisa C, Owen, James, Hagel, Harry et al. (2016) Impact of the RxVaccinate program for pharmacy-based pneumococcal immunization: A cluster-randomized controlled trial. Journal of the American Pharmacists Association : JAPhA 56(1): 29-36e1	- Data not reported in an extractable format *Data was given as percentages without participant numbers*
Whelan, Noella W, Steenbeek, Audrey, Martin-Misener, Ruth et al. (2014) Engaging parents and schools improves uptake of the human papillomavirus (HPV) vaccine: examining the role of the public health nurse. Vaccine 32(36): 4665-71	- Not a relevant study design *This is a survey that looks at factors affecting vaccine uptrake*
Whitaker JA, Poland CM, Beckman TJ et al. Immunization education for internal medicine residents: A cluster-randomized controlled trial. Vaccine 36(14): 1823-1829	- The study did not report any of the outcomes specified in the protocol
White, C M and Lines, D R (1995) Compliance with neonatal hepatitis B vaccination. The Medical journal of Australia 162(11): 613	- Not a peer-reviewed publication
Whittaker, Karen (2002) Lay workers for improving the uptake of childhood immunization. British journal of community nursing 7(9): 474-9	- Systematic review used as source of primary studies

Study	Reason for exclusion
Wigham, Sarah, Ternent, Laura, Bryant, Andrew et al. (2014) Parental financial incentives for increasing preschool vaccination uptake: systematic review. Pediatrics 134(4): e1117-28	- Systematic review used as source of primary studies
Williams, Nia, Woodward, Helen, Majeed, Azeem et al. (2011) Primary care strategies to improve childhood immunisation uptake in developed countries: systematic review. JRSM short reports 2(10): 81	- Systematic review used as source of primary studies
Willis, Natalie, Hill, Sophie, Kaufman, Jessica et al. (2013) "Communicate to vaccinate": the development of a taxonomy of communication interventions to improve routine childhood vaccination. BMC international health and human rights 13: 23	- Does not contain an outcome of relevance to this review *Study aims to develop a taxonomy of communication interventions but does not look at whether the identified studies increase uptake*
Wilson, Matthew W; Brown, Blair J; Miles, Matthew C (2016) A Multicomponent Intervention to Improve Pneumococcal Vaccination Knowledge Among Internal Medicine Residents. MedEdPORTAL : the journal of teaching and learning resources 12: 10414	- Does not contain an outcome of relevance to this review
Wilson, Thad R, Fishbein, Daniel B, Ellis, Peggy A et al. (2005) The impact of a school entry law on adolescent immunization rates. The Journal of adolescent health : official publication of the Society for Adolescent Medicine 37(6): 511-6	- Not a relevant study design *Survey that looks at factors affecting uptake*
Witt, CE, Ulm, M, Redfern, T et al. (2020) Video-assisted counseling for human papillomavirus vaccination: a quality improvement study. Journal of investigative medicine 68(2): 683	- Conference abstract
Wong VWY, Fong DYT, Lok KYW et al. Brief education to promote maternal influenza vaccine uptake: A randomized controlled trial. Vaccine 34(44): 5243-5250	- Study took place in a non-OECD country
Wood, Heidi M; McDonough, Randal P; Doucette, William R (2009) Retrospective financial analysis of a herpes zoster vaccination program from an independent community pharmacy perspective. Journal of the American Pharmacists Association : JAPhA 49(1): 12-7	- Does not contain an outcome of relevance to this review *This study does not have a comparator*

Study	Reason for exclusion
Wright A, Poon EG, Wald J et al. (2012) Randomized controlled trial of health maintenance reminders provided directly to patients through an electronic PHR. Journal of general internal medicine 27(1): 85-92	- Study participants are the wrong age group *This study looked at pneumococcal vaccine but ~50% of participants were under the age of 50 years and only ~15% were over ~63 years old.*
Wright, P.J., Fortinsky, R.H., Covinsky, K.E. et al. (2000) Delivery of preventive services to older black patients using neighborhood health centers. Journal of the American Geriatrics Society 48(2): 124-130	- Does not contain an outcome of relevance to this review *This study does not have a comparator*
Yanagihara, Dolores M, Taira, Deborah A, Davis, James et al. (2005) A health plan intervention to improve pneumococcal vaccination in the elderly. Managed care interface 18(9): 25-30	- The study did not report any of the outcomes specified in the protocol *This study does not focus on the effect of specific interventions.*
Yang TU, Kim E, Park YJ et al. (2016) Successful introduction of an underutilized elderly pneumococcal vaccine in a national immunization program by integrating the pre-existing public health infrastructure. Vaccine 34(13): 1623-1629	- The intervention is a free vaccine- not in scope
Yee, Lynn M, Martinez, Noelle G, Nguyen, Antoinette T et al. (2017) Using a Patient Navigator to Improve Postpartum Care in an Urban Women's Health Clinic. Obstetrics and gynecology 129(5): 925-933	- Vaccine on UK routine schedule but wrong context for administration *Study includes data for HPV vaccination for new mothers. Our age range of interest for HPV vaccine is 11-18 years of age.*
Yeh, Sylvia, Mink, ChrisAnna, Kim, Matthew et al. (2014) Effectiveness of hospital-based postpartum procedures on pertussis vaccination among postpartum women. American journal of obstetrics and gynecology 210(3): 237e1-6	- Vaccine on UK routine schedule but wrong context for administration *Pertussis vaccination given to women post-partum in*

Study	Reason for exclusion
	USA, during pregnancy in UK.
Yokley, J M and Glenwick, D S (1984) Increasing the immunization of preschool children; an evaluation of applied community interventions. Journal of applied behavior analysis 17(3): 313-25	- Study published before 1990 date limit set in review protocol
Yoo GJ, Fang T, Zola J et al. (2012) Destigmatizing hepatitis B in the Asian American community: lessons learned from the San Francisco Hep B Free Campaign. Journal of cancer education : the official journal of the American Association for Cancer Education 27(1): 138-144	- The study did not report any of the outcomes specified in the protocol
Yoost, Jennie Lee, Starcher, Rachael Whitley, King-Mallory, Rebecca Ann et al. (2017) The Use of Telehealth to Teach Reproductive Health to Female Rural High School Students. Journal of pediatric and adolescent gynecology 30(2): 193-198	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Young, S A, Halpin, T J, Johnson, D A et al. (1980) Effectiveness of a mailed reminder on the immunization levels of infants at high risk of failure to complete immunizations. American journal of public health 70(4): 422-4	- Study published before 1990 date limit set in review protocol
Yudin MH; Salaripour M; Sgro MD (2010) Acceptability and feasibility of seasonal influenza vaccine administration in an antenatal clinic setting. Journal of obstetrics and gynaecology Canada : JOGC = Journal d'obstetrique et gynecologie du Canada : JOGC 32(8): 745-748	- Not a relevant study design
Yun, Katherine, Urban, Kailey, Mamo, Blain et al. (2016) Increasing Hepatitis B Vaccine Prevalence Among Refugee Children Arriving in the United States, 2006-2012. American journal of public health 106(8): 1460-2	- Study does not contain an intervention aimed at increasing vaccine uptake
Zajicek-Farber, Michaela L (2010) Building Practice Evidence for Parent Mentoring Home Visiting in Early Childhood. Research on Social Work Practice 20(1): 46-64	- The study did not report any of the outcomes specified in the protocol *This study involves general education for parents. However, they do not mention any compotent that should increase vaccine uptake.*

Study	Reason for exclusion
Zimet, G, Dixon, B, Xiao, S et al. (2016) Can automated physician reminders increase 2nd and 3rd dose administration of HPV vaccine?. Sexually transmitted diseases 43(10): S158	- Conference abstract
Zucker, Rachel A, Reiter, Paul L, Mayer, Melissa K et al. (2015) Effects of a Presidential Candidate's Comments on HPV Vaccine. Journal of health communication 20(7): 783-9	- Study does not contain an intervention aimed at increasing vaccine uptake

Excluded from the re-runs search

Study	Reason for exclusion
(2019) Impact of shingrix (recombinant zoster vaccine) second dose reminder member calls by a commercial health plan. Journal of managed care and specialty pharmacy 25: S95-S96	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Abdullahi, Leila H, Kagina, Benjamin M, Ndze, Valantine Ngum et al. (2020) Improving vaccination uptake among adolescents. The Cochrane database of systematic reviews 1: cd011895	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Acampora, Anna, Grossi, Adriano, Barbara, Andrea et al. (2020) Increasing HPV Vaccination Uptake among Adolescents: A Systematic Review. International journal of environmental research and public health 17(21)	- Multicomponent non-RCT. Excluded because there was sufficient RCT evidence for this review
Akojie, Halimat (2021) Strategies for teaching new mothers the importance of vaccination. Dissertation Abstracts International: Section B: The Sciences and Engineering 82(3b): no-specified	- Not a peer-reviewed publication *This is a thesis and was not published in a peer-reviewed journal*
Arendt, F. and Scherr, S. (2020) News-stimulated public-attention dynamics and vaccination coverage during a measles outbreak: An observational study. Social Science and Medicine 265: 113495	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Austin, S., Wooten, K., Dunkle, W. et al. (2021) Increasing HPV Vaccination Support Through a Pilot Film-Based	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Community Engagement. Journal of community health 46(2): 343-348	
Balzarini, F., Frascella, B., Oradini-Alacreu, A. et al. (2020) Does the use of personal electronic health records increase vaccine uptake? A systematic review. Vaccine 38(38): 5966-5978	- Duplicate reference
Barchitta, M., Maugeri, A., Lio, R.M.S. et al. (2021) Vaccination status of mothers and children from the 'mamma & bambino' cohort. Vaccines 9(2): 1-11	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Blanchi, S., Vaux, J., Toque, J.M. et al. (2020) Impact of a catch-up strategy of DT-IPV vaccination during hospitalization on vaccination coverage among people over 65 years of age in france: The HOSPIVAC study (Vaccination during hospitalization). Vaccines 8(2): 1-13	- The vaccine(s) were not on the UK routine vaccine schedule for this age group *Diphtheria, tetanus and polio vaccine are not on the UK vaccination schedule for people aged 65+ years.*
Bond, Amelia M, Volpp, Kevin G, Emanuel, Ezekiel J et al. (2019) Real-time Feedback in Pay-for-Performance: Does More Information Lead to Improvement?. Journal of general internal medicine 34(9): 1737-1743	- Infrastructure before-and-after study. Excluded because there was sufficient RCT and cohort evidence for this review
Bouchez, M., Ward, J.K., Bocquier, A. et al. (2021) Physicians' decision processes about the HPV vaccine: A qualitative study. Vaccine 39(3): 521-528	- Qualitative study
Chantler, Tracey, Pringle, Ellen, Bell, Sadie et al. (2020) Does electronic consent improve the logistics and uptake of HPV vaccination in adolescent girls? A mixed-methods theory informed evaluation of a pilot intervention. BMJ open 10(11): e038963	- Study already identified in the intital search and sift *Already included as a mixed methods study in the qualitative review*
Cunningham, Andrew K, Rourke, Meaghan M, Moeller, James L et al. (2021) HPV Immunization in High School Student-Athletes Receiving Preparticipation Physical Evaluations at Mass Event Versus Other Venues. Sports health 13(1): 91-94	- Not a relevant study design *All participants had access to the same interventions. This study looks at 'risk factors' for getting vaccinated.*

Study	Reason for exclusion
de Cock, Caroline, van Velthoven, Michelle, Milne-Ives, Madison et al. (2020) Use of Apps to Promote Childhood Vaccination: Systematic Review. JMIR mHealth and uHealth 8(5): e17371	- Systematic review that did not include any additional relevant papers
Dempsey, Amanda F, Pyrzanowski, Jennifer, Campbell, Jonathan et al. (2020) Cost and reimbursement of providing routine vaccines in outpatient obstetrician/gynecologist settings. American journal of obstetrics and gynecology 223(4): 562e1-562e8	- Duplicate reference *This is an economic analysis of O'Leary 2019: "Effectiveness of a multimodal intervention to increase vaccination in obstetrics/gynecology settings"*
Duong, H.T. and Hopfer, S. (2021) Let's Chat: Development of a Family Group Chat Cancer Prevention Intervention for Vietnamese Families. Health education & behavior : the official publication of the Society for Public Health Education 48(2): 208-219	- Qualitative study
Duong, H.T. and Hopfer, S. (2020) "Let's Chat": process evaluation of an intergenerational group chat intervention to increase cancer prevention screening among Vietnamese American families. Translational behavioral medicine	- Qualitative study
Eisenhauer, L.; Hansen, B.R.; Pandian, V. (2021) Strategies to improve human papillomavirus vaccination rates among adolescents in family practice settings in the United States: A systematic review. Journal of clinical nursing 30(34): 341-356	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Elliott, T.E., O'Connor, P.J., Asche, S.E. et al. (2021) Design and rationale of an intervention to improve cancer prevention using clinical decision support and shared decision making: A clinic-randomized trial. Contemporary Clinical Trials 102: 106271	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Falkenberg-Olson, A.C., Hayter, K.L., Holzer, R.A. et al. (2020) Infant Vaccinations among Mothers with Substance-Use Disorders: A Comparative Study. Clinical medicine & research	- Multicomponent non-RCT. Excluded because there was sufficient RCT evidence for this review
Flood, T., Wilson, I.M., Prue, G. et al. (2020) Impact of school-based educational interventions in middle adolescent populations (15-17yrs) on human papillomavirus (HPV) vaccination uptake and perceptions/knowledge of HPV and its associated cancers: A systematic review. Preventive Medicine 139: 106168	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Foss, Hakan Safaralilo, Oldervoll, Ann, Fretheim, Atle et al. (2019) Communication around HPV vaccination for adolescents in low- and middle-income countries: a systematic scoping overview of systematic reviews. Systematic reviews 8(1): 190	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Glanz, J.M., Wagner, N.M., Narwaney, K.J. et al. (2020) Web-Based Tailored Messaging to Increase Vaccination: A Randomized Clinical Trial. Pediatrics 146(5): e20200669	- Study already identified in the intital search and sift
Gleeson, S; Kelleher, K; Gardner, W (2016) Evaluating a Pay-for-Performance Program for Medicaid Children in an Accountable Care Organization. JAMA pediatrics 170(3): 259-266	- Infrastructure before-and-after study. Excluded because there was sufficient RCT and cohort evidence for this review
Gori, D., Costantino, C., Odone, A. et al. (2020) The impact of mandatory vaccination law in Italy on mmr coverage rates in two of the largest italian regions (Emilia-romagna and sicily): An effective strategy to contrast vaccine hesitancy. Vaccines 8(1): 57	- Infrastructure before-and-after study. Excluded because there was sufficient RCT and cohort evidence for this review
Hansen, Peter R; Schmidtblaicher, Matthias; Brewer, Noel T (2020) Resilience of HPV vaccine uptake in Denmark: Decline and recovery. Vaccine 38(7): 1842-1848	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Hohmann, Lindsey A, Hastings, Tessa J, Ha, David R et al. (2019) Impact of a multi-component immunization intervention on pneumococcal and herpes zoster vaccinations: A randomized controlled trial of community pharmacies in 2 states. Research in social & administrative pharmacy : RSAP 15(12): 1453-1463	- The study did not report any of the outcomes specified in the protocol *And unable to determine what proportion of individuals were over 65 years of age*
Ilozumba, O., Schmidt, P., Ket, J.C.F. et al. (2021) Can mHealth interventions contribute to increased HPV vaccination uptake? A systematic review. Preventive Medicine Reports 21: 101289	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
JPRN-UMIN000039273 (2020) A blinded RCT to verify the effect of changing the awareness and behavior of HPV vaccination by video viewing intervention for parents who have daughters of targeted generation. http://www.who.int/trialsearch/Trial2.aspx?TrialID=JPRN-UMIN000039273	- This is a study protocol without a published study

Study	Reason for exclusion
Kaufman, J., Attwell, K., Hauck, Y. et al. (2020) Designing a multi-component intervention (P3-MumBubVax) to promote vaccination in antenatal care in Australia. Health promotion journal of Australia : official journal of Australian Association of Health Promotion Professionals	- The study did not report any of the outcomes specified in the protocol *This study is about how an intervention was developed. There is no qualitative data published in this study.*
Kuehne, F., Sanftenberg, L., Dreischulte, T. et al. (2020) Shared decision making enhances pneumococcal vaccination rates in adult patients in outpatient care. International Journal of Environmental Research and Public Health 17(23): 1-15	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Lin, S.-C., Tam, K.-W., Yen, J.Y.-C. et al. (2020) The impact of shared decision making with patient decision aids on the rotavirus vaccination rate in children: A randomized controlled trial. Preventive Medicine 141: 106244	- Study not carried out in an OECD country *Study took place in Taiwan.*
Loskutova, Natalia Y, Smail, Craig, Callen, Elisabeth et al. (2020) Effects of multicomponent primary care-based intervention on immunization rates and missed opportunities to vaccinate adults. BMC family practice 21(1): 46	- Multicomponent non-RCT. Excluded because there was sufficient RCT evidence for this review
Lott, B.E., Okusanya, B.O., Anderson, E.J. et al. (2020) Interventions to increase uptake of Human Papillomavirus (HPV) vaccination in minority populations: A systematic review. Preventive Medicine Reports 19: 101163	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Maggio, L.A.; Krakow, M.; Moorhead, L.L. (2020) There were some clues': A qualitative study of heuristics used by parents of adolescents to make credibility judgements of online health news articles citing research. BMJ Open 10(8): e039692	- Qualitative study
Maria, DS (2020) 8. Efficacy of a Student-Nurse Brief Parent-Based Sexual Health Intervention to Increase HPV Vaccination Among Adolescents. Journal of adolescent health 66(2): S4-S5	- Conference abstract
McAdam-Marx, C., Tak, C., Petigara, T. et al. (2019) Impact of a guideline-based best practice alert on pneumococcal vaccination rates in adults in a primary care setting. BMC health services research 19(1): 474	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
Nagykaldi, Z., Scheid, D., Zhao, Y.D. et al. (2020) A sustainable model for preventive services in rural counties: The healthier together study. Journal of the American Board of Family Medicine 33(5): 698-706	- Multicomponent non-RCT. Excluded because there was sufficient RCT evidence for this review
NCT04638010 (2020) Increasing Breast, Cervical, and Colorectal Cancer Screening and HPV Vaccination Among Underserved Texans. https://clinicaltrials.gov/show/NCT04638010	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
O'Leary, Sean T, Narwaney, Komal J, Wagner, Nicole M et al. (2019) Efficacy of a Web-Based Intervention to Increase Uptake of Maternal Vaccines: An RCT. American journal of preventive medicine 57(4): e125-e133	- Study already identified in the intital search and sift
O'Leary, Sean T, Pyrzanowski, Jennifer, Brewer, Sarah E et al. (2019) Effectiveness of a multimodal intervention to increase vaccination in obstetrics/gynecology settings. Vaccine 37(26): 3409-3418	- Duplicate reference
Orefice, R. and Quinlivan, J.A. (2019) Small interface changes have dramatic impacts: how mandatory fields in electronic medical records increased pertussis vaccination rates in Australian obstetric patients. BMJ health & care informatics 26(1): 0	- This study has already been included in RQ1
Perkins, RB, Legler, A, Jansen, E et al. (2020) Improving HPV Vaccination Rates: a Stepped-Wedge Randomized Trial. Pediatrics 146(1)	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Peterson, Caryn E, Silva, Abigail, Holt, Hunter K et al. (2020) Barriers and facilitators to HPV vaccine uptake among US rural populations: a scoping review. Cancer causes & control : CCC 31(9): 801-814	- Qualitative study
Pot, Mirjam, Paulussen, Theo Gwm, Ruiter, Robert Ac et al. (2020) Dose-Response Relationship of a Web-Based Tailored Intervention Promoting Human Papillomavirus Vaccination: Process Evaluation of a Randomized Controlled Trial. Journal of medical Internet research 22(7): e14822	- Duplicate reference *This is a process evaluation of Pot 2017, which has been assessed in the education evidence review.*

Study	Reason for exclusion
Rani, Uzma, Darabaner, Ellen, Seserman, Michael et al. (2020) Public Education Interventions and Uptake of Human Papillomavirus Vaccine: A Systematic Review. Journal of public health management and practice : JPHMP	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Saitoh, A., Katsuta, T., Mine, M. et al. (2020) Effect of a vaccine information statement (VIS) on immunization status and parental knowledge, attitudes, and beliefs regarding infant immunization in Japan. Vaccine 38(50): 8049-8054	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Scarinci, Isabel C; Hansen, Barbara; Kim, Young-Il (2020) HPV vaccine uptake among daughters of Latinx immigrant mothers: Findings from a cluster randomized controlled trial of a community-based, culturally relevant intervention. Vaccine 38(25): 4125-4134	- Study already identified in the intital search and sift *It was already included in the education evidence review*
Schellenberg, Naomi and Crizzle, Alexander M. (2020) Vaccine hesitancy among parents of preschoolers in Canada: a systematic literature review. Canadian journal of public health = Revue canadienne de sante publique 111(4): 562-584	- Systematic review that did not include any additional relevant papers
Spina, C.I., Brewer, S.E., Ellingson, M.K. et al. (2020) Adapting Center for Disease Control and Prevention's immunization quality improvement program to improve maternal vaccination uptake in obstetrics. Vaccine 38(50): 7963-7969	- Infrastructure before-and-after study. Excluded because there was sufficient RCT and cohort evidence for this review
Staras, S.A.S., Richardson, E., Merlo, L.J. et al. (2021) A feasibility trial of parent HPV vaccine reminders and phone-based motivational interviewing. BMC public health 21(1): 109	- The study did not report any of the outcomes specified in the protocol
Staras, SAS, Vadaparampil, ST, Thompson, LA et al. (2020) Postcard reminders for HPV vaccination mainly primed parents for providers' recommendations. Preventive medicine reports 20	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Szilagyi, Peter, Albertin, Christina, Gurfinkel, Dennis et al. (2020) Effect of State Immunization Information System Centralized Reminder and Recall on HPV Vaccination Rates. Pediatrics 145(5)	- Duplicate reference
Thompson, E.L., Livingston, M.D., Daley, E.M. et al. (2020) Rhode Island Human Papillomavirus Vaccine School Entry	- Study already identified in the intital search and sift

Study	Reason for exclusion
Requirement Using Provider-Verified Report. American Journal of Preventive Medicine 59(2): 274-277	*It was included in the accessibility evidence review.*
Tull, Fraser, Borg, Kim, Knott, Cameron et al. (2019) Short Message Service Reminders to Parents for Increasing Adolescent Human Papillomavirus Vaccination Rates in a Secondary School Vaccine Program: A Randomized Control Trial. The Journal of adolescent health : official publication of the Society for Adolescent Medicine 65(1): 116-123	- Study already identified in the intital search and sift *This study had already been included in the reminders evidence review.*
Tyler, R., Kile, S., Strain, O. et al. (2020) Impact of pharmacist intervention on completion of recombinant zoster vaccine series in a community pharmacy. Journal of the American Pharmacists Association	- Reminders non-RCT. Excluded because there was sufficient RCT evidence for this review
Ulm, MA, Redfern, T, Pierce, V WF et al. (2020) Video-assisted counseling for human papillomavirus vaccination: a quality improvement study. Gynecologic oncology 159: 288-289	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Wallace-Brodeur, R., Li, R., Davis, W. et al. (2020) A quality improvement collaborative to increase human papillomavirus vaccination rates in local health department clinics. Preventive Medicine 139: 106235	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review
Wilder-Smith, Annika B and Qureshi, Kaveri (2020) Resurgence of Measles in Europe: A Systematic Review on Parental Attitudes and Beliefs of Measles Vaccine. Journal of epidemiology and global health 10(1): 46-58	- Qualitative study
Wilkinson, Tracey A, Dixon, Brian E, Xiao, Shan et al. (2019) Physician clinical decision support system prompts and administration of subsequent doses of HPV vaccine: A randomized clinical trial. Vaccine 37(31): 4414-4418	- Study already identified in the intital search and sift *This study has already been included in the reminders evidence review.*
Yunusa, Umar, Garba, Saleh Ngaski, Umar, Addakano Bello et al. (2021) Mobile phone reminders for enhancing uptake, completeness and timeliness of routine childhood immunization in low and middle income countries: A systematic review and meta-analysis. Vaccine 39(2): 209-221	- Systematic review that did not include any additional relevant papers

Economic studies

Study	Reason for exclusion
Ameel, B.M.; Beigi, R.H.; Caughey, A.B. (2018) Cost-effectiveness of the Tdap vaccine during pregnancy. American Journal of Obstetrics and Gynecology 218(1supplement1): 516-s517	- Study did not consider increasing uptake
Atkins, Katherine E, Fitzpatrick, Meagan C, Galvani, Alison P et al. (2016) Cost-Effectiveness of Pertussis Vaccination During Pregnancy in the United States. American journal of epidemiology 183(12): 1159-70	- Study did not consider increasing uptake
Bae, Geun-Ryang, Choe, Young June, Go, Un Yeong et al. (2013) Economic analysis of measles elimination program in the Republic of Korea, 2001: a cost benefit analysis study. Vaccine 31(24): 2661-6	- Study did not consider increasing uptake
Bettampadi, D., Boulton, M.L., Power, L.E. et al. (2019) Are community health workers cost-effective for childhood vaccination in India?. Vaccine 37(22): 2942-2951	- Non-OECD country
Beutels, Ph and Gay, N J (2003) Economic evaluation of options for measles vaccination strategy in a hypothetical Western European country. Epidemiology and infection 130(2): 273-83	- Study did not consider increasing uptake
Burmeister, J., Schroeder, M., Veach, S. et al. (2013) The cost effectiveness of various marketing techniques on Tdap vaccination rates within two community pharmacies. Journal of the American Pharmacists Association 53(2): e45	- No results reported - Did not include QALYs as an outcome - adult studies
Chesson, Harrell W and Markowitz, Lauri E (2015) The cost-effectiveness of human papillomavirus vaccine catch-up programs for women. The Journal of infectious diseases 211(2): 172-4	- No results reported
Chiappini, Elena, Stival, Alessia, Galli, Luisa et al. (2013) Pertussis re-emergence in the post-vaccination era. BMC infectious diseases 13: 151	- Study did not consider increasing uptake
Derrah, K., Ameel, B.M., Hersh, A.R. et al. (2020) 1053: Cost-effectiveness of Tdap vaccination during pregnancy. American Journal of Obstetrics and Gynecology 222(1supplement): 652	- Study did not consider increasing uptake
Ding, Y., Hay, J., Yeh, S.H. et al. (2012) Cost-benefit analysis of hospital based postpartum vaccination with combined tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (TDAP). Value in Health 15(4): a241	- Study did not consider increasing uptake
Ding, Yao, Yeh, Sylvia H, Mink, Chris Anna M et al. (2013) Cost-benefit analysis of hospital based postpartum vaccination with combined tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine (Tdap). Vaccine 31(22): 2558-64	- Study did not consider increasing uptake

Study	Reason for exclusion
Fernandes, E.G., Rodrigues, C.C.M., Sartori, A.M.C. et al. (2019) Economic evaluation of adolescents and adults' pertussis vaccination: A systematic review of current strategies. Human Vaccines and Immunotherapeutics 15(1): 14-27	- Study did not consider increasing uptake
Fernandes, Eder Gatti, Sartori, Ana Marli Christovam, de Soarez, Patricia Coelho et al. (2020) Cost-effectiveness analysis of universal adult immunization with tetanus-diphtheria-acellular pertussis vaccine (Tdap) versus current practice in Brazil. Vaccine 38(1): 46-53	- Non-OECD country
Fernandez-Cano, Maria Isabel; Armadans Gil, Lluis; Campins Marti, Magda (2015) Cost-benefit of the introduction of new strategies for vaccination against pertussis in Spain: cocooning and pregnant vaccination strategies. Vaccine 33(19): 2213-2220	- Study did not consider increasing uptake
Getsios D, Caro J J, Caro G, De Wals P, Law B J, Robert Y, Lance J M R (2002) Instituting a routine varicella vaccination program in Canada: an economic evaluation. Pediatric Infectious Disease Journal 21(6): 542-547	- Vaccine not routine in the UK
Greengold, Barbara, Nyamathi, Adeline, Kominski, Gerald et al. (2009) Cost-effectiveness analysis of behavioral interventions to improve vaccination compliance in homeless adults. Vaccine 27(5): 718-25	- Vaccine not routine in the UK
Hayman, D T S, Marshall, J C, French, N P et al. (2017) Cost-benefit analyses of supplementary measles immunisation in the highly immunized population of New Zealand. Vaccine 35(37): 4913-4922	- Study did not consider increasing uptake
Hoshi, Shu-Ling, Seposo, Xerxes, Okubo, Ichiro et al. (2018) Cost-effectiveness analysis of pertussis vaccination during pregnancy in Japan. Vaccine 36(34): 5133-5140	- Study did not consider increasing uptake
Hui, Charles, Dunn, Jessica, Morton, Rachael et al. (2018) Interventions to Improve Vaccination Uptake and Cost Effectiveness of Vaccination Strategies in Newly Arrived Migrants in the EU/EEA: A Systematic Review. International journal of environmental research and public health 15(10)	- Systematic review - the only CE study did not consider increasing uptake - Not a cost-effectiveness study
Hurley, L.P., Beaty, B., Lockhart, S. et al. (2017) Centralized vaccine reminder/recall to improve adult vaccination rates at an urban safety net health system. Journal of General Internal Medicine 32(2supplement1): 135-s136	- Did not include QALYs as an outcome - adult studies
Kempe, Allison, Barrow, Jennifer, Stokley, Shannon et al. (2012) Effectiveness and cost of immunization recall at school-based health centers. Pediatrics 129(6): e1446-52	- Not a cost-effectiveness study
Lugner, Anna K, van der Maas, Nicoline, van Boven, Michiel et al. (2013) Cost-effectiveness of targeted vaccination to protect new-borns against pertussis: comparing neonatal, maternal,	- Study did not consider increasing uptake

Study	Reason for exclusion
and cocooning vaccination strategies. Vaccine 31(46): 5392-7	
Major, J.; Wingate, L.T.; Oishi, T.S. (2016) A cost-effectiveness evaluation of a multifaceted community pharmacy intervention to increae rates of herpes zoster vaccination. Value in Health 19(3): a217	- Vaccine not routine in the UK
Ouwens, M., Littlewood, K., Sauboin, C. et al. (2010) Impact of mmrv mass vaccination with or without a catch up program on the incidence of varicella complications in France. Value in Health 13(7): a430	- Vaccine not routine in the UK
Poirrier, J.E., Mungall, B., Lee, I.H. et al. (2014) Cost-effectiveness of maternal immunisation for pertussis in new zealand. Value in Health 17(7): a806	- Study did not consider increasing uptake
Portnoy, A., Campos, N.G., Sy, S. et al. (2020) Impact and cost-effectiveness of human papillomavirus vaccination campaigns. Cancer Epidemiology Biomarkers and Prevention 29: 22-30	- Study did not consider increasing uptake - Non-OECD country
Rivero-Santana, Amado, Cuellar-Pompa, Leticia, Sanchez-Gomez, Luis M et al. (2014) Effectiveness and cost-effectiveness of different immunization strategies against whooping cough to reduce child morbidity and mortality. Health policy (Amsterdam, Netherlands) 115(1): 82-91	- Study did not consider increasing uptake
Russell, Louise B, Pentakota, Sri Ram, Toscano, Cristiana Maria et al. (2016) What Pertussis Mortality Rates Make Maternal Acellular Pertussis Immunization Cost-Effective in Low- and Middle-Income Countries? A Decision Analysis. Clinical infectious diseases : an official publication of the Infectious Diseases Society of America 63(suppl4): 227-s235	- Non-OECD country - Study did not consider increasing uptake
Suh, Christina A, Saville, Alison, Daley, Matthew F et al. (2012) Effectiveness and net cost of reminder/recall for adolescent immunizations. Pediatrics 129(6): e1437-45	- Cost perspective was inappropriate (private practice, net additional revenue)
Terranella, A., Beeler Asay, G.R., Messonnier, M.L. et al. (2013) Pregnancy dose Tdap and postpartum cocooning to prevent infant pertussis: A decision analysis. Obstetrical and Gynecological Survey 68(9): 615-616	- Study did not consider increasing uptake
Terranella, Andrew, Asay, Garrett R Beeler, Messonnier, Mark L et al. (2013) Pregnancy dose Tdap and postpartum cocooning to prevent infant pertussis: a decision analysis. Pediatrics 131(6): e1748-56	- Study did not consider increasing uptake
Van Bellinghen, Laure-Anne, Dimitroff, Alex, Haberl, Michael et al. (2018) Is adding maternal vaccination to prevent whooping cough cost-effective in Australia?. Human vaccines & immunotherapeutics 14(9): 2263-2273	- Study did not consider increasing uptake
van Hoek, Albert Jan, Campbell, Helen, Amirthalingam, Gayatri et al. (2016) Cost-effectiveness and programmatic benefits of	- Study did not consider increasing uptake

Study	Reason for exclusion
maternal vaccination against pertussis in England. The Journal of infection 73(1): 28-37	
Wateska, A.R., Nowalk, M.P., Lin, C.J. et al. (2019) An intervention to improve pneumococcal vaccination uptake in high risk 50-64 year olds vs. expanded age-based recommendations: an exploratory cost-effectiveness analysis. Human Vaccines and Immunotherapeutics 15(4): 863-872	- Vaccine not routine in this age group in the UK
Westra, T.A., De Vries, R., Tamminga, H.J. et al. (2009) Cost-effectiveness of a cocooning immunization strategy against pertussis for The Netherlands. Value in Health 12(7): a425-a426	- Study did not consider increasing uptake
Westra, Tjalke A, de Vries, Robin, Tamminga, Johannes J et al. (2010) Cost-effectiveness analysis of various pertussis vaccination strategies primarily aimed at protecting infants in the Netherlands. Clinical therapeutics 32(8): 1479-95	- Study did not consider increasing uptake

Appendix L — Research recommendation

L.1.1 Research recommendation

What is the effectiveness and acceptability of different types of content in a vaccination invitation in the UK?

L.1.2 Why this is important

There is evidence that providing information to accompany invitations for vaccinations can result in an increase vaccination uptake. However, limited evidence was identified and met the inclusion criteria for this review, which compared different formats of information to each other, and much of the this evidence is low quality with only one study identified that was based in the UK. Although this evidence compares different formats of information, such as paper-based information to websites, or websites to social media, none of the identified evidence compared different ways in which the information is presented or framed (such as high threat vs low threat, or language which highlights the potential gains associated with vaccination compared to potential losses associated with not being vaccinated). In addition, only one study was identified that compared different styles of wording (neutral versus using a health belief model) in a vaccination invitation and this study was considered to be flawed by the committee, complicating interpretation of the results. UK-based research is therefore important to establish whether certain ways of framing invitations and information about vaccination are more effective at increasing vaccine uptake.

L.1.3 Rationale for research recommendation

Importance to communities	High levels of vaccine uptake are necessary for reducing the chances of disease.
Relevance to NICE guidance	Medium: the research is relevant to the recommendations in the guidance, but the research recommendations are not essential to future updates. Understanding the most effective ways of phrasing the invitation and providing information about vaccination could lead to more detailed recommendations on how to present the invitation/ reminders and the information that accompanies them to have the most impact on the recipients.
Relevance to the NHS	Understanding the most effective ways to phrase vaccination invitations and information will help providers to improve their vaccination programmes to try to increase uptake.
National priorities	There is a new DHSC vaccination strategy due in late 2021 and it is expected that this work would fall under the goal of increasing the uptake of routine vaccinations
Current evidence base	No studies were identified that met the inclusion criteria for this review and looked at different ways of phrasing the information. One study was identified as part of the reminders review looking at different ways of framing invitations, but this was considered to be flawed by the committee and they were unable to draw useful conclusions from it.
Equality considerations	Language and literacy barriers need to be considered, as written information is not accessible to all people.

L.1.4 Modified PICO table

Population	Individuals eligible for routine schedule vaccination(s) or their parents or carers.
Intervention	Different formats of phrasing information including: • Type of language (such as potential gains vs losses, e.g. gaining immunity to a disease vs avoiding catching a disease) • Level of threat (high threat vs low threat)
Comparator	Active intervention - Other methods of phrasing the same information. For example: • Information using phrasing highlighting the benefits of vaccination vs information using phrasing highlighting the negatives of not being vaccinated • Information phrased in second person perspective (e.g. the benefits to you of being vaccinated) vs general information (e.g. benefits of being vaccinated)
Outcome	• Quantitative outcomes including: o uptake of routine vaccinations by eligible people o offers of vaccination • Qualitative outcomes including: o acceptability of different ways of framing the invitation and information or o acceptability of specific interventions o views about implementation of specific interventions
Study design	• Quantitative study: RCTs, cluster RCTs • Qualitative study: interviews, focus groups only (not surveys or open - ended questions on surveys)
Timeframe	There is no specified timeframe in which this study needs to be completed.
Additional information	• Vaccinations of interest must be on the UK routine schedule (apart from influenza, see below) and the intervention must be aimed at increasing uptake in the relevant population for this schedule. • Influenza vaccination is not of interest because it is out of scope of the NICE guideline on routine vaccination. • The same information (such as the specific benefits and risks of vaccination, and links to websites/other sources of information) should be included in both the intervention and comparator arms.