National Institute for Health and Care Excellence

Final

Vaccine uptake in the general population

[H] Evidence review for multicomponent interventions to increase the uptake of routine vaccines

NICE guideline NG218

Evidence review underpinning recommendations 1.1.19 to 1.1.21, 1.1.16 to 1.1.18, 1.2.15, 1.3.7 and 1.3.14 to 1.3.16 in the NICE guideline

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Final

This evidence review was developed by the Guideline Development Team

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1.1 Review question

What are the most effective multicomponent 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 is part of a series of reviews looking at interventions to increase routine vaccine uptake. It aims to identify effective multicomponent interventions that are not already covered by any of the categories in the other reviews and that have 3 or more distinct components. It follows the protocol and overarching review question detailed in Appendix A which has been divided across each of the reviews based on intervention type. The protocol is summarised in Table 1.

1.1.2 Summary of the protocol for multicomponent interventions

Table 1 PICO table for multicomponent 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	**Multicomponent interventions**: • Interventions which include more than one intervention type (as detailed below) 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 intervention review instead (for example, education for providers and information for parents). NOTE: the individual intervention reviews used the following categories: • Reminders and recall (including invitations) • Education, information and communication • Access • Acceptability • Infrastructure (including systems and processes, financial and other incentives, mandatory vaccination, assessment and feedback etc.) See the protocol in Appendix A for more details about the intervention categories used.

Comparators	• Usual approaches to increase vaccine uptake
	• Other interventions to increase vaccine uptake
	  • Other interventions targeting same issues/ themes
	  • Other interventions targeting different issues/ themes

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 to reviews 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.
6. 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.
7. 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.
8. 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.
9. 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.
10. 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.
11. Where no or limited direct evidence was identified, 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.
12. 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.
13. 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.

14. 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.
15. 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.
16. 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.
17. 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.
18. 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.
19. 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.

20. 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.
21. 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.)
22. 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.
23. Different risk of bias checklists may use different terminology to represent the overall risk of bias judgements and for domain summaries. Where they differ from those used in the methods chapter for this review the following applies:
    - Some concerns = moderate risk of bias
    - Serious = high risk of bias
24. 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.

25. 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.

Multicomponent review specific methods

1. This review covers more complex multicomponent interventions that do not:
    - fit into any single category in the other reviews (for example they do consist of interventions with multiple components only targeting reminders, access, education, or infrastructure).
    - have only 2 components from different categories. These interventions are multicomponent (such as reminders and education) but have been included and reviewed by the committee as part of the other evidence reviews to enable this review to focus on more complex multicomponent interventions (with components targeting 3 or more categories of interventions listed above). (See Table 2 for more details of where these other analyses are located.) The 2 component interventions are compared to control, another single intervention or another 2-component intervention. Where they are compared to a multicomponent intervention with 3 or more components then they are included in this review.

Table 2 Interventions with 2 components that matched the inclusion criteria for other reviews

Interventions with 2 components	Evidence review
Access and education	Access (evidence review D)
Access and reminders	Access (evidence review D)
Access and financial incentives	Access (evidence review D)
Information/education and reminders	Education (evidence review E)
Reminders and financial incentives	Infrastructure (evidence review G)
Education and assessment/feedback	Infrastructure (evidence review G)
Feedback and financial incentives	Infrastructure (evidence review G)

2. 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.
3. Interventions have been grouped in overarching categories that correspond to the other reviews where possible, such as those that include an infrastructure, access or education component. Subgroups have been used to separate the results by the specific interventions used.
4. It was decided that there was sufficient evidence from RCTs and cRCTs for this review, and so results from other study types were not included. The inclusion of other study types was not expected to provide additional useful information that would influence the committee's decisions on recommendations and this decision was approved by the committee.
5. Studies of intervention versus control were included if the controls were the following:
    - No intervention
    - Usual practice. Studies did not need to specify what was usual practice was.
    - Part of the interventions cancelled each other out (such as 2 arms including education, or an active control such as information about another vaccination).
6. Where cRTCs reported an ICC value which was used to adjust statistical outcomes for clustering, the same value was used to adjust the values reported for vaccine uptake and

the number of people per trial arm. Only 3 studies reported ICC values, ranging from 0.02 to 0.2. In the absence of consistency on the most appropriate ICC value from these studies, an ICC of 0.05 was used to adjust the values for the other studies that did not report an ICC. 0.05 was selected as this matches the methods used in the other reviews in this guideline, which have had similar populations to the studies included in this review. Adjusted data is presented in the forest plots with a note to state the data has been adjusted. However, the GRADE tables retain the original study sample sizes if the data has been adjusted by us.

7. Mixed methods were not used for this review to avoid repetition from the other evidence reviews and because of the complexity of including qualitative evidence linking to multiple intervention types. The relevant qualitative findings are already covered as part of each of the separate intervention reviews.

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, 9 studies met the criteria for inclusion in the multicomponent 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. 4 additional primary studies were included at this stage. No additional primary studies were identified that were relevant for this review. Therefore, this review consisted of 9 included studies.

1.4.1 Included studies

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

The 9 studies targeted individuals, parents, carers or healthcare providers (Table 3) and were either RCTs or cRCTs:

- One RCT compared an intervention for parents or carers to control, examining an intervention relating to access, education and reminders.
- One cRCT compared provider-based interventions to control, with an intervention including provider education, standing orders and vaccination champions.
- Five studies (all cRCTs) compared interventions that had both provider- and individual/parent/carer-based components to control. Of these, one used an intervention which included a combination of provider education and parent/carer education and reminders and another used provider financial incentives with parent/carer information and reminders. Three studies used a combination of provider education, reminders and incentives with individual/parent/carer home visits, education and reminders.
- One cRCT compared an intervention that had both provider- and individual/parent/carer-based components to another intervention that had both provider- and individual/parent/carer-based components.
- One cRCT had 3 intervention arms (Fiks 2013), 1 of which was a provider-based intervention, the second was a family-based intervention and the third was a combination of both the provider and family interventions. Comparisons included in this review are those made between the clinician intervention and control, the combined intervention and control, the clinician and family-based interventions, and the family and combined interventions (for more information see the evidence table in Appendix D).

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

Primary studies

Table 3 Summary of the characteristics of the primary studies

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control or comparator group	Vaccine(s)	Relevant outcomes
Barnes 1999	USA	163	RCT	Ambulatory paediatric clinics	Children aged less than 24 months	Home visits, education, reminders and appointment booking	Usual care	DtaP (Diphtheria, tetanus, pertussis), polio, Hib (Haemophilus influenzae type b) , hepatitis B, MMR (Measles, mumps, and rubella)	Vaccine uptake
Desiante 2017	Italy	5720	cRCT	Schools and vaccination centres	Adolescents aged 13 years	Invitation letter with information about the HPV vaccination, vaccination available in a separate clinic with open invitation to attend.	Counselling and HPV vaccine promotion meetings with healthcare professionals and teachers. Consent obtained from parents at meetings.	HPV (human papillomavirus)	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control or comparator group	Vaccine(s)	Relevant outcomes
							Vaccines administered in school.		
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 [1] **Intervention 2:** Family intervention – reminder phone calls with information about vaccination [1] **Intervention 3:** Combined clinician and family intervention [1]	Usual care	HPV	Vaccine uptake
Goodyear-Smith 2012	New Zealand	5256	Cluster RCT	General practices	Children aged up to 8 weeks	Information and reminders sent to parents. Shopping vouchers given to practices for each vaccine appointment	Usual care	Diphtheria, tetanus, pertussis, polio, hep B (Hepatitis B), Hib b, meningitis, pneumococcal	Vaccine uptake
Hambidge 2004	USA	2565	cRCT	Medical centre	Children aged up to 12 months	**Intervention 1:** Immunisation arm – parent education and reminders about immunisation, referral for home visits if needed; provider education, reminders and incentives for immunisation	Usual care	DtaP, polio, Hib b, hepatitis B	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control or comparator group	Vaccine(s)	Relevant outcomes
						Intervention 2: Well child arm – as for the immunisation arm but the intervention was targeted at well child visits rather than immunisations			
O'Leary 2019	USA	83,372	cRCT	Obstetrics and gynaecology clinics	Pregnant women	Practices selected intervention from a choice of best practice interventions	Usual care	Tdap	Vaccine uptake
Paskett 2016	USA	4798	cRCT	Local clinics	Adolescents aged 9-17 years	HPV brochures and posters in clinics, provider education and parent education and reminders	Provider and parent education about the flu vaccine	HPV	Vaccine uptake
Zimmerman 2017a	USA	279	cRCT	Primary care family medicine and paediatric practices	Adolescents aged 11-17 years	4 Pillars: Clinic-based intervention which used immunisation champions and aimed to improve access to vaccination services, communication with young people and office systems.	Usual care	HPV	Vaccine uptake
Zimmerman 2017b	USA	18,107	cRCT	Primary care practices	Adults aged 18 years and over	4 Pillars: Clinic-based intervention which used immunisation champions and aimed to improve access to vaccination services, communication with patients and office systems.	Usual care	Pneumococcal	Vaccine uptake

1. 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. The comparisons between arm 2 and control is in the review for education and reminders. The comparison of arm 3 versus arm 2 has not been included in either review because the family intervention was in both arms and would therefore 'cancel each other out' leaving the same comparison as arm 1 versus usual care.

For the full evidence tables, please see Appendix C.

1.1.6 Summary of the evidence

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

See Appendix F for full GRADE tables

Individual/parent/carer interventions vs control

Table 4 Summary of effectiveness findings for individual/parent/carer interventions vs control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Individual/parent/carer home visits, education and reminders (RR >1 favours intervention)							
0-5 year olds							
1 (Barnes 1999)	RCT	155	RR 1.21 (0.90, 1.62)	49 per 100	59 per 100 (44, 79)	The studies could not differentiate change in vaccine uptake between home visits, education and reminders or control	Low

Individual/parent/carer interventions vs other individual/parent/carer interventions

Table 5 Summary of effectiveness findings for individual/parent/carer interventions vs other individual/parent/carer interventions

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
CLUSTER RCTs: Reminder letter with information and separate clinic for vaccination versus education, obtaining consent and vaccinations at school (RR >1 favours reminder plus information)							
11-18 years, HPV at least 1 dose							
1 (Desiante 2017)	Cluster RCT	5720	RR 0.83 (0.8, 0.86)	79 per 100	66 per 100 (63, 68)	Increased with education, obtaining consent and vaccinations at school.	Moderate
11-18 years, HPV at least 2 doses							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Desiante 2017)	Cluster RCT	5720	RR 0.77 (0.74, 0.80)	72 per 100	56 per 100 (53, 58)	Increased with education and vaccinations at school.	Moderate

Provider interventions vs control

Provider infrastructure interventions (audits, feedback), reminders, and education vs control

Table 6 Summary of effectiveness findings for provider infrastructure interventions (audits, feedback), reminders, and education vs control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider education, alerts, audits and feedback vs control (usual care)[1]							
11-18 year olds – HPV dose 1							
1 (Fiks 2013)	cRCT	11245	RR 1.50 (1.39, 1.62)	16 per 100	24 per 100 (22, 26)	Vaccine uptake increased with provider education, audits and feedback	Moderate
11-18 year olds – HPV dose 2							
1 (Fiks 2013)	cRCT	11245	RR 1.48 (1.34, 1.63)	10 per 100	15 per 100 (14, 17)	Vaccine uptake increased with provider education, audits and feedback	Moderate
11-18 year olds – HPV dose 3							
1 (Fiks 2013)	cRCT	11245	RR 1.57 (1.39, 1.78)	7 per 100	10 per 100 (9, 12)	Vaccine uptake increased with provider education, audits and feedback	Moderate
Provider education, alerts, audits and feedback and individual/parent/carer information and reminders vs Individual/parent/carer information and reminders[2]							
11-18 year olds – HPV dose 1							
1 (Fiks 2013)	cRCT	11241	RR 1.39 (1.29, 1.49)	18 per 100	25 per 100 (23, 27)	Vaccine uptake increased with provider education, audits and feedback	Moderate
11-18 year olds – HPV dose 2							

1 (Fiks 2013)	cRCT	11241	RR 1.43 (1.31, 1.56)	13 per 100	18 per 100 (17, 20)	Vaccine uptake increased with provider education, audits and feedback	Moderate
11-18 year olds – HPV dose 3							
1 (Fiks 2013)	cRCT	11241	RR 1.49 (1.34, 1.65)	9 per 100	14 per 100 (12, 15)	Vaccine uptake increased with provider education, audits and feedback	Moderate
1. Comparison between clinician intervention arm (arm 1) and control (usual care) 2. Comparison between clinician and family intervention arm (arm 3) and family intervention arm (arm 2). Family intervention is in both arms and so arm 2 serves as control. The comparison therefore demonstrates the effects of the clinician intervention.							

Provider infrastructure interventions (standing orders, vaccination champions) and education vs control

Table 7 Summary of effectiveness findings for provider infrastructure interventions (standing orders, vaccination champions) and education vs control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider education, standing orders and vaccination champions vs control							
Pregnant women							
1 (O'Leary 2019)	cRCT	496	RR 0.98 (0.83, 1.16)	52 per 100	51 per 100 (43, 60)	The studies could not differentiate change in vaccine uptake between provider education, standing orders and vaccination champions or control	Low

Provider interventions and individual/parent/carer interventions vs control

Provider education and individual/parent/carer education and reminders vs control

Table 8 Summary of effectiveness findings for provider education and individual/parent/carer education and reminders vs control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider education and individual/parent/carer education and reminders vs control (RR >1 favours intervention)							

11-18 year olds – HPV vaccine within 3 months of intervention							
1 (Paskett 2016)	cRCT	176	RR 2.34 (0.47, 11.72)	2 per 100	6 per 100 (1, 28)	The studies could not differentiate change in vaccine uptake between provider education and individual/parent/carer education and reminders or control	Very low
11-18 year olds – HPV vaccine within 6 months of intervention							
1 (Paskett 2016)	cRCT	176	RR 2.10 (0.67, 6.57)	5 per 100	10 per 100 (3, 31)	The studies could not differentiate change in vaccine uptake between provider education and individual/parent/carer education and reminders or control	Very low

Provider infrastructure interventions (audits and feedback), reminders and education and individual/parent/carer information and reminders vs control

Table 9 Summary of effectiveness findings for provider infrastructure interventions (audits and feedback) reminders and education and individual/parent/carer information and reminders vs control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider audits, alerts, education and feedback and individual/parent/carer information and reminders vs control (RR >1 favours intervention)[1]							
11-18 year olds – HPV dose 1							
1 (Fiks 2013)	cRCT	11249	RR 1.56 (1.45, 1.68)	16 per 100	25 per 100 (23, 27)	Increased with provider infrastructure and education and individual/parent/carer information and reminders	Moderate
11-18 year olds – HPV dose 2							
1 (Fiks 2013)	cRCT	11249	RR 1.75 (1.60, 1.93)	10 per 100	18 per 100 (17, 20)	Increased with provider infrastructure and education and individual/parent/carer information and reminders	Moderate
11-18 year olds – HPV dose 2							
1 (Fiks 2013)	cRCT	11249	RR 2.11 (1.88, 2.38)	7 per 100	RR 2.11 (1.88, 2.38)	Increased with provider infrastructure and education and individual/parent/carer information and reminders	Moderate

1. Comparison between clinician and family intervention (arm 3) and control

Provider infrastructure interventions (financial incentives) and individual/parent/carer information and reminders vs control

Table 10 Summary of effectiveness findings for provider financial incentives and individual/parent/carer information and reminders vs control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider financial incentives and individual/parent/carer information and reminders vs control (RR >1 favours intervention)							
0-5 year olds							
1 (Goodyear-Smith 2012)	cRCT	1026	RR 0.98 (0.96, 0.99)	99 per 100	97 per 100 (95, 98)	Increased with control	Moderate

Provider infrastructure, reminders and education interventions and individual/parent/carer access, education and reminders interventions vs control

Table 11 Summary of effectiveness findings for provider reminders and education interventions and individual/parent/carer access, education and reminders interventions vs control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider immunisation education, reminders and incentives and individual/parent/carer home visits, education and reminders vs control (RR >1 favours intervention)							
0-5 year olds – Immunisation focused interventions							
1 (Hambidge 2004)	cRCT	149	RR 1.07 (0.88, 1.30)	71 per 100	76 per 100 (62, 92)	The studies could not differentiate change in vaccine uptake between provider financial incentives and individual/parent/carer information and reminders or control	Moderate
0-5 year olds – Well child visit focused interventions							

1 (Hambidge 2004)	cRCT	130	RR 1.08 (0.87, 1.35)	71 per 100	76 per 100 (61, 95)	The studies could not differentiate change in vaccine uptake between provider financial incentives and individual/parent/carer information and reminders or control	Moderate
Provider immunisation champions and feedback and individual/parent/carer access, education and reminders versus control (RR >1 favours intervention)[1]							
11-18 years. HPV series initiation							
1 (Zimmerman 2017)	cRCT	99	RR 0.91 (0.68, 1.21)	69 per 100	62 per 100 (47, 83)	The studies could not differentiate change in vaccine uptake between provider immunisation champions and feedback and individual/parent/carer access, education and reminders or control	Very low
11-18 years. HPV series completion							
1 (Zimmerman 2017)	cRCT	99	RR 0.89 (0.58, 1.36)	50 per 100	45 per 100 (29, 68)	The studies could not differentiate change in vaccine uptake between provider immunisation champions and feedback and individual/parent/carer access, education and reminders or control	Very low
65 years and over. Pneumococcal vaccination at Houston sites							
1 (Zimmerman 2017b)	cRCT	117	RR 0.94 (0.78, 1.13)	82 per 100	77 per 100 (64, 93)	The studies could not differentiate change in vaccine uptake between provider immunisation champions and feedback and individual/parent/carer access, education and reminders or control	Very low
65 years and over. Pneumococcal vaccination at Pittsburgh sites							
1 (Zimmerman 2017b)	cRCT	370	RR 0.99 (0.89, 1.11)	78 per 100	77 per 100 (69, 87)	The studies could not differentiate change in vaccine uptake between provider immunisation champions and feedback and individual/parent/carer access, education and reminders or control	Very low

1. 4 Pillars intervention

Provider interventions vs individual/parent/carer interventions

Provider infrastructure interventions (audits, feedback), reminders and education vs individual/parent/carer information and reminders

Table 12 Summary of effectiveness findings for provider infrastructure interventions (audits, feedback), reminders and education vs individual/parent/carer information and reminders

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: intervention 2	Absolute risk: intervention 1 (95% CI)	Interpretation	Quality
Provider education, alerts, audits and feedback vs individual/parent/carer information and reminders (RR >1 favours intervention)[1]							
11-18 year olds – HPV dose 1							
1 (Fiks 2013)	cRCT	11237	RR 1.33 (1.24, 1.43)	18 per 100	24 per 100 (22, 26)	Increased with provider intervention	Moderate
11-18 year olds – HPV dose 2							
1 (Fiks 2013)	cRCT	11237	RR 1.20 (1.10, 1.32)	13 per 100	15 per 100 (14, 17)	Increased with provider intervention	Moderate
11-18 year olds – HPV dose 2							
1 (Fiks 2013)	cRCT	11237	RR 1.11 (0.99, 1.24)	9 per 100	10 per 100 (9, 12)	The studies could not differentiate vaccine uptake between provider intervention and individual/parent/carer intervention	Low
1. Comparison between clinician intervention arm (arm 1) and family intervention arm (arm 2)							

Provider and individual/parent/carer interventions vs other provider and individual/parent/carer interventions

Provider immunisation specific intervention vs well child non-immunisation specific intervention (both with provider education, reminders, incentives and individual/ parent/ carer home visits, education and reminders

Table 13 Summary of effectiveness findings for provider immunisation specific intervention vs well child non-immunisation specific intervention (both with provider education, reminders, incentives and individual/ parent/ carer home visits, education and reminders)

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider immunisation focused education, reminders and incentives and individual/parent/carer immunisation education and reminders vs provider well child visit focused education, reminders and incentives and individual/parent/carer well child visit education and reminders (RR >1 favours immunisation intervention)							
0-5 year olds – Up to date on childhood vaccines at 12 months of age							
1 (Hambidge 2004)	cRCT	129	RR 1.01 (0.82, 1.24)	76 per 100	76 per 100 (62, 94)	The studies could not differentiate change in vaccine uptake between the immunisation-focused intervention and the well-child focused intervention	Moderate

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. 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

Four of the eleven studies looked at multicomponent interventions. A summary of these studies is given in 1.1.8 Summary of included economic evidence. Detailed information and quality checklists for the studies identified from the review 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. Three studies were in multicomponent interventions, namely the 4 Pillars program. These studies were deemed partially applicable for this review question, but had minor methodological limitations, indicating that the evidence has some value to inform recommendations.

Study	Comparators	Incremental cost	Incremental QALYs	ICER	Uncertainty	Applicability	Limitations
Smith 2017 (J Am Geriatr Soc) US Societal perspective 4 Pillars program Adults aged 65+ years	No intervention	$1.60 (£1.24, 2021 GBP)	0.0031	$512 (£398.13, 2021 GBP)	In one-way sensitivity analysis no individual parameter variation caused the intervention to cost >$20,000 per QALY gained. Variation of only 2 parameters caused the favoured strategy to change when lowering the threshold to $10,000/QALY gained: a) when the program-related absolute increase in influenza vaccination was below 0.9% (base case = 5%); or b) when influenza VE was less than 25.1% (base case = 59.0%). Results were insensitive to individual variation of all other parameters over their listed ranges. In a probabilistic sensitivity analysis, where all parameters were simultaneously varied, the 4 Pillars intervention was cost saving in 35.4% of model iterations and favoured in 98.6% at a $50,000/QALY gained, a commonly cited cost-effectiveness benchmark.	Partially applicable	Minor limitations

Study	Comparators	Incremental cost	Incremental QALYs	ICER	Uncertainty	Applicability	Limitations
Wateska 2018 US Third-party payer perspective (societal perspective also included in the study) 4 Pillars program High-risk adults aged 18-64 years	No program	$17.88 (£13.90, 2021 GBP)	0.00063	$28,301 (£22,006.93, 2021 GBP) (Note: the intervention was cost saving in from the societal perspective)	When varying each parameter individually in 1-way sensitivity analysis over the plausible ranges, the intervention program remained favoured from both third party and societal perspectives when using a $100,000/QALY threshold, a commonly cited U.S. benchmark At a $100,000/QALY gained threshold, the 4 Pillars Program was favoured in 83.3% of the model iterations from a third party perspective and in 96.2% of model iterations from a societal perspective. From a societal perspective, the program was cost saving and more effective than no program in 75.7% of model iterations.	Partially applicable	Minor limitations
Wateska 2020 US Healthcare perspective 4 Pillars program (in combination with current policy or alternative policy) Adults aged 65 years and older	Current policy or alternative policy without the 4 pillars program	Current policy: $151.85 (£119.34, 2021 GBP) Alternative policy: $16.53 (£12.99, 2021 GBP)	Current policy: 0.00045 Alternative policy: 0.00006	Current policy: $337,444 (£265,204, 2021 GBP) Alternative policy: $275,500 (£216,521, 2021 GBP)	All model parameters were varied individually in one-way sensitivity analyses, and varied simultaneously 1000 times across their respective ranges in probabilistic sensitivity analyses. Further analyses separately examined the effects of eliminating outpatient pneumonia as a disease outcome, due to the substantial uncertainty regarding outpatient pneumococcal pneumonia rates. An analysis was conducted in which a potentially influential parameter, hospitalized NBP risk, was modified	Partially applicable	Minor limitations

Study	Comparators	Incremental cost	Incremental QALYs	ICER	Uncertainty	Applicability	Limitations
					to more closely reflect values used in a recent CDC economic analysis. Model results were not sensitive to any of the individual one-way sensitivity analyses. In probabilistic analyses for the current strategy the uptake program was more likely to be cost-effective over no program at all WTP thresholds, and for the alternative strategy the uptake program was more likely to be cost-effective than no program at WTP thresholds of $240,000 and above.		

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, one looked at a multicomponent intervention. All studies were rated as only partially applicable, and had potentially serious limitations, so may be of limited value in informing recommendations.

Study	Comparators	Incremental cost	Incremental outcomes	Cost-effectiveness	Uncertainty	Applicability	Limitations
Deuson 2001 US Education, physician enrolment, home visits, reminders and offering vaccines in public clinics, health fairs and homes to increase uptake of hepatitis B vaccination	Usual practice – no uptake intervention	Total intervention cost: $268,660 (£304,608 2021 GBP)	Coverage increase: 1 dose: 8.8% 2 doses: 4.7% 3 doses: 11.9% At least 1 dose: 25.4% Life years saved:	Benefit-cost ratio: 30% infection rate: 4.44 60% infection rate: 8.88 Cost per life year saved:	Sensitivity analyses were performed to explore the effect of assumptions for discount rate and infection rate on the estimates of cost per life year saved and benefit-cost ratios. Results were computed	Partially applicable	Potentially serious limitations

Study	Comparators	Incremental cost	Incremental outcomes	Cost-effectiveness	Uncertainty	Applicability	Limitations
Asian-American children aged 2-13 years			30% infection rate: 106 years 60% infection rate: 213 years	30% infection rate: $11,525 (£13,067 2021 GBP) 60% infection rate: $5,763 (£6,534 2021 GBP)	for all combinations of 3% and 5% discount rates and 15% increments in infection rate from 15% to 75%. The broad range of infection rates was to account for variability resulting from differences in baseline vaccination levels and risk levels within countries of origin, and different ages at immigration. Probabilistic sensitivity analyses were not considered.		

1.1.9 Economic model

No economic modelling was conducted for this review question.

1.1.10 Economic evidence statements

- One cost-utility analysis found that in adults aged 65 years and older, the 4 pillars program to increase uptake of the pneumococcal and flu vaccines was cost-effective with an ICER of £398 compared with no program. This analysis was assessed as partially applicable with minor limitations.
- One cost-utility analysis found that in high-risk adults aged 18-64 years, the 4 pillars program to increase uptake of the pneumococcal, TDaP and flu vaccines had an ICER of £22,007 compared with no program. This analysis was assessed as partially applicable with minor limitations.
- One cost-utility analysis found that in adults aged 65 years and older, the 4 pillars program to increase uptake of the pneumococcal vaccine had an ICER of £265,204 compared with no program assuming the PPSV23 vaccine is not effective against nonbacteraemic pneumococcal pneumonia. Assuming the PPSV23 vaccine is effective against nonbacteraemic pneumococcal pneumonia lowers the ICER to £161,831. This analysis was assessed as partially applicable with minor limitations.
- One cost-effectiveness analysis found that in a children aged between 2 and 13 years, the cost per life year saved when a multicomponent intervention approach for hepatitis B vaccination was implemented was £26,134 when compared with no catch-up efforts at a 15% baseline infection rate. This analysis was assessed as partially applicable with potentially serious limitations.

1.1.11 The committee's discussion and interpretation of the evidence

1.1.11.1 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.

1.1.11.2 The quality of the evidence

The evidence ranged from moderate to very low quality. The quality of many of the outcomes were downgraded for studies being at high or moderate risk of bias, with common reasons for downgrading including limited information provided about randomisation or analysis methods. Some of the evidence also reported differences in baseline characteristics between trial arms. Results were also downgraded for imprecision (where the results crossed the line of no effect), but not indirectness. Most of the evidence was based in the USA, with none from the UK, but the studies were considered directly applicable to the review. The evidence compared different combinations of interventions, some only targeted at providers, some targeted at individuals or families, and some that used a combination of interventions targeting both providers and individuals or families. The wide range of interventions meant that the outcomes of each study had to presented individually, rather than using pooled meta-analyses.

Most of the evidence was for HPV vaccines for young people aged 11-18 years. Evidence for children aged 0-5 years was more limited, and there was only one study for vaccines for pregnant women and for people aged 65 years and over. However, the committee decided that the evidence for HPV vaccination could be applied to other age groups, particularly as the Fiks 2013 study was based on the wider healthcare system, rather than vaccine delivery in a school setting. The committee discussed how this evidence supported recommendations

made in the other reviews, and was applicable to most vaccination programmes, rather than one particular vaccine or population group.

No multicomponent evidence was identified for the subgroups of particular interest in the protocol, who included care home residents, Gypsy, Roma and Travellers or migrants and asylum seekers. It is therefore unclear whether multicomponent interventions would be effective at increasing vaccination in these potentially harder to reach groups and what the most effective combination of components would be.

1.1.11.3 Advantages and disadvantages

The committee used the evidence in this review to supplement the evidence from other intervention reviews to make recommendations and to provide additional support for recommendations the committee had already drafted. Please refer to the following reviews for further discussion of the advantages and disadvantages associated with the interventions and how the committee made their recommendations:

- For recommendations about making providers aware of payment streams and how feedback is linked to existing incentives, plus recommendations on provider feedback and audits, see the infrastructure review (evidence review G).
- For recommendations on education for providers or other staff who come into contact with eligible people, see the education and reminders review under the section 'Training and education for health and social care practitioners' (evidence review E).
- For recommendations on information and reminders aimed at individuals, parents or carers see the reminders, and education and reminders reviews (evidence reviews C and E).

When looking at the evidence, the committee noted that only one study (Fiks 2013) reported higher vaccine uptake in the intervention than the control arm. HPV vaccine uptake was higher for both intervention arms analysed in this review (provider-only intervention and a combined provider and family intervention) in comparison to control (the family intervention arm was included in the education review – evidence review E). The committee noted that this study was based in the USA, where 3 HPV vaccines are given in comparison to the 2 that are given in the UK, and vaccinations are not delivered in a school-based setting as they are in the UK. However, the committee decided that the outcomes were still relevant to the delivery of other vaccines by the NHS, as the interventions were appropriate to deliver in other settings, such as primary care.

Most of the other studies in this review could not differentiate between an intervention and control, and one study showed increased vaccine uptake in the control arm. Two of the studies that could not differentiate vaccine uptake between intervention and control arms investigated the use of the 4 Pillars intervention (Zimmerman 2017, Zimmerman 2017b). Both of these studies had differences in baseline characteristics between study arms, including the number of people vaccinated at baseline, which may have impacted on the results for vaccine uptake. As a result, the committee could not establish the effectiveness of this specific intervention, but it was considered an example of how a programme can use a range of different interventions which target both providers and individuals or families to try to increase vaccine uptake.

When discussing recommendations, the committee considered which types of interventions were included in the effective multicomponent intervention evaluated by Fiks 2013. This included reminders (in the form of electronic health record-based alerts), education, audits and feedback for clinicians, and phone-based reminders and information for parents and carers. The committee had already made a recommendation on the use of reminders for providers, based on the evidence in the reminders review (see evidence review C) and were confident that the results of this multicomponent intervention further supported that recommendation.

There was very little evidence identified for provider education in the education review; it was low-quality and could not differentiate between provider education and control. The findings from the Fiks study provided higher quality quantitative evidence and supported the use of provider education as part of a multicomponent intervention, although we could not determine which individual components were effective. In addition, qualitative evidence (from the barriers to and facilitators for vaccine uptake review B, reproduced in evidence review E) indicated a need for provider training and a lack of provider knowledge and confidence when discussing or giving vaccines. The committee therefore made recommendations in support of provider education for vaccination (see evidence review E for more details).

The third aspect of the provider intervention in the Fiks study was the use of audits and feedback. Based on the results in the infrastructure review (see evidence review G), the committee had already made recommendations on the use of regular audits and feedback. These are intended to allow providers to evaluate their performance, make comparisons with other providers and to enable continuous improvement. The effectiveness of the provider intervention in the Fiks study further supported the inclusion of these recommendations as an important way to raise awareness of a provider's current activity and highlight ways in which they could further improve vaccine uptake.

The second group of interventions in the Fiks study was a family-based intervention which used phone calls to provide vaccine information and reminders to parents or carers. Evidence in the reminders review (see review C) showed that reminders are effective at increasing vaccine uptake in different population groups, and so the committee had already recommended that invitations and reminders should be sent to people eligible for vaccination, and that there should be further, more direct, contact if there is no response to the reminder. The Fiks study used a similar system to these recommendations, with initial phone call reminders, followed by further phone calls if a vaccine appointment was not made. The committee were confident that this provided further support for the importance of patient reminders, and the need for them to be included in the recommendations.

Quantitative evidence in the education review (evidence review E) was low quality and although the pooled results showed an increase in vaccine uptake with education/ information for individuals (or their parents) this was very small and the lower 95% CI touched 1.00 (the line of no effect). The recommendations to provided information to individuals and families that the committee had already drafted were informed by findings in the qualitative reviews on barriers to and facilitators for uptake and on the acceptability of specific interventions (see evidence reviews B and J respectively). Both reviews highlighted that individuals and families wanted more information about the vaccine being offered to them or their children. The family-based intervention in the Fiks 2013 study included the provision of vaccine information together with reminders, and therefore provided higher quality quantitative evidence to support the use of patient information in the existing recommendations.

1.1.11.4 Cost effectiveness and resource use

Four cost-effectiveness studies were identified for multicomponent interventions, and the committee felt that these studies supported the recommendations already made on the individual components of the interventions (see evidence reviews C, E and G). Although the studies looked at some potentially relevant interventions, all studies had applicability issues. The Deuson study was in a population with a very high infection rate which the committee noted was not directly applicable to any populations in the UK (the lowest infection rate considered in the study was 15% where in the UK no individual population could be identified that had infection rates higher than 10%), and this in combination with other applicability issues and limitations meant that the committee could not be confident in the results of the study. The Smith and Wateska studies were agreed to not be fully applicable to the UK setting as they were all based in the US which has a very different vaccination system to that in the UK. All of the multicomponent studies identified differed slightly from the NICE

reference case in terms of perspective, setting and discounting. Therefore the committee did not use the economic evidence directly when making recommendations and instead used their expertise to inform discussion around the expected resource impact of the recommendations.

A costing analysis was not conducted for the multicomponent interventions, as the committee had already agreed the individual components were an appropriate use of NHS resources and did not make recommendations for combining different interventions, or specific multicomponent interventions.

1.1.11.5 Other factors the committee took into account

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.

1.1.12 Recommendations supported by this evidence review

This evidence review supports recommendations 1.1.19-1.1.21 on staff education; 1.2.15 on provider electronic prompts; 1.1.16 -1.1.18 on audits and feedback, 1.3.11-1.3.12 on information for individuals and their family members/ carers and 1.3.7, 1.3.14-1.3.16 on invitations and reminders for individuals and their family members/ carers. Other evidence supporting these recommendations can be found in the evidence reviews on education interventions to increase vaccine uptake (evidence review E); barriers to and facilitators for vaccine uptake (evidence review B); reminders interventions to increase vaccine uptake (evidence review C) and interventions to increase the uptake of routine vaccines by improving infrastructure (evidence review G).

1.1.13 References – included studies

1.1.13.1 Effectiveness

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Goodyear-Smith, Felicity, Grant, Cameron, Poole, Tracey et al. (2012) Early connections: effectiveness of a pre-call intervention to improve immunisation coverage and timeliness. Journal of primary health care 4(3): 189-98

Hambidge, Simon J, Davidson, Arthur J, Phibbs, Stephanie L et al. (2004) Strategies to improve immunization rates and well-child care in a disadvantaged population: a cluster randomized controlled trial. Archives of pediatrics & adolescent medicine 158(2): 162-9

O'Leary, S.T., Pyrzanowski, J., Brewer, S.E. et al. (2019) Effectiveness of a multimodal intervention to increase vaccination in obstetrics/gynecology settings. Vaccine 37(26): 3409-3418

Paskett, Electra D, Krok-Schoen, Jessica L, Pennell, Michael L et al. (2016) Results of a Multilevel Intervention Trial to Increase Human Papillomavirus (HPV) Vaccine Uptake among Adolescent Girls. Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology 25(4): 593-602

Zimmerman, Richard K, Moehling, Krissy K, Lin, Chyongchiou J et al. (2017) Improving adolescent HPV vaccination in a randomized controlled cluster trial using the 4 Pillars TM practice Transformation Program. Vaccine 35(1): 109-117

Zimmerman, RK, Brown, AE, Pavlik, VN et al. (2017) Using the 4 Pillars Practice Transformation Program to Increase Pneumococcal Immunizations for Older Adults: a Cluster-Randomized Trial. Journal of the american geriatrics society 65(1): 114-122

1.1.13.2 Economic

Deuson, R R, Brodovicz, K G, Barker, L et al. (2001) Economic analysis of a child vaccination project among Asian Americans in Philadelphia, Pa. Archives of pediatrics & adolescent medicine 155(8): 909-14

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

Wateska, Angela R, Nowalk, Mary Patricia, Zimmerman, Richard K et al. (2018) Cost-effectiveness of increasing vaccination in high-risk adults aged 18-64 Years: a model-based decision analysis. BMC infectious diseases 18(1): 52

Wateska, Angela R, Nowalk, Mary Patricia, Lin, Chyongchiou J et al. (2020) Cost-Effectiveness of Pneumococcal Vaccination Policies and Uptake Programs in US Older Populations. Journal of the American Geriatrics Society 68(6): 1271-1278

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="8">23.</td><td rowspan="8">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 identify systematic reviews identifying interventions to improve uptake of routine vaccinations was run on 23rd and 24th March 2020 and re run on 5th and 6th May 2021. 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 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. 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 12th 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

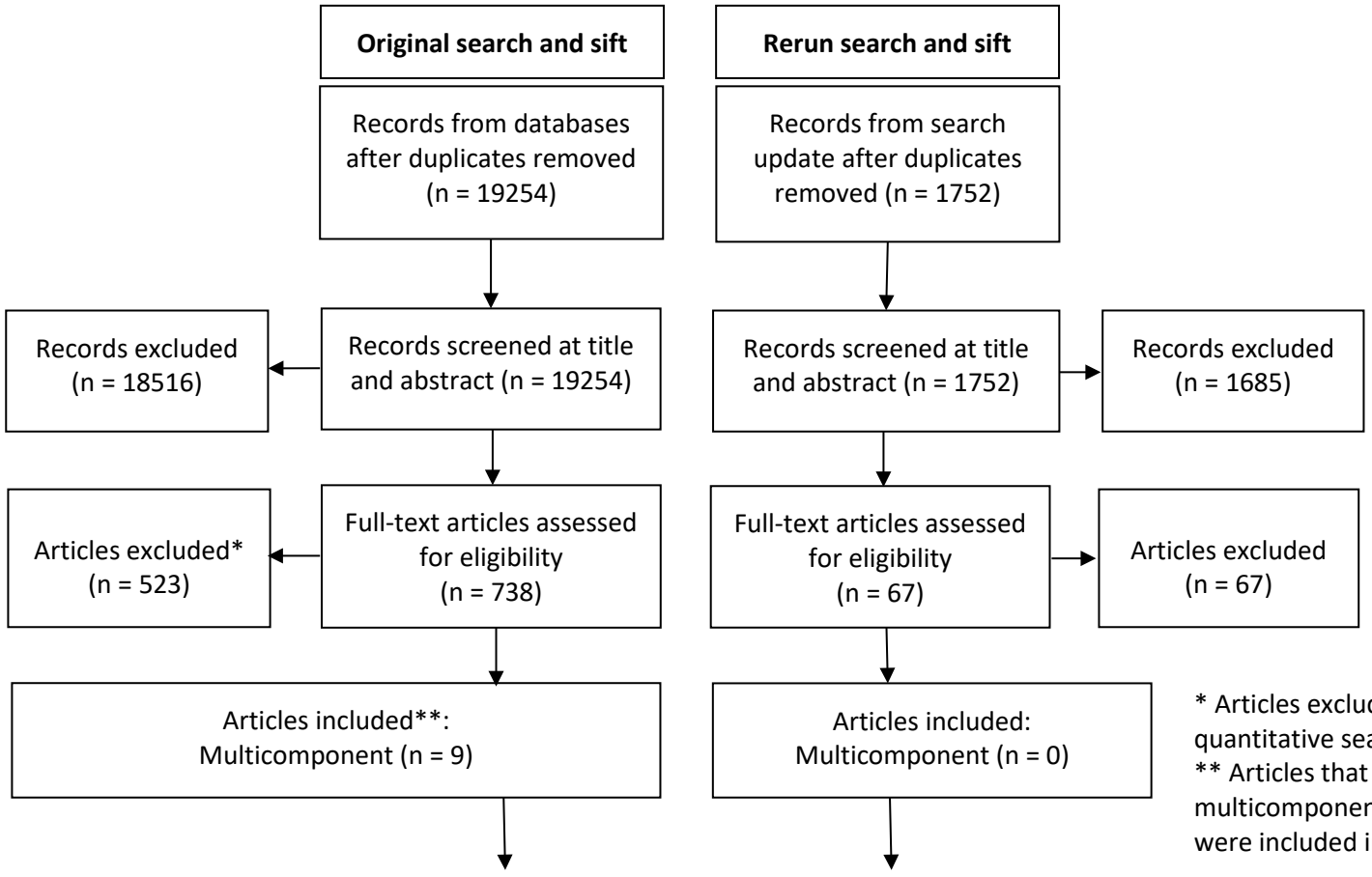
A single search to identify economic evidence for all review questions was run on 12th February 2020.The following databases were searched: Medline, Medline in Process, Embase, Econlit (all via the Ovid platform) NHS Economic Evaluation Database (NHS EED) and the Health Technology Assessment Database (HTA) (via the CRD platform). The searches were re run on 13th April 2021 with the HTA database replaced by the International Health Technology Database (INAHTA). The Medline strategy is presented 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 vaccines combined/ 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/
45 43 or 44
46 animals/ not humans/
47 45 not 46
48 limit 47 to english language/
49 limit 48 to ed=19900101-20200212
50 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 colombia/ 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/ (1062747)
51 australasia/ or exp australia/ or austria/ or exp Baltic States/ or belgium/ or exp canada/ or chile/ or czech republic/ or europe/ or European Union/ 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/ or "Organisation for Economic Co-Operation and Development"/ or Developed Countries/
52 50 not (50 and 51)
53 49 not 52 (53810)
54 Cost-Benefit Analysis/
55 Quality-Adjusted Life Years/
56 Markov Chains/
57 exp Models, Economic/
58 cost*.ti.
59 (cost* adj2 utilit*).tw.
60 (cost* adj2 (effective* or assess* or evaluat* or analys* or model* or benefit* or threshold* or quality or expens* or saving* or reduc*)).tw.
61 (economic* adj2 (evaluat* or assess* or analys* or model* or outcome* or benefit* or threshold* or expens* or saving* or reduc*)).tw.
62 (qualit* adj2 adjust* adj2 life*).tw.
63 QALY*.tw.
64 (incremental* adj2 cost*).tw.
65 ICER.tw.
66 utilities.tw.
67 markov*.tw.
68 (dollar* or USD or cents or pound or pounds or GBP or sterling* or pence or euro or euros or yen or JPY).tw.
69 ((utility or effective*) adj2 analys*).tw.
70 (willing* adj2 pay*).tw.
71 (EQ5D* or EQ-5D*).tw.
72 ((euroqol or euro-qol or euroquol or euro-quol or eurocol or euro-col) adj3 ("5" or five)).tw.
73 (european* adj2 quality adj3 ("5" or five)).tw.
74 or/54-73
75 53 and 74

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 multicomponent review. The rest of the 215 articles were included in other reviews.

Appendix D – Effectiveness evidence tables

Barnes, 1999

Bibliographic Reference	Barnes K; Friedman SM; Brickner Namerow P; Honig J; Impact of community volunteers on immunization rates of children younger than 2 years.; Archives of pediatrics & adolescent medicine; 1999; vol. 153 (no. 5)

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	2 ambulatory paediatric clinics in New York
Study dates	December 1995 - July 1996
Sources of funding	New York City Department of Health, Immunization Action Plan
Inclusion criteria	Age less than 24 months and living in Northwest Manhattan Chart review showed missing immunisations Missed the due date (based on age) of diphtheria, tetanus and pertussis, polio, haemophilus influenza type B, hepatitis B or MMR vaccines by 30 days Missed a scheduled appointment at either of the 2 clinics
Exclusion criteria	Families that declined study participation
Intervention(s)	At the initial home visit, families were given basic immunisation education and a referral from a community volunteer. Contact with community volunteers continued for up to 6 months by home visits or by phone, and included reminders of upcoming vaccinations and follow-up contact to ensure vaccines were received. Volunteers also provided support to help families access immunisation services if needed (e.g. contacting the clinic or being an escort to appointments).
Comparator	Families were informed of their child's immunisation status at enrolment into the study. They were told to rebook the missed appointment but received no further contact from study personnel
Relevant outcome measures	Vaccine uptake

Study arms

Home visits, education, reminders and appointment booking (N = 74)

Home visits with vaccine education and reminders. Help with booking or attending appointments if needed

Control (N = 89)

Families were informed of their child's immunisation status at the enrolment visit and told to reschedule their missed vaccine appointment

Characteristics

Arm-level characteristics

	Home visits, education, reminders and appointment booking (N = 74)	**Control (N = 89)**
Mean age of child *(Months)*		
Nominal	9.5	9.4
% Female		
Nominal	50	40

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
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

Desiante, 2017

Bibliographic Reference	Desiante, F; Russo, C; Giorgino, A; Caputi, G; Battista, T; Cipriani, R; Conversano, M; Universal proposal strategies of anti-HPV vaccination for adolescents: comparative analysis between school-based and clinic immunization programs.; Journal of preventive medicine and hygiene; 2017; vol. 58 (no. 3); e225-e230

Study details

Study type	Cluster randomised controlled trial
Study location	Italy
Study setting	Schools and vaccination centres
Study dates	2016
Sources of funding	This research did not receive any specific grant from any funding agencies in the public, commercial, or not-for-profit sectors.
Inclusion criteria	Adolescents Adolescents who were born in 2003 and were registered at 24 vaccination centres.
Exclusion criteria	None reported
Intervention(s)	The family of the target subjects received an invitation letter to go to the vaccination centre for the immunisation. The letter also contained information on benefits and risks of anti-HPV vaccination. This vaccination strategy didn't need a date, but the teenagers and their parents could freely access the outpatient clinic.
Comparator	These participants were offered organised counselling and HPV vaccine promotional meetings with the participation of the Local Health Unit's healthcare professionals, the teachers, the students and their parents. During the meetings, planned outside of school time, the parents provided written consent for the vaccine administration within the schools. Administration for both doses was scheduled within the schools during the class time.
Relevant outcome measures	Vaccine uptake
Number of participants	School vaccine strategy = 2530 adolescents registered at 10 vaccination centres. Clinic vaccine strategy = 3190 adolescents registered at 14 vaccination centres.
Duration of follow-up	Data was collected from a computerised registry on 31 December 2016.
Loss to follow-up	None
Additional comments	Baseline characteristics were not provided for each arm. Vaccine uptake data was not adjusted for clustering by the investigators. Therefore, we adjusted the data for clustering by using an ICC of 0.05.

Study arms

Reminder letter with information. Vaccinations at immunisation centres, which could be accessed at any time (N = 3190)
Educational counselling and promotional meetings. Vaccinations were given at scheduled times in schools (N = 2530)

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. The baseline characteristics of each arm were not provided so it was not possible to check how successful randomisation was.)*
1b. Bias arising from the timing of identification and	Risk of bias judgement for the timing of identification and	Low

Section	Question	Answer
recruitment of individual participants in relation to timing of randomisation	recruitment of individual participants in relation to timing of randomisation	
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 *(Uptake was measured using a computerised registry.)*
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 *(There are some concerns with randomisation.)*
	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)	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
Relevant 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

Arm 1: 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)
Arm 2: 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)
Arm 3: 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)
Control: 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				
Nominal	70	70	68	68
% aged 14-17 years				
Nominal	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 *(No information about whether clusters and participants were analysed in the group to which they were assigned)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Some concerns *(No information about missing outcome data for any of the trial arms)*

Section	Question	Answer
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 *(No information about whether clusters and participants were analysed in the group to which they were assigned. No information about missing outcome data)*
	Overall Directness	Directly applicable

Goodyear-Smith, 2012

Bibliographic Reference	Goodyear-Smith, Felicity; Grant, Cameron; Poole, Tracey; Petousis-Harris, Helen; Turner, Nikki; Perera, Rafael; Harnden, Anthony; Early connections: effectiveness of a pre-call intervention to improve immunisation coverage and timeliness.; Journal of primary health care; 2012; vol. 4 (no. 3); 189-98

Study details

Study type	Cluster randomised controlled trial
Study location	Aukland, New Zealand
Study setting	General practices in Auckland District Health Board (ADHB) catchment area and the study population was babies born in the ADHB region and/or those whose parents nominated practices in the ADHB region as their general practice.
Study dates	November 2008 and 20 April 2010.
Sources of funding	Health Research Council of New Zealand and the Ministry of Health.
Inclusion criteria	Living in a defined area Auckland District Health Board (ADHB) catchment area
Exclusion criteria	Practices not involved in delivering infant immunisations
Intervention(s)	Invitation to attend when baby is six weeks, plus simple information on immunisation. This was sent by the practice to the baby's caregiver when the baby was four weeks old material). A follow-up phone call was made to the baby's caregiver when the baby was five weeks old if an appointment had not already been made for the six week vaccinations and, if the caregiver did not present the baby for immunisation, a further attempt at contact (early recall) was made to the caregiver

	when the baby was seven weeks old. Phone calls were the preferred method of pre-call/recall although a text message, email or letter could also be used. Practices were given a $15 shopping mall voucher per baby to acknowledge the time and effort required to administer the intervention, to be claimed irrespective of whether or not it resulted in immunisation of the baby.
Comparator	Usual care. No further information
Relevant outcome measures	Vaccine uptake Number given 6 week vaccination
Number of participants	Practice level: 63 were recruited with 31 randomised to the intervention group and 32 to the control group. Parents of babies receiving intervention: N = 2842 Parents of babies in control group: N = 2414
Duration of follow-up	6 weeks
Loss to follow-up	None reported
Additional comments	Baseline characteristics not provided. Only 1198 of the 2842 babies in the intervention arm received pre-call interventions (42%). Study reports that it adjusted for clustering but ICC not not stated. Vaccine uptake was calculated for the multicomponent review using an ICC of 0.05, based on similar analyses in other reviews in this guideline

Study arms

Parent information and reminders. Provider financial incentives (N = 2842) Information sent to parents with vaccine information and reminder sent if vaccine appointment is not booked. Practices given shopping vouchers for each vaccine appointment
Control (parents) (N = 2414)

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

Section	Question	Answer
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	Some concerns Only 42% of the babies in the intervention arm received the interventions
	Overall Directness	Directly applicable

Hambidge, 2004

Bibliographic Reference	Hambidge, Simon J; Davidson, Arthur J; Phibbs, Stephanie L; Chandramouli, Vijayalaxmi; Zerbe, Gary; LeBaron, Charles W; Steiner, John F; Strategies to improve immunization rates and well-child care in a disadvantaged population: a cluster randomized controlled trial.; Archives of pediatrics & adolescent medicine; 2004; vol. 158 (no. 2); 162-9

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Denver Health Medical Center
Study dates	July 1998 - June 1999
Sources of funding	Association of Teachers of Preventive Medicine and the Centers for Disease Control and Prevention
Inclusion criteria	All patients born at DH Medical Center
Exclusion criteria	Parents indicated that the child would receive care outside of the DH system, the infant received no care at DH after newborn discharge or because the infant

	attended a separately funded clinic that did not use DH's administrative billing system
Intervention(s)	Immunisation arm: Patient services - recall for missed appointments, recall if behind on immunisations or well child visits, reminders and education for immunisations and assistance with transport, referral for home visits if missed appointment. Clinic-based services - medical charts marked if behind on immunisations, monthly AFIX cycles directed about immunisations, education about immunisation and recall methods, incentives for highest immunisation rates. System-based services - flag patients who are behind on immunisations, automated reminders, computerised immunisation registry. Well child visit arm: As for immunisation but interventions targeted at well child visit appointments rather than immunisation
Comparator	No patient-based or clinic-based interventions
Relevant outcome measures	Vaccine uptake Up to date on vaccinations at 12 months (3 diphtheria-tetanus-acellular pertussis, 2 polio, 2 Haemophilis influenzae b, and 2 hepatitis B)
Number of participants	10 clinics, 2565 infants
Duration of follow-up	12 months
Additional comments	Study reports that it adjusted for clustering but ICC not not stated. Vaccine uptake was calculated for the multicomponent review using an ICC of 0.05, based on similar analyses in other reviews in this guideline

Study arms

Immunisation arm (N = 4) Patient education and reminders about immunisation , provider education, reminders and incentives about immunisation, system identification of patients eligible for immunisation. 4 clinics, 1030 infants
Well child arm (N = 3) Patient education and reminders about well child visits, provider education, reminders and incentives about well child visits, automated appointment reminders. 3 clinics, 475 infants
Control (N = 4) No patient or provider-based interventions. 4 clinics, 1160 infants

Characteristics

Arm-level characteristics

	Immunisation arm (N = 4)	**Well child arm (N = 3)**	**Control (N = 4)**
% Female			
Nominal	48	49	47

	Immunisation arm (N = 4)	Well child arm (N = 3)	Control (N = 4)
Mother's age at delivery *(years)*			
Mean/SD	24 (6)	25 (6)	26 (6)

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 *(No information about whether clusters or participants were analysed in a different group to which they were assigned)*
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

O'Leary, 2019

Bibliographic Reference	O'Leary, S.T.; Pyrzanowski, J.; Brewer, S.E.; Sevick, C.; Miriam Dickinson, L.; Dempsey, A.F.; Effectiveness of a multimodal intervention to increase vaccination in obstetrics/gynecology settings; Vaccine; 2019; vol. 37 (no. 26); 3409-3418

Study details

Trial registration	NCT01565135

number and/or trial name	
Study type	Cluster randomised controlled trial
Study location	USA
Study setting	13 obstetrics/gynaecology clinics in Coloradp
Study dates	September 2011 - May 2014 (May 2013 - May 2014 for post-intervention)
Sources of funding	Centers for Disease Control and Prevention
Inclusion criteria	Obstetrics/gynecology practice in Colorado All female patients with a record of care between September 6, 2011 and May 31, 2014 and were between the ages of 15 and 100
Exclusion criteria	None reported
Intervention(s)	Clinics were presented with best practices in immunization delivery and then chose which procedures they felt best suited the needs of their clinic. Minimum interventions at each clinic included stocking each of the three vaccines of interest, offering the three vaccines, offering training on vaccination program 'best practices' to practice staff and designating an immunisation champion to serve as a primary point of contact for their immunisation program and liaison with study personnel. Immunisation champions were compensated for their additional duties for the study. Standing orders were strongly encouraged at all clinics, with assistance from the study team for implementation. Educational training was provided at each site for all staff involved in immunisation delivery. This included best practices for delivering immunizations in ob-gyn settings and use of standing orders, including how to identify eligible patients, collect immunisation history, provide patient education and delivering vaccines. Training were was tailored to the interventions chosen for implementation by each clinic. Clinics also provided education for medical assistants and nursing staff each time they implemented a policy or procedure change. The study team had monthly meetings with immunisation champions to ensure the outcomes of training were implemented.
Comparator	No education or implementation of the best practice interventions
Relevant outcome measures	Vaccine uptake Tdap vaccination during the study period
Number of participants	13 practices, 83372 participants
Duration of follow-up	1 year
Loss to follow-up	Intervention: 2 practices withdrew, 1 lost to follow-up Control: 2 practices lost to follow-up
Additional comments	Study also reported outcomes for flu vaccination but that was not relevant to this review. Study reported data for both obstetric and gynaecological patients but only data for obstetrics is reported in this review as the routine schedule for Tdap is for pregnant women. Study reports that it selected sample size based on an expected

	ICC of 0.02 (similar to other immunisation studies). An ICC of 0.02 was therefore used to adjust vaccine uptake for this review

Study arms

Vaccination programme best practice (N = 41983) Practices selected interventions from a choice of best practice interventions that best suited their clinic's needs. Minimum interventions included standing orders for vaccines, staff training on vaccination best practice and designating an immunisation champion (5 practices, 41983 women)
Control (N = 41389) No best practice intervention (7 practices, 41389 women)

Characteristics

Arm-level characteristics

	Vaccination programme best practice (N = 41983)	**Control (N = 41389)**
Age at most recent visit (years) For obs and gyn patients combined (obstetrics not reported separately for baseline characteristics)		
Mean/SD	41 (14.9)	38 (12.9)

Risk of bias

Section	**Question**	**Answer**
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(2 intervention practices withdrew following randomisation. One control practice was reallocated to the intervention arm based on having similar characteristics to those that withdrew - final allocation not truly randomised)*
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 *(No information about missing outcome data for participants)*

Section	Question	Answer
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 *(Not truly randomised - one cluster was moved from the control to intervention arm after 2 other clusters withdrew. No information about the proportion of missing outcome data for either arm.)*
	Overall Directness	Directly applicable

Paskett, 2016

Bibliographic Reference	Paskett, Electra D; Krok-Schoen, Jessica L; Pennell, Michael L; Tatum, Cathy M; Reiter, Paul L; Peng, Juan; Bernardo, Brittany M; Weier, Rory C; Richardson, Morgan S; Katz, Mira L; Results of a Multilevel Intervention Trial to Increase Human Papillomavirus (HPV) Vaccine Uptake among Adolescent Girls.; Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology; 2016; vol. 25 (no. 4); 593-602

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Clinics in 12 Ohio counties
Study dates	2010 - 2015
Sources of funding	NCI and the Behavioral Measurement Shared Resource at The Ohio State University Comprehensive Cancer Center
Inclusion criteria	Clinics located in one of the 12 counties in the study which provided care to girls aged 9-17 and either provided immunizations or referrals for immunizations Parents aged 18 or over, who were fluent in English, were a resident of one of the participating counties Parent or legal guardian of a girl age 9 to 17 years who had not received the HPV vaccine, and had no children who had received the HPV vaccine
Exclusion criteria	None reported
Intervention(s)	Clinic-level intervention: Waiting room and examination room posters, brochures, and tabletop tent cards for the HPV vaccine intervention.

	Provider-level intervention: An educational session for providers, facilitated by a member of the research team, including a 1-hour presentation and handouts on the HPV vaccine, focusing on current HPV vaccine information and strategies to assist physicians in discussing HPV vaccination with parents. Parent-level intervention: After the initial phone call, parents were mailed a packet that included a $10 thank you gift card for completing the telephone-administered baseline survey, an educational brochure and DVD video about HPV and HPV vaccination, a magnet reminder to get the 2nd and 3rd HPV vaccine shots, and a CDC HPV vaccine information statement. Health educators conducted an education session about the HPV vaccine via telephone to reinforce the message about the need for vaccination and addressed any barriers or questions.
Comparator	Providers were given information on the flu and flu vaccine. Parents were mailed a packet that included similar items to the intervention group but with a focus on the flu vaccine - a flu vaccine information statement from the CDC and flu information sheets from Ohio Department of Health.
Relevant outcome measures	Vaccine uptake Receipt of the first dose within 3 and 6 months
Number of participants	12 counties, 24 clinics, 4798 parents
Duration of follow-up	6 months
Loss to follow-up	Intervention: 17 Control: 15
Additional comments	Study reports that it adjusted for clustering using an ICC of 0.07 based on vaccination rates in local county health departments. Vaccine uptake was re-calculated to account for clustering using the same value

Study arms

Parent and provider education, information and reminders (N = 2456) HPV brochures and posters in clinic, provider education and parent education and reminders via phone and post (6 counties, 2456 parents)
Control (N = 2342) Provider and parent education about the flu vaccine (6 counties, 2342 parents)

Characteristics

Arm-level characteristics

	Parent and provider education, information and reminders (N = 2456)	**Control (N = 2342)**
Age of parent *(years)*		
Mean/SD	44.5 (6.6)	42.5 (6.6)

	Parent and provider education, information and reminders (N = 2456)	Control (N = 2342)
% Female %of parents that were female		
Nominal	92	92.6
Age of child *(years)*		
Mean/SD	13.6 (2.3)	13.3 (2.3)

Risk of bias

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No 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	Some concerns *(Unclear when participants were identified relative to cluster 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	Some concerns *(No information about whether clusters or participants were analysed in the group that they were assigned to)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Some concerns *(Unable to obtain medical records for 25% of participants. However, proportion of missing data was similar between arms)*
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(For 6 months data, where information on vaccine uptake was partly taken from parent's reports. Low concerns at 3 months where uptake was based on medical records)*
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 *(No information about randomisation or when participants were identified relative to randomisation. No information about whether participants were analysed in the intervention they were assigned to, and missing data for 25% of participants. At 6 months vaccine uptake was partly based on parent's reports)*
	Overall Directness	Directly applicable

Zimmerman, 2017a

Bibliographic Reference	Zimmerman, Richard K; Moehling, Krissy K; Lin, Chyongchiou J; Zhang, Song; Raviotta, Jonathan M; Reis, Evelyn C; Humiston, Sharon G; Nowalk, Mary Patricia; Improving adolescent HPV vaccination in a randomized controlled cluster trial using the 4 Pillars TM practice Transformation Program.; Vaccine; 2017; vol. 35 (no. 1); 109-117

Study details

Other publications associated with this study included in review	Zimmerman 2017b
Trial registration number and/or trial name	NCT02165722
Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Primary care family medicine and paediatric practices from 2 practice-based research networks in Pittsburgh and a clinical network in Southwestern Pennsylvania
Study dates	2013 - 2014 (baseline), 2014-2015 (study period)
Sources of funding	Pfizer, Inc and National Institutes of Health
Inclusion criteria	Practice with at least 50 adolescent patients, estimated vaccination rates for at least one adolescent vaccine (HPV, Tdap, MCV) was less than national goals and a willingness to make office changes to increase vaccination rates
Exclusion criteria	None reported
Intervention(s)	Four Pillars Practice Transformation Program - Pillar 1: Convenient vaccination services - using every patient visit as a n opportunity to vaccinate offering walk-in vaccination clinics and create a dedicated vaccination station. Pillar 2: Communication with patients about the importance of immunisation and the availability of vaccines - training staff to discuss vaccination during routine processes, promote staff vaccination, using advertising to promote vaccination and conducting outreach services. Pillar 3: Enhanced office systems to facilitate immunization - assess vaccine eligibility of scheduled patients, use EMR prompts, use of standing orders and inventories, promoting simultaneous vaccinations. Pillar 4: Motivation through an office immunization champion - tracking progress, providing regular feedback, promote discussions about what is working and provide rewards

	for successful results. Intervention sites were expected to implement strategies from each of the 4 pillars, and were encouraged to use as many strategies as possible to maximize their impact on vaccine uptake
Comparator	Usual care - sites were told that the intervention would be implemented the following year and had no further contact with study staff until the study period was completed
Relevant outcome measures	Vaccine uptake HPV series initiation and completion
Number of participants	20 sites, 10861 young people
Duration of follow-up	1 year
Loss to follow-up	Intervention: 2 practices Control: None reported
Additional comments	Also reported data separately for 11-13 year olds and 14-17 year olds. Only the combined data for both of these groups has been reported in this review. Study reported that sample size was calculated based on an expected ICC of 0.20. Data for vaccine uptake was therefore re-calculated using an ICC of 0.20 for the multicomponent review

Study arms

4 Pillars (N = 4942) Clinic-based intervention, aimed at improving access to vaccination services and communication with patients as well as improving office systems and using immunisation champions (9 sites, 4942 young people)
Control (N = 5919) Usual care - informed by the research team that their intervention would take place the following year. No further contact until the end off the study (11 sites, 5919 young people)

Characteristics

Arm-level characteristics

	4 Pillars (N = 4942)	**Control (N = 5919)**
% aged 11-13 years		
Nominal	39.9	37.2
% non-white		
Nominal	12	23.4
% vaccinated at baseline		
Nominal	52.5	61.8

Risk of bias

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	High *(No information about randomisation methods and a higher % of young people were vaccinated at baseline in the control than the intervention 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 *(No information about whether clusters or participants were analysed in a different group to which they were assigned)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Some concerns *(No information about missing data in either arm)*
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	High *(Baseline imbalances, no information about missing data or whether clusters and participants were analysed in the group to which they were assigned)*
	Overall Directness	Directly applicable

Zimmerman, 2017b

Bibliographic Reference	Zimmerman, RK; Brown, AE; Pavlik, VN; Moehling, KK; Raviotta, JM; Lin, CJ; Zhang, S; Hawk, M; Kyle, S; Patel, S; et, al.; Using the 4 Pillars Practice Transformation Program to Increase Pneumococcal Immunizations for Older Adults: a Cluster-Randomized Trial; Journal of the american geriatrics society; 2017; vol. 65 (no. 1); 114-122

Study details

Other publications associated with this study	Zimmerman 2017

included in review	
Trial registration number and/or trial name	Four Pillars
Study type	Cluster randomised controlled trial
Study location	USA
Study setting	25 primary care practices in Houston and Pittsburgh
Study dates	Baseline: June 2012 - May 2013; Study period: June 2013 - May 2014
Sources of funding	Centers for Disease Control and Prevention and the National Institutes of Health
Inclusion criteria	Primary care family medicine and internal medicine practices from a practice-based research network in Pittsburgh, a clinical network in Southwestern Pennsylvania and a PBRN of safety net practices in Houston Practice with at least 100 patients ≥18 years of age, preliminary baseline vaccination rates for at least one adult vaccine (influenza, pneumococcal, Tdap) <50% and a willingness to make office changes to increase vaccination rates
Exclusion criteria	None reported
Intervention(s)	Four Pillars Practice Transformation Program - Pillar 1: Convenient vaccination services - using every patient visit as an opportunity to vaccinate offering walk-in vaccination clinics and create a dedicated vaccination station. Pillar 2: Communication with patients about the importance of immunisation and the availability of vaccines - training staff to discuss vaccination during routine processes, promote staff vaccination, using advertising to promote vaccination and conducting outreach services. Pillar 3: Enhanced office systems to facilitate immunization - assess vaccine eligibility of scheduled patients, use EMR prompts, use of standing orders and inventories, promoting simultaneous vaccinations. Pillar 4: Motivation through an office immunization champion - tracking progress, providing regular feedback, promote discussions about what is working and provide rewards for successful results. Intervention sites were expected to implement strategies from each of the 4 pillars, and were encouraged to use as many strategies as possible to maximize their impact on vaccine uptake
Comparator	Usual care - sites were told that the intervention would be implemented the following year and had no further contact with study staff until the study period was completed
Relevant outcome measures	Vaccine uptake Number receiving pneumococcal vaccination
Number of participants	18107
Duration of follow-up	1 year
Loss to follow-up	

Additional comments	Study included a cross-over period. Only data from before the cross-over period is reported in this review as this meets the inclusion criteria for the review. Study reports that it adjusted for clustering but ICC not stated. Vaccine uptake was calculated for the multicomponent review using an ICC of 0.05, based on similar analyses in other reviews in this guideline The study reports data for Houston and Pittsburgh sites separately and for both sites combined. Only the data for the individual sites is presented in this review because of differences in baseline characteristics (% vaccinated at baseline) for the Houston site.

Study arms

4 Pillars (N = 9105) Clinic-based intervention, aimed at improving access to vaccination services and communication with patients as well as improving office systems and using immunisation champions (13 practices, 9105 individuals)
Control (N = 9002) Sites were informed that their intervention would take place during Year 2 of the study and were not contacted again until the next year

Characteristics

Arm-level characteristics

	4 Pillars (N = 9105)	**Control (N = 9002)**
Age *(years)*		
Pittsburgh		
Mean/SD	75.9 (7.9)	74.8 (7.4)
Houston		
Mean/SD	72.1 (6.8)	71.3 (6.4)
% Female		
Pittsburgh		
Nominal	57.5	57.5
Houston		
Nominal	68.5	66.2
% vaccinated at baseline		
Pittsburgh		
Nominal	71.4	71.5
Houston		
Nominal	67.7	75.1

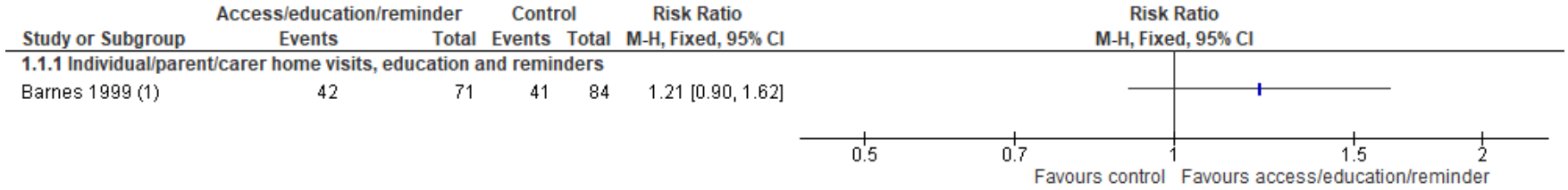
Risk of bias

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	High *(No information about randomisation methods. Baseline characteristics for Pittsburgh sites are similar for control and intervention arms but there were differences between the two arms for Houston sites - intervention sites had a higher % of females, higher % of non-white patients and differences in health insurance status. Houston intervention sites also had lower vaccine uptake at baseline)*
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 *(No information about whether clusters or participants were analysed in the arm to which they were randomised)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Some concerns *(No information about missing data for participants)*
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	High *(Houston sites and pooled outcome. No information about randomisation methods, whether participants were analysed in the cluster to which they were assigned or about missing data for participants. Differences in many of the baseline characteristics for Houston sites.)* Moderate *(Pittsburgh sites where baseline characteristics were similar between intervention and control arms)*
	Overall Directness	Directly applicable

Appendix E – Forest plots

Individual/parent/carer interventions vs control

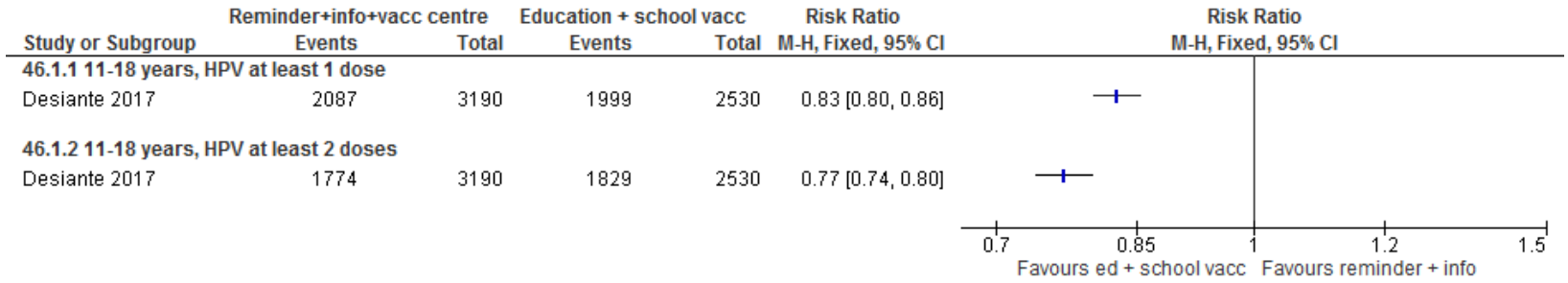
RCT: Individual/parent/carer access, education and reminders vs control



(1) 0–5 years. Up to date with childhood vaccinations

Individual/parent/carer interventions vs other individual/parent/carer interventions

cRCT: Reminder letter with information and a separate clinic for vaccination versus education, obtaining consent and vaccinations at school



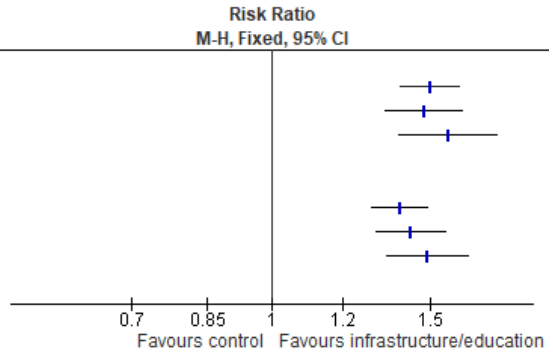
Footnotes

Desiante 2017 was a cRCT. Data was not adjusted for clustering. Reminder letter with information plus vaccinations at immunisation centres, which could be accessed at any time versus educational counselling and promotional meetings with consent obtained for vaccination plus vaccinations were given at scheduled times in schools.

Provider interventions vs control

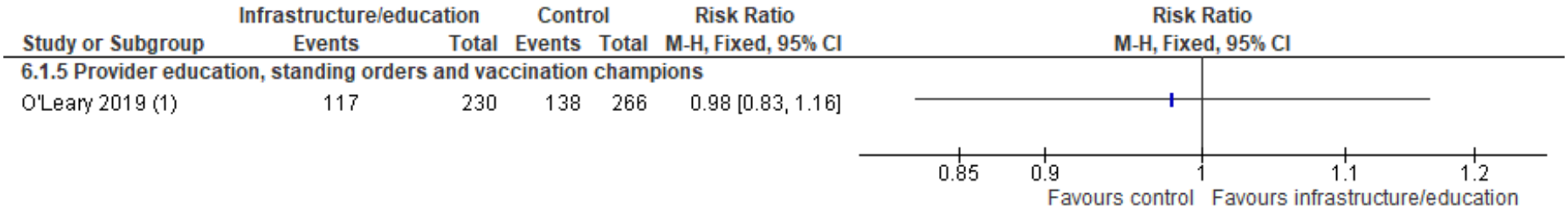
cRCT: Provider infrastructure interventions (audits, feedback), reminders and education vs control

Study or Subgroup	Infrastructure/education Events	Total	Control Events	Total	Risk Ratio M-H, Fixed, 95% CI
7.1.1 Provider education, alerts, audits and feedback vs control					
Fiks 2013 (1)	1334	5557	910	5688	1.50 [1.39, 1.62]
Fiks 2013 (2)	854	5557	592	5688	1.48 [1.34, 1.63]
Fiks 2013 (3)	572	5557	373	5688	1.57 [1.39, 1.78]
7.1.2 Provider education, alerts, audits and feedback and individual/parent/carer information and reminder vs Individual/parent/carer information and reminders					
Fiks 2013 (4)	1390	5561	1022	5680	1.39 [1.29, 1.49]
Fiks 2013 (5)	1015	5561	725	5680	1.43 [1.31, 1.56]
Fiks 2013 (6)	771	5561	529	5680	1.49 [1.34, 1.65]



(1) 11-18 years. HPV dose 1. Arm 1 (clinician intervention) vs control. Study authors adjusted data for clustering
(2) 11-18 years. HPV dose 2. Arm 1 (clinician intervention) vs control. Study authors adjusted data for clustering
(3) 11-18 years. HPV dose 3. Arm 1 (clinician intervention) vs control. Study authors adjusted data for clustering
(4) 11-18 years. HPV dose 1. Arm 3 (clinician and family intervention) vs Arm 2 (family intervention). Family intervention serves as active comparator. Study authors adjusted data for clustering
(5) 11-18 years. HPV dose 2. Arm 3 (clinician and family intervention) vs Arm 2 (family intervention). Family intervention serves as active comparator. Study authors adjusted data for clustering
(6) 11-18 years. HPV dose 3. Arm 3 (clinician and family intervention) vs Arm 2 (family intervention). Family intervention serves as active comparator. Study authors adjusted data for clustering

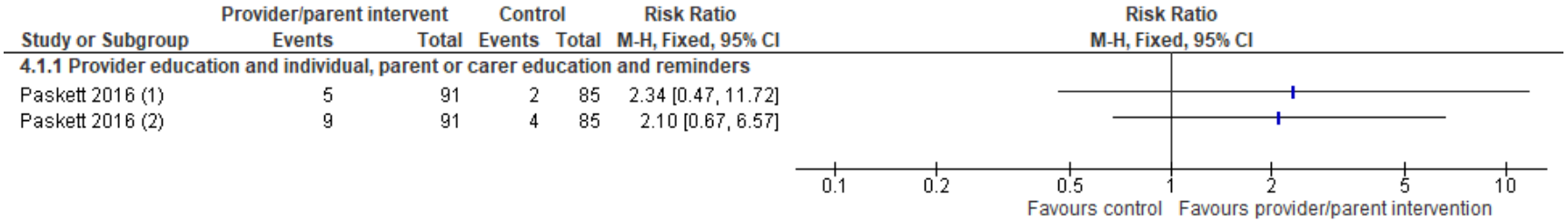
cRCT: Provider infrastructure interventions (standing orders), vaccination champions and education vs control



(1) Pregnancy. Tdap vaccination during the study period. Data adjusted for this review using an ICC of 0.02 (used by study authors for other statistical analysis)

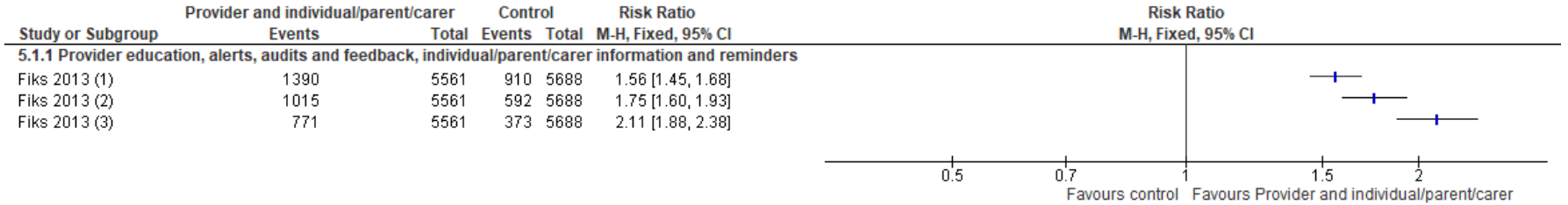
Provider interventions and individual/parent/carer interventions vs control

cRCT: Provider education and individual/parent/carer education and reminders vs control



(1) 11-18 years. HPV vaccine within 3 months of intervention. Data adjusted for this review using an ICC of 0.07 (used by study authors for other statistical analysis)
(2) 11-18 years. HPV vaccine within 6 months of intervention. Data adjusted for this review using an ICC of 0.07 (used by study authors for other statistical analysis)

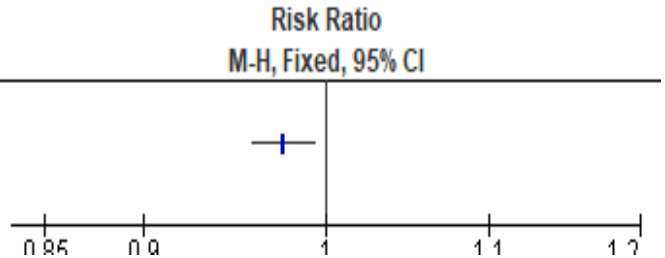
cRCT: Provider infrastructure interventions (audits, feedback), reminders and education and individual/parent/carer information and reminders vs control



(1) 11-18 years. HPV dose 1. Arm 3 (clinician and family intervention) vs control. Study authors adjusted data for clustering
(2) 11-18 years. HPV dose 2. Arm 3 (clinician and family intervention) vs control. Study authors adjusted data for clustering
(3) 11-18 years. HPV dose 3. Arm 3 (clinician and family intervention) vs control. Study authors adjusted data for clustering

cRCT: Provider infrastructure interventions (financial incentives) and individual/parent/carer information and reminders vs control

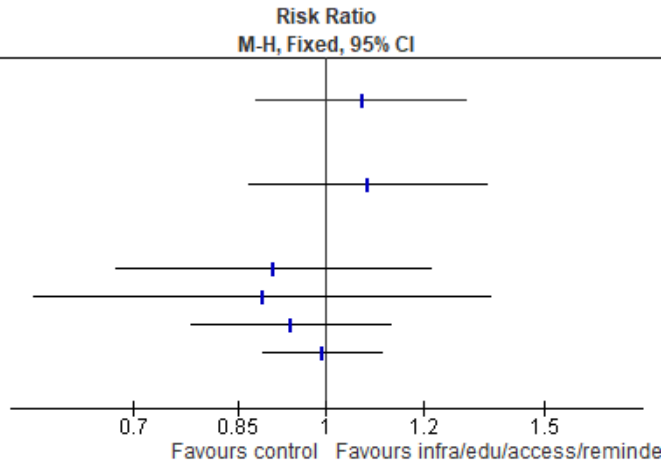
Study or Subgroup	Infra/info/reminders Events	Total	Control Events	Total	Risk Ratio M-H, Fixed, 95% CI
9.1.1 Provider financial incentives, individual, parent or carer information and reminders					
Goodyear-Smith 2012 (1)	536	555	466	471	0.98 [0.96, 0.99]



(1) 0-5 years. 6-week childhood vaccination given by 8 weeks. Data adjusted for this review using an ICC of 0.05

cRCT: Provider infrastructure, reminders and education interventions and individual/parent/carer access, education and reminders interventions vs control (no pooling as interventions are very different to each other)

Study or Subgroup	Infra/edu/access/reminder Events	Total	Control Events	Total	Risk Ratio M-H, Fixed, 95% CI
10.1.1 Provider immunisation education, reminders and incentives, individual home visits, education and reminders					
Hambidge 2004 (1)	53	70	56	79	1.07 [0.88, 1.30]
10.1.2 Provider well child visit education, reminders and incentives, individual home visits, education and reminders					
Hambidge 2004 (2)	29	38	65	92	1.08 [0.87, 1.35]
10.1.3 Provider immunisation champions and feedback, individual access, education and reminders					
Zimmerman 2017 (3)	28	45	37	54	0.91 [0.68, 1.21]
Zimmerman 2017 (4)	20	45	27	54	0.89 [0.58, 1.36]
Zimmerman 2017b (5)	47	61	46	56	0.94 [0.78, 1.13]
Zimmerman 2017b (6)	142	183	146	187	0.99 [0.89, 1.11]



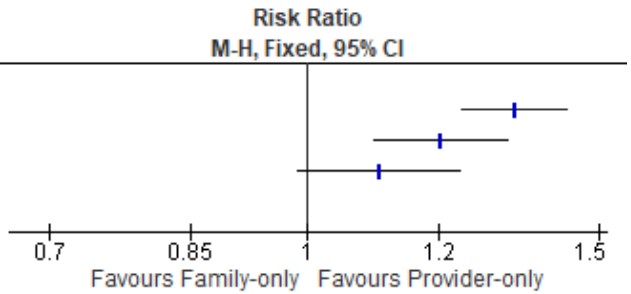
(1) 0-5 years. Immunisation arm. Up to date on childhood vaccines at 12 months of age. Data adjusted for this review using an ICC of 0.05
(2) 0-5 years. Well child visits arm. Up to date on childhood vaccines at 12 months of age. Data adjusted for this review using an ICC of 0.05
(3) 4 Pillars (11-18 years). HPV series initiation. Data adjusted for this review using an ICC of 0.2 (used by study authors for other statistical analysis)
(4) 4 Pillars (11-18 years). HPV series completion. Data adjusted for this review using an ICC of 0.2 (used by study authors for other statistical analysis)

(5) 4 Pillars (65 years and over). Pneumococcal vaccination at Houston sites. Separated from Pittsburgh sites due to differences in population groups. Data adjusted for this review using an ICC of 0.2 (used by study authors for other statistical analysis)
(6) 4 Pillars (65 years and over). Pneumococcal vaccination at Pittsburgh sites. Separated from Houston sites due to differences in population groups. Data adjusted for this review using an ICC of 0.2 (used by study authors for other statistical analysis)

Provider interventions vs individual/parent/carer interventions

cRCT: Provider infrastructure interventions (audits, feedback), reminders and education vs individual/parent/carer information and reminders

	Provider-only		Family-only		Risk Ratio
Study or Subgroup	Events	Total	Events	Total	M-H, Fixed, 95% CI
3.1.1 Provider education, alerts, audits and feedback vs Individual/parent/carer information and reminders					
Fiks 2013 (1)	1334	5557	1022	5680	1.33 [1.24, 1.43]
Fiks 2013 (2)	854	5557	725	5680	1.20 [1.10, 1.32]
Fiks 2013 (3)	572	5557	529	5680	1.11 [0.99, 1.24]

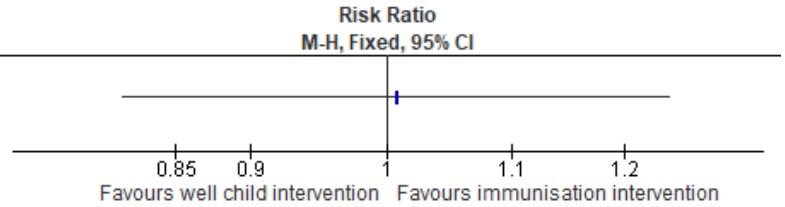


(1) 11-18 years. HPV dose 1. Arm 1 (clinician intervention) vs arm 2 (family intervention). Study authors adjusted for clustering
(2) 11-18 years. HPV dose 2. Arm 1 (clinician intervention) vs arm 2 (family intervention). Study authors adjusted for clustering
(3) 11-18 years. HPV dose 3. Arm 1 (clinician intervention) vs arm 2 (family intervention). Study authors adjusted for clustering

Provider and individual/parent/carer interventions vs other provider and individual/parent/carer interventions

cRCT: Provider immunisation specific intervention vs well child non-immunisation specific intervention (both with provider education, reminders, incentives and individual/ parent/ carer home visits, education and reminders)

Study or Subgroup	Immunisation intervention Events	Total	Well child intervention Events	Total	Risk Ratio M-H, Fixed, 95% CI
11.1.1 Provider immunisation education, reminders and incentives, individual home visits, education and reminders					
Hambidge 2004 (1)	67	88	31	41	1.01 [0.82, 1.24]



(1) 0-5 years. Up to date on childhood vaccines at 12 months of age. Data adjusted for this review using an ICC of 0.5

Appendix F – GRADE tables

Vaccine uptake outcome

Data from cluster RCTs has been adjusted by the study authors or GUT but the original sample size is retained.

Individual/parent/carer interventions vs control

Table 14 GRADE table for individual/parent/carer access, education and reminders vs 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
Individual/parent/carer home visits, education and reminders vs control (usual care) (RR >1 favours intervention)										
0-5 year olds										
1 (Barnes 1999)	RCT	155	RR 1.21 (0.90, 1.62)	49 per 100	59 per 100 (44, 79)	Not serious	Not serious	N/A[1]	Very serious[2]	Low

1. Single study. Inconsistency not applicable
2. 95% confidence intervals crossed the line of no effect and number of participants <200. Quality of the outcome downgraded twice for imprecision

Individual/parent/carer interventions vs other individual/parent/carer interventions

Table 15 GRADE table for individual/parent/carer interventions vs other individual/parent/carer 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
CLUSTER RCTs: Reminder letter with information and a separate clinic for vaccination versus education, obtaining consent and vaccinations at school access (RR >1 favours reminder plus information)										
11-18 years, HPV at least 1 dose										
1 (Desiante 2017)	Cluster RCT	5720	RR 0.83 (0.80, 0.86)	79 per 100	66 per 100 (63, 68)	Serious[3]	Not serious	N/A[1]	Not serious[2]	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
11-18 years, HPV at least 2 doses										
1 (Desiante 2017)	Cluster RCT	5720	RR 0.77 (0.74, 0.80)	72 per 100	56 per 100 (53, 58)	Serious[3]	Not serious	N/A[1]	Not serious[2]	Moderate

1. Single study. Inconsistency not applicable
2. 95% confidence intervals crossed the line of no effect. Quality of the outcome downgraded once for imprecision
3. Single study with some concerns about risk of bias. Quality of the outcome downgraded twice

Provider interventions vs control

Provider infrastructure interventions (audits, feedback), reminders and education vs control

Table 16 GRADE table for provider infrastructure interventions (audits, feedback), reminders and education vs 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
Provider education, alerts, audits and feedback vs control (usual care)[3]										
11-18 year olds – HPV dose 1										
1 (Fiks 2013)	cRCT	11245	RR 1.50 (1.39, 1.62)	16 per 100	24 per 100 (22, 26)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
11-18 year olds – HPV dose 2										
1 (Fiks 2013)	cRCT	11245	RR 1.48 (1.34, 1.63)	10 per 100	15 per 100 (14, 17)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
11-18 year olds – HPV dose 3										
1 (Fiks 2013)	cRCT	11245	RR 1.57 (1.39, 1.78)	7 per 100	10 per 100 (9, 12)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
Provider education, alerts, audits and feedback and individual/parent/carer information and reminders vs Individual/parent/carer information and reminders[4]										
11-18 year olds – HPV dose 1										

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 (Fiks 2013)	cRCT	11241	RR 1.39 (1.29, 1.49)	18 per 100	25 per 100 (23, 27)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
11-18 year olds – HPV dose 2										
1 (Fiks 2013)	cRCT	11241	RR 1.43 (1.31, 1.56)	13 per 100	18 per 100 (17, 20)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
11-18 year olds – HPV dose 3										
1 (Fiks 2013)	cRCT	11241	RR 1.49 (1.34, 1.65)	9 per 100	14 per 100 (12, 15)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
1. Single study with some concerns over risk of bias. Quality of the outcome downgraded once for risk of bias 2. Single study. Inconsistency not applicable 3. Comparison between clinician intervention arm (arm 1) and control 4. Comparison between clinician and family intervention arm (arm 3) and family intervention arm (arm 2). Family intervention is in both arms and so arm 2 serves as control. The comparison therefore demonstrates the effects of the clinician intervention.										

Provider infrastructure interventions (standing orders), vaccination champions and education vs control

Table 17 GRADE table for provider infrastructure interventions (standing orders), vaccination champions and education vs 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
Provider education, standing orders and vaccination champions vs control										
Pregnant women										
1 (O'Leary 2019)	cRCT	496	RR 0.98 (0.83, 1.16)	52 per 100	51 per 100 (43, 60)	Serious[1]	Not serious	N/A[2]	Serious[3]	Low
1. Single study with some concerns over risk of bias. Quality of the outcome downgraded once for risk of bias 2. Single study. Inconsistency not applicable 3. 95% confidence intervals crossed the line of no effect. Quality of the outcome downgraded once for imprecision										

Provider interventions and individual/parent/carer interventions vs control

Provider education and individual/parent/carer education and reminders vs control

Table 18 GRADE table for provider education and individual/parent/carer education and reminders vs 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
Provider education and individual/parent/carer education and reminders vs control (RR >1 favours intervention)										
11-18 year olds – HPV vaccine within 3 months of intervention										
1 (Paskett 2016)	cRCT	176	RR 2.34 (0.47, 11.72)	2 per 100	6 per 100 (1, 28)	Very serious[1]	Not serious	N/A[2]	Very serious[3]	Very low
11-18 year olds – HPV vaccine within 6 months of intervention										
1 (Paskett 2016)	cRCT	176	RR 2.10 (0.67, 6.57)	5 per 100	10 per 100 (3, 31)	Very serious[1]	Not serious	N/A[2]	Very serious[3]	Very low
1. Single study at high risk of bias. Quality of the outcome downgraded twice for risk of bias 2. Single study. Inconsistency not applicable 3. 95% confidence intervals crossed the line of no effect and number of participants <200. Quality of the outcome downgraded twice for imprecision										

Provider infrastructure interventions (audits, feedback), reminders and education and individual/parent/carer information and reminders vs control

Table 19 GRADE table for provider infrastructure interventions (audits, feedback), reminders and education and individual/parent/carer information and reminders vs 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
Provider audits, alerts, education and feedback and individual/parent/carer information and reminders vs control (RR >1 favours intervention)[3]										
11-18 year olds – HPV dose 1										
1 (Fiks 2013)	cRCT	11249	RR 1.56 (1.45, 1.68)	16 per 100	25 per 100 (23, 27)	Serious[1]	Not serious	N/A[2]	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
11-18 year olds – HPV dose 2										
1 (Fiks 2013)	cRCT	11249	RR 1.75 (1.60, 1.93)	10 per 100	18 per 100 (17, 20)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
11-18 year olds – HPV dose 2										
1 (Fiks 2013)	cRCT	11249	RR 2.11 (1.88, 2.38)	7 per 100	14 per 100 (12, 16)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
1. Single study with some concerns over risk of bias. Quality of the outcome downgraded once for risk of bias 2. Single study. Inconsistency not applicable 3. Comparison between clinician and family intervention (arm 3) and control										

Provider infrastructure interventions (financial incentives) and individual/parent/carer information and reminders vs control

Table 20 GRADE table for provider financial incentives and individual/parent/carer information and reminders vs 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
Provider financial incentives and individual/parent/carer information and reminders vs control (RR >1 favours intervention)										
0-5 year olds										
1 (Goodyear-Smith 2012)	cRCT	1026	RR 0.98 (0.96, 0.99)	99 per 100	97 per 100 (95, 98)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
1. Single study with some concerns over risk of bias. Quality of the outcome downgraded once for risk of bias 2. Single study. Inconsistency not applicable										

Provider infrastructure, reminders and education interventions and individual/parent/carer access, education and reminders interventions vs control

Table 21 GRADE table for provider infrastructure, reminders and education interventions and individual/parent/carer access, education and reminders interventions vs 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
Provider education, reminders and incentives and individual/parent/carer home visits, education and reminders vs control (RR >1 favours intervention)										
0-5 year olds – Immunisation focused intervention										
1 (Hambidge 2004)	cRCT	149	RR 1.07 (0.88, 1.30)	71 per 100	76 per 100 (62, 92)	Not serious	Not serious	N/A[2]	Very serious[1]	Moderate
0-5 year olds – Well child visit focused interventions										
1 (Hambidge 2004)	cRCT	130	RR 1.08 (0.87, 1.35)	71 per 100	76 per 100 (61, 95)	Not serious	Not serious	N/A[2]	Very serious[1]	Moderate
Provider immunisation champions and feedback and individual/parent/carer access, education and reminders vs control (RR >1 favours intervention)[4]										
11-18 years. HPV series initiation										
1 (Zimmerman 2017)	cRCT	99	RR 0.91 (0.68, 1.21)	69 per 100	62 per 100 (47, 83)	Very serious[3]	Not serious	N/A[2]	Very serious[1]	Very low
11-18 years. HPV series completion										
1 (Zimmerman 2017)	cRCT	99	RR 0.89 (0.58, 1.36)	50 per 100	45 per 100 (29, 68)	Very serious[3]	Not serious	N/A[2]	Very serious[1]	Very low
65 years and over. Pneumococcal vaccination at Houston sites										
1 (Zimmerman 2017b)	cRCT	117	RR 0.94 (0.78, 1.13)	82 per 100	77 per 100 (64, 93)	Very serious[3]	Not serious	N/A[2]	Very serious[1]	Very low
65 years and over. Pneumococcal vaccination at Pittsburgh sites										
1 (Zimmerman 2017b)	cRCT	370	RR 0.99 (0.89, 1.11)	78 per 100	77 per 100 (69, 87)	Very serious[3]	Not serious	N/A[2]	Serious[5]	Very low

1. 95% confidence intervals crossed the line of no effect and number of participants <200. Quality of the outcome downgraded twice for imprecision
2. Single study. Inconsistency not applicable
3. Single study at high risk of bias. Quality of the outcome downgraded twice for 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
4. 4 Pillars intervention 5. 95% confidence intervals crossed the line of no effect. Quality of the outcome downgraded once for imprecision										

Provider interventions vs individual/parent/carer interventions

Provider infrastructure interventions (audits, feedback), reminders and education vs individual/parent/carer information and reminders

Table 22 GRADE table for provider infrastructure interventions, reminders and education vs individual/parent/carer information and reminders

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: intervention 2	Absolute risk: intervention 1 (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Provider education, alerts, audits, and feedback vs individual/parent/carer information and reminders (RR >1 favours provider intervention)[4]										
11-18 year olds – HPV dose 1										
1 (Fiks 2013)	cRCT	11237	RR 1.33 (1.24, 1.43)	18 per 100	24 per 100 (22, 26)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
11-18 year olds – HPV dose 2										
1 (Fiks 2013)	cRCT	11237	RR 1.20 (1.10, 1.32)	13 per 100	15 per 100 (14, 17)	Serious[1]	Not serious	N/A[2]	Not serious	Moderate
11-18 year olds – HPV dose 2										
1 (Fiks 2013)	cRCT	11237	RR 1.11 (0.99, 1.24)	9 per 100	10 per 100 (9, 12)	Serious[1]	Not serious	N/A[2]	Serious[3]	Low
1. Single study with some concerns over risk of bias. Quality of the outcome downgraded once for risk of bias 2. Single study. Inconsistency not applicable 3. 95% confidence intervals crossed the line of no effect. Quality of the outcome downgraded once for imprecision 4. Comparison between clinician intervention (arm 1) and family intervention (arm 2)										

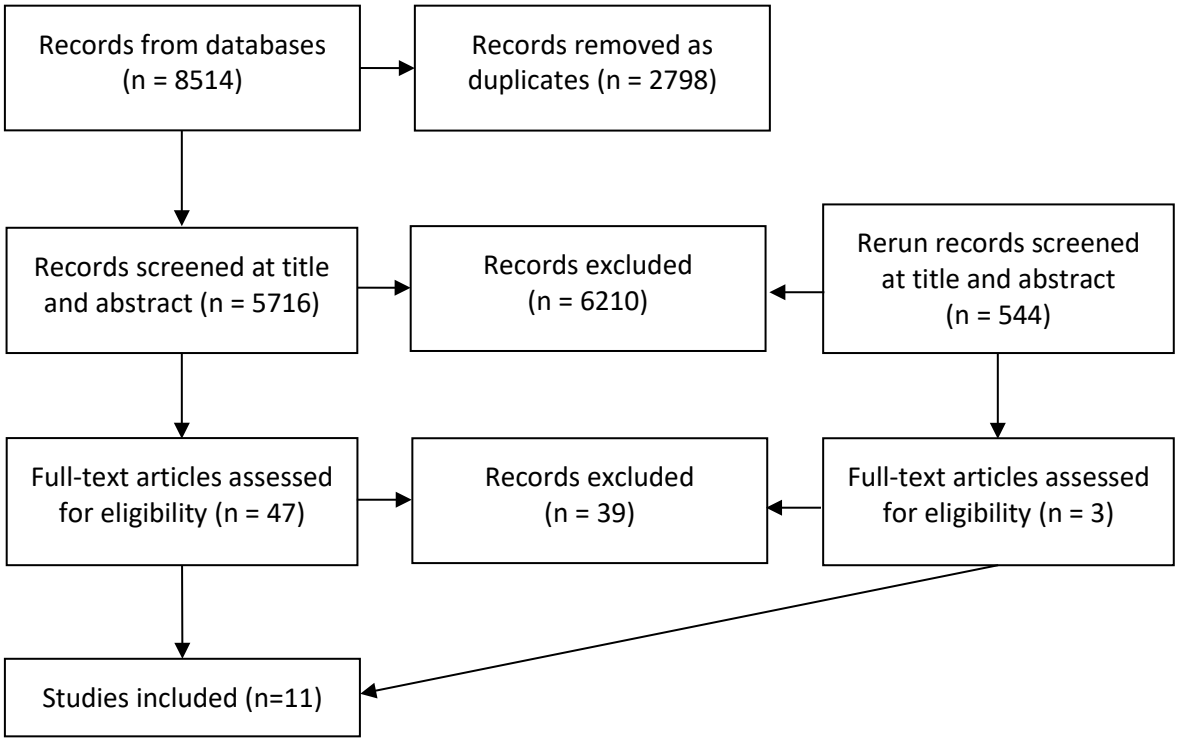
Provider and individual/parent/carer interventions vs other provider and individual/parent/carer interventions

Provider immunisation specific intervention vs well child non-immunisation specific intervention (both with provider education, reminders, incentives and individual/ parent/ carer home visits, education and reminders)

Table 23 GRADE table for provider immunisation specific intervention vs well child non-immunisation specific intervention (both with provider education, reminders, incentives and individual/ parent/ carer home visits, education and reminders)

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
Provider immunisation education, reminders and incentives and individual/parent/carer immunisation education and reminders vs provider well child visit education, reminders and incentives and individual/parent/carer well child visit education and reminders (RR >1 favours immunisation intervention)										
0-5 year olds – Up to date on childhood vaccines at 12 months of age										
1 (Hambidge 2004)	cRCT	129	RR 1.01 (0.82, 1.24)	76 per 100	76 per 100 (62, 94)	Not serious	Not serious	N/A[1]	Serious[2]	Moderate
1. Single study. Inconsistency not applicable 2. 95% confidence intervals crossed the line of no effect. Quality of the outcome downgraded once for imprecision										

Appendix G – Economic evidence study selection



Appendix H – Economic evidence tables

Appendix H1 – Evidence tables

Smith 2017

Study	Smith et al. (2017) Cost Effectiveness of the 4 Pillars™ Practice Transformation Program to Improve Vaccination of Adults Aged ≥65 years			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**
Economic analysis: Cost-utility analysis Study design: Decision analytic model Approach to analysis: A decision tree model was used to estimate the cost-effectiveness of the intervention. Identical hypothetical cohorts traversed the two modelled strategies. The sum of the baseline vaccine uptake and observed percentage point improvement was held constant over the 10-year model time horizon in the base-case analysis. To test robustness of the model all parameters were individually varied over their plausible ranges, and a probabilistic sensitivity analysis was carried out. Perspective: US societal perspective Time horizon: 10 years Discounting: 3% per year for costs and effectiveness	Population: Adults aged 65 years and older Intervention: The 4 Pillars program; a set of medical practice-based tools to improve: 1) the convenience of vaccination services, 2) communication with patients about the importance of immunization and the availability of vaccines, 3) office systems to facilitate immunization, and 4) motivation through an office immunization champion who monitors progress and encourages adherence to vaccination-promoting office practices. Comparator: No program	Cost difference: $1.60 (£1.24, 2021 GBP) Currency and cost year: USD, 2015 Costs included: Cost of vaccine and administration, cost of intervention, cost of illness	QALY difference: 0.0031	Incremental analysis: $512 per QALY gained (£398.13, 2021 GBP) Analysis of uncertainty: No individual parameter variation caused the intervention to cost >$20,000 per QALY gained. Variation of only 2 parameters caused the favoured strategy to change when lowering the threshold to $10,000/QALY gained: a) when the program-related absolute increase in influenza vaccination was below 0.9% (base case = 5%); or b) when influenza VE was less than 25.1% (base case = 59.0%). Results were insensitive to individual variation of all other parameters over their listed ranges. In a probabilistic sensitivity analysis, where all parameters were simultaneously varied, the 4 Pillars intervention was cost saving in 35.4% of model iterations and favoured in 98.6% at a $50,000/QALY gained, a

Study	Smith et al. (2017) Cost Effectiveness of the 4 Pillars™ Practice Transformation Program to Improve Vaccination of Adults Aged ≥65 years			
				commonly cited cost-effectiveness benchmark.
Data sources				
Outcomes: Vaccination rates for each vaccine are based on those observed in the trial and improvements in rates post intervention. Vaccine effectiveness (VE) was used to determine protection from illness, with illness risk calculated as the rate of illness for the ≥65-year-old population multiplied by 1 minus VE. The sum of the baseline vaccine uptake and observed percentage point improvement was held constant over the time horizon. Quality of life: US databases and medical literature data were used to inform quality of life parameters. Costs: Intervention costs were derived from an RCT using questionnaire data regarding personnel and material costs. US databases and medical literature were used for parameters describing vaccine costs and illness costs.				
Comments				
Source of funding: The investigation was supported by a grant (U01 IP000662) from the Centers for Disease Control and Prevention. The project was also supported by the National Institutes of Health through Grant Numbers UL1RR024153, UL1TR000005, and R01 AI116575.				
Overall applicability: Partially applicable				
The study was in a primary care setting in the US. A 3% discount rate was used, and it was unclear how the QALY outcomes had been derived. The results are not separated by which vaccine was used - influenza is not relevant for this guideline as there is existing guidance (NG103).				
Overall quality: Minor limitations				
There was a potential financial conflict of interest regarding research grants. It was unclear whether an SLR had been performed. It was assumed that the intervention had an independent effect on uptake of different vaccines, and this assumption was not tested in sensitivity analysis. Outcomes of being vaccinated against tetanus and diphtheria were not included due to the rarity of those diseases.				

Wateska 2018

Study	Wateska et al. (2018) Cost-effectiveness of increasing vaccination in high-risk adults aged 18–64 Years: a model-based decision analysis			
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 (0, 1, 2 or 3 vaccinations) and subsequent disease status of	Population: High risk adults aged 18-64 years. High-risk adults were defined as those with one or more comorbid or immunocompromising conditions, with comorbid	Cost difference: $17.88 (£13.90, 2021 GBP) (in the societal perspective 4 pillars was cost-saving [-$31.15 (-£24.22, 2021	QALY difference: 0.00063	Incremental analysis: $28,301 per QALY gained (£22,006.93, 2021 GBP) (From the societal perspective the intervention is dominant i.e. the intervention is more effective and less costly than no intervention)

Study	Wateska et al. (2018) Cost-effectiveness of increasing vaccination in high-risk adults aged 18–64 Years: a model-based decision analysis			
participants who either did or did not receive the 4 Pillars program. It was assumed that the probability of receiving one vaccine was independent of receiving the others. Perspective: US third-party payer perspective (a societal perspective was also included) Time horizon: 10 years Discounting: Unclear, discounting was mentioned but not explained in the study	conditions including: chronic heart, lung, or liver diseases, alcoholism, diabetes mellitus, or individuals who smoke cigarettes; immunocompromising conditions were: HIV disease, hematologic malignancies, dialysis, nephrotic syndrome, organ or bone marrow transplant, sickle cell disease, immune deficiency, or current immunosuppressive therapy. Intervention: The 4 Pillars program; a set of medical practice-based tools to improve: 1) the convenience of vaccination services, 2) communication with patients about the importance of immunization and the availability of vaccines, 3) office systems to facilitate immunization, and 4) motivation through an office immunization champion who monitors progress and encourages adherence to	GBP)] versus no program) Currency and cost year: USD, 2015 Costs included: Direct medical costs from illness outcomes, vaccinations, intervention program, cost of death, lost productivity from illness, disability, and death.		Analysis of uncertainty: When varying each parameter individually in 1-way sensitivity analysis over the plausible ranges, the intervention program remained favoured from both third party and societal perspectives when using a $100,000/QALY threshold, a commonly cited US benchmark for cost-effectiveness. At a $100,000/QALY gained threshold, the 4 Pillars Program was favoured in 83.3% of the model iterations from a third party perspective and in 96.2% of model iterations from a societal perspective. From a societal perspective, the program was cost saving and more effective than no program in 75.7% of model iterations.

Study	Wateska et al. (2018) Cost-effectiveness of increasing vaccination in high-risk adults aged 18–64 Years: a model-based decision analysis			
	vaccination-promoting office practices. Comparator: No program			

Data sources
Outcomes: The cohort of high-risk 18–64 year-olds not receiving the intervention was assigned baseline vaccination rates for high-risk 18–64 year olds from the trial, while an identical cohort receiving the intervention had absolute increases in vaccination uptake rates for this age and risk group from the end of the two-year trial. Ranges of vaccine coverage in both intervention and non-intervention cohorts came from uptake rates in different trial sites. As the original study did not collect illness rate data, illness attack rates for unvaccinated high-risk individuals 18–64 years of age were derived from the medical literature; whereas illness risk for vaccinated individuals was calculated as each illness's attack rate in the unvaccinated multiplied by 1 minus vaccine effectiveness. Quality of life: Vaccine-preventable illnesses occurring over the 10-year model time horizon had effectiveness modelled as lifetime per-person losses in QALYs due to those illnesses; disability and death resulted in QALY losses based on the discounted life expectancy of the cohort. Costs: Costs of the 4 Pillars Program were calculated based on questionnaire data completed by study sites on personnel time and materials costs during the program implementation and maintenance phases. All other costs were obtained from the medical literature and U.S. databases. All costs were inflated as necessary to 2015 US dollars using the Consumer Price Index.
Comments
Source of funding: Supported by a grant (U01 IP000662) from the Centers for Disease Control and Prevention.
Overall applicability: Partially applicable
The results are not separated by which vaccine was used - influenza is not relevant for this guideline as there is existing guidance (NG103). The study was in primary care in the US, and it was unclear how the QALY outcomes were derived and what the discount rate used was. This population would not routinely receive primary vaccinations but are relevant for a catch-up campaign.
Overall quality: Minor limitations
There was a potential financial conflict of interest regarding research grants. It was unclear whether an SLR had been performed. It was assumed that the intervention had an independent effect on uptake of different vaccines, and this assumption was not tested in sensitivity analysis. Outcomes of being vaccinated against tetanus and diphtheria were not included due to the rarity of those diseases. The parameter distributions used in the PSA were not detailed in the paper, so it is unclear whether these were assigned appropriately.

Wateska 2020

Study	Wateska at al. (2020) Cost-Effectiveness of Pneumococcal Vaccination Policies and Uptake Programs in US Older Populations			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**

Study	Wateska at al. (2020) Cost-Effectiveness of Pneumococcal Vaccination Policies and Uptake Programs in US Older Populations			
Economic analysis: Cost-utility analysis Study design: Decision analytic model Approach to analysis: Markov model, following the vaccine uptake and subsequent disease status of participants who either did or did not receive the vaccination strategy and/or the uptake intervention. Perspective: US healthcare perspective Time horizon: Lifetime Discounting: All future costs and benefits were discounted by 3%	Population: People aged 65 years and older Intervention: (2) Alternative policy (omitting age-based PCV13 use in immunocompetent older people) (3) Current policy + 4 pillars (4) Alternative policy + 4 pillars Comparator: (1) Current policy (PPSV23 use in all older people plus routine PCV13 for immunocompromised and potentially for immunocompetent based on shared decision making)	Cost difference: General population, assuming PPSV23 not effective vs NBP (4) vs (1) $151.85 (£119.34, 2021 GBP) (3) vs (2) $16.53 (£12.99, 2021 GBP) General population, assuming PPSV23 is effective vs NBP (4) vs (1) $142.08 (£111.66, 2021 GBP) (3) vs (2) $14.57 (£11.45, 2021 GBP) Currency and cost year: USD, 2014 Costs included: Intervention costs, vaccine costs, administration costs, disease costs, disability costs.	QALY difference: General population, assuming PPSV23 not effective vs NBP (4) vs (1) 0.00045 (3) vs (2) 0.00006 General population, assuming PPSV23 is effective vs NBP (4) vs (1) 0.00069 (3) vs (2) 0.00011	Incremental analysis: incremental cost per QALY gained: General population, assuming PPSV23 not effective vs NBP (4) vs (1) $337,444 (£265,204, 2021 GBP) (3) vs (2) $275,500 (£216,521, 2021 GBP) General population, assuming PPSV23 is effective vs NBP (4) vs (1) $205,913 (£161,831, 2021 GBP) (3) vs (2) $132,455 (£104,099, 2021 GBP) Analysis of uncertainty: All model parameters were varied individually in one-way sensitivity analyses, and varied simultaneously 1000 times across their respective ranges in probabilistic sensitivity analyses. Further analyses separately examined the effects of eliminating outpatient pneumonia as a disease outcome, due to the substantial uncertainty regarding outpatient pneumococcal pneumonia rates. An analysis was conducted in which a potentially influential parameter, hospitalized NBP risk, was modified to more closely reflect values used in a recent CDC economic analysis.

Study	Wateska at al. (2020) Cost-Effectiveness of Pneumococcal Vaccination Policies and Uptake Programs in US Older Populations			
				Model results were not sensitive to any of the individual one-way sensitivity analyses. In probabilistic analyses for the current strategy the uptake program was more likely to be cost-effective over no program at all WTP thresholds, and for the alternative strategy the uptake program was more likely to be cost-effective than no program at WTP thresholds of $240,000 and above.
Data sources				
Outcomes: Transitions between health states were informed by age and race specific NHIS data and life tables. Invasive pneumococcal disease data on yearly risk, mortality, disability and vaccine coverage was obtained from CDC active core bacterial surveillance data. Vaccine effectiveness was estimated using Delphi panel data and results from a randomized clinical trial in adults aged 65 years or older and detailed by vaccine type and time since vaccination Quality of life: Utility data were taken from previously published studies. Costs: Cost data were taken from previously published studies, CDC vaccine price lists and US department of Health data.				
Comments				
Source of funding: Supported by the National Institutes of Health (grant R01 AI11657503).				
Overall applicability: Partially applicable				
The study was in a US primary care setting. A 3% discount rate was used, and it was unclear how the QALY outcomes had been derived.				
Overall quality: Minor limitations				
There was a potential financial conflict of interest regarding research grants and consulting positions of the authors. It was unclear whether an SLR had been performed or how the data was selected.				

Deuson 2001

Study	Deuson et al (2001) Economic Analysis of a Child Vaccination Project Among Asian Americans in Philadelphia, Pa			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**

Study	Deuson et al (2001) Economic Analysis of a Child Vaccination Project Among Asian Americans in Philadelphia, Pa			
Economic analysis: Cost-effectiveness and cost-benefit analyses Study design: Decision analytic model Approach to analysis: Data from the study was used with assumptions and cost data to estimate cost-effectiveness ratios and the benefit-cost ratio of the intervention. A spreadsheet program (BENCOST) based on the work of Margolis et al. was used, consisting of a decision tree model following the outcomes of hepatitis B infection. Health benefits associated with vaccination were quantified in monetary terms, and the benefit-cost ratio calculated from the net present value of benefits and net present value of costs incurred. Perspective: Public health system Time horizon: Lifetime (cost per life-year saved was used, and benefit-cost over life expectancy of the population) Discounting: 3% discount rate for costs and benefits (5% also considered)	Population: Asian-American children aged 2-13 years Intervention: A multicomponent approach was used including education of parents, physician enrolment, home visits, patient reminder letters and offering vaccines in public clinics, health fairs and homes to increase uptake of hepatitis B vaccination Comparator: No catch-up efforts	Cost difference: $268,660 (£304,608 2021 GBP) 4,384 children were in the database used in the study – cost difference per child ~$61 (£69 2021 GBP) Currency and cost year: USD, 1995 Costs included: Intervention costs (design, education, outreach, vaccination)	Difference in outcomes: Coverage increase: 1 dose: 8.8% 2 doses: 4.7% 3 doses: 11.9% At least 1 dose: 25.4% Life years saved: 15% infection rate: 53 years 30% infection rate: 106 years 60% infection rate: 213 years	Incremental analysis: Benefit-cost ratio: 15% infection rate: 2.22 30% infection rate: 4.44 60% infection rate: 8.88 Cost per life year saved: 15% infection rate: $23,050 (£26,134 2021 GBP) 30% infection rate: $11,525 (£13,067 2021 GBP) 60% infection rate: $5,763 (£6,534 2021 GBP) Analysis of uncertainty: Sensitivity analyses were performed to explore the effect of assumptions for discount rate and infection rate on the estimates of cost per life year saved and benefit-cost ratios. Results were computed for all combinations of 3% and 5% discount rates and 15% increments in infection rate from 15% to 75%. The broad range of infection rates was to account for variability resulting from differences in baseline vaccination levels and risk levels within countries of origin, and different ages at immigration. Probabilistic sensitivity analyses were not considered.
Data sources				
Outcomes: Number of children vaccinated was taken directly from the study, and protection was estimated from vaccine seroprotection rates. It was unclear where the data on LYs saved was taken from. Quality of life: Quality of life was not included as an outcome				

Study	Deuson et al (2001) Economic Analysis of a Child Vaccination Project Among Asian Americans in Philadelphia, Pa
Costs: All cost data in the model came from the Bureau of Labor Statistics, the Bureau of the Census, the MEDSTAT Marketscan database, refereed publications, interviews of experts in the field, and Centers for Disease Control and Prevention data.	
Comments	
-	
Overall applicability: Partially applicable	
The study was a cost-effectiveness and cost-benefit analysis, using non-QALY outcomes. The study was conducted in a US public health system, and the population was assumed to have a very high infection rate. Discount rates of 3% and 5% were considered.	
Overall quality: Potentially serious limitations	
No probabilistic sensitivity analyses were conducted, and the other sensitivity analyses were limited to discount rate and infection rate. It was unclear whether some of the resource use estimates were from the best available source. Relative intervention effects were not the best quality, as these were taken from the before and after study.	

Appendix H2 – Study quality tables

Smith 2017

Study Identification: Smith 2017, Cost-Effectiveness of the 4 Pillars Practice Transformation Program to Improve Vaccination of Adults Aged 65 and Older.		
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	Adults aged 65+
1.2 Are the interventions appropriate for the review question?	Partly	4 Pillars Program - uptake of vaccines including pneumococcal, influenza and pertussis. The results are not separated by which vaccine was used - influenza is not relevant for this guideline as there is existing guidance (NG103)

Study Identification: Smith 2017, Cost-Effectiveness of the 4 Pillars Practice Transformation Program to Improve Vaccination of Adults Aged 65 and Older.		
1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	Partly	Primary care in the US
1.4 Is the perspective for costs appropriate for the review question?	Yes	Societal perspective in the base-case All costs were healthcare-related costs
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	Societal perspective in the base-case All outcomes were health-related
1.6 Are all future costs and outcomes discounted appropriately?	Partly	3% discount rate for costs and effects
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).	Unclear	QALYs were used as an outcome but it was unclear how they were derived
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	It is assumed that the intervention has independent effects on uptake of different vaccines - this was assumed to simplify the model but it has not been tested in sensitivity analyses and seems unrealistic.
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	10 year time horizon - no reason in the paper that this would not be sufficient
2.3 Are all important and relevant outcomes included?	Partly	The vaccine effectiveness of Tdap only considered pertussis prevention, due to the rarity of tetanus and diphtheria.
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	From the trial
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	From the trial

Study Identification: Smith 2017, Cost-Effectiveness of the 4 Pillars Practice Transformation Program to Improve Vaccination of Adults Aged 65 and Older.		
2.6 Are all important and relevant costs included?	Yes	Cost of intervention, vaccine, vaccine administration and costs of illness
2.7 Are the estimates of resource use from the best available source?	Partly	Unclear if there was an SLR, but US databases and medical literature were used
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?	Yes	Univariate and probabilistic sensitivity analyses were performed Beta distributions approximating the listed ranges were assigned to probabilities and utilities; gamma distributions were used for costs and time lost due to illness.
2.11 Has no potential financial conflict of interest been declared?	No	Potential conflicts of interest were research grants from Sanofi, Pfizer and Merck
2.12 Overall assessment: **Minor limitations**		

Wateska 2018

Study Identification: Wateska 2018, Cost-effectiveness of increasing vaccination in high-risk adults aged 18-64 Years: a model-based decision analysis.		
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	Adults aged 18-64 with comorbid/immunocompromising conditions are at

Study Identification: Wateska 2018, Cost-effectiveness of increasing vaccination in high-risk adults aged 18-64 Years: a model-based decision analysis.		
		higher risk of complications, and this population group is recommended to have vaccinations in the UK schedule. This population would be considered in a catch-up campaign scenario.
1.2 Are the interventions appropriate for the review question?	Partly	4 Pillars Program Increasing uptake of PPV, influenza and Tdap vaccines The results are not separated by which vaccine was used - influenza is not relevant for this guideline as there is existing guidance (NG103)
1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	Partly	Primary care in the US
1.4 Is the perspective for costs appropriate for the review question?	Partly	Third party payer and societal perspectives considered Costs include direct medical costs and lost productivity costs
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	Health-related outcomes were considered in the analysis
1.6 Are all future costs and outcomes discounted appropriately?	Unclear	Discounting was mentioned but it is unclear at what rate or how this was implemented
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).	Unclear	QALYs were used as an outcome but it was unclear how they were derived
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**

Study Identification: Wateska 2018, Cost-effectiveness of increasing vaccination in high-risk adults aged 18-64 Years: a model-based decision analysis.		
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Partly	Independence was assumed because there is no cross protection from one vaccine to another. It may be unrealistic in the real world for increase in uptake of different vaccines to be totally independent.
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	10 year time horizon is acceptable for older people but may be considered too short for younger people.
2.3 Are all important and relevant outcomes included?	Partly	Diphtheria and tetanus outcomes were not included in the analysis due to rarity of those diseases.
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	From the trial
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	From the trial
2.6 Are all important and relevant costs included?	Yes	The analysis included the costs of vaccines, administration, intervention, illness, death and lost productivity
2.7 Are the estimates of resource use from the best available source?	Partly	Unclear if there was an SLR, but US databases and medical literature were used
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?	Partly	Univariate and probabilistic sensitivity analyses were performed It was not mentioned which parameter distributions were used in PSA so the appropriateness is unclear
2.11 Has no potential financial conflict of interest been declared?	No	Potential conflicts of interest were research grants from Sanofi, Pfizer, MedImmune and Merck
2.12 Overall assessment: **Minor limitations**		

Wateska 2020

Study Identification: Wateska 2020, Cost-Effectiveness of Pneumococcal Vaccination Policies and Uptake Programs in US Older Populations.		
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	Adults aged 65 years and over
1.2 Are the interventions appropriate for the review question?	Yes	One of the interventions was the 4 pillars programme which is an appropriate/relevant intervention for the review question
1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	Partly	Primary care in the US
1.4 Is the perspective for costs appropriate for the review question?	Yes	Healthcare perspective
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	Healthcare perspective
1.6 Are all future costs and outcomes discounted appropriately?	Partly	Costs and outcomes discounted by 3% annually
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).	Partly	QALYs were used but it was unclear what method was used to derive them.
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	Markov model, estimated ICER from QALYs and costs associated with uptake program, vaccination, disease outcomes.

Study Identification: Wateska 2020, Cost-Effectiveness of Pneumococcal Vaccination Policies and Uptake Programs in US Older Populations.		
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	Cases prevented, deaths prevented, QALYs
2.4 Are the estimates of baseline outcomes from the best available source?	Partly	Unclear how the data was chosen or whether there would be better sources - CDC Active Core Bacterial surveillance (ABCs) data and survey data
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	Data on increase in uptake with the 4 pillars intervention taken from the 4 pillars trial
2.6 Are all important and relevant costs included?	Yes	Vaccine acquisition and administration costs, 4 pillars program costs, AE costs, disease costs, death costs, disability costs, cost of hospitalisation.
2.7 Are the estimates of resource use from the best available source?	Yes	CDC ABC data
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?	Yes	All model parameters were varied individually in one-way sensitivity analysis, and simultaneously varied in PSA.
2.11 Has no potential financial conflict of interest been declared?	No	Dr Zimmerman has no current conflicts of interest but within 3 years had research grants from Sanofi Pasteur, Merck & Co, and Pfizer on unrelated topics. Drs Nowalk and Lin have an active research grant from Merck & Co on an unrelated topic and had research grants

Study Identification: Wateska 2020, Cost-Effectiveness of Pneumococcal Vaccination Policies and Uptake Programs in US Older Populations.		
		within 3 years from Pfizer and Sanofi Pasteur on unrelated topics that are no longer active. Dr Schaffner is a member of a data safety monitoring board (DSMB) for Pfizer, former member of a DSMB for Merck, and has served as a consultant to Roche Diagnostics. Dr Harrison has served as a consultant to GSK, Merck, Pfizer, and Sanofi Pasteur.
2.12 Overall assessment: **Minor limitations**		

Deuson 2001

Study Identification: Deuson et al (2001) Economic Analysis of a Child Vaccination Project Among Asian Americans in Philadelphia, Pa		
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	The infection rates assumed in the paper are between 15% and 75% which is quite high - this population is likely to only be applicable to similarly high risk UK populations
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?	Partly	US public health system
1.4 Is the perspective for costs appropriate for the review question?	Yes	Public health perspective on costs
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	
1.6 Are all future costs and outcomes discounted appropriately?	Partly	Discount rates of 3% and 5% were explored

Study Identification: Deuson et al (2001) Economic Analysis of a Child Vaccination Project Among Asian Americans in Philadelphia, Pa		
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	The study was a cost-effectiveness and cost-benefit analysis, using non-QALY outcomes
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	The spreadsheet program used in the analysis (based on the work of Margolis et al) was a decision tree following the disease trajectory of hepatitis B in patients who are and are not vaccinated, and the outcomes predicted were used in the benefit-cost analysis
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	A lifetime time horizon was used
2.3 Are all important and relevant outcomes included?	Partly	QALYs were not collected, but alternative effectiveness outcomes were included (number of doses given, LYs saved)
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	Baseline outcomes were taken from the population before the intervention was introduced
2.5 Are the estimates of relative intervention effects from the best available source?	Partly	Relative effects were taken from the study, comparative to the same cohort before the intervention was introduced - this was the best available source but is not the best quality as it is not an RCT.
2.6 Are all important and relevant costs included?	Yes	
2.7 Are the estimates of resource use from the best available source?	Partly	No SLR was mentioned but the resource use was taken from the study

Study Identification: Deuson et al (2001) Economic Analysis of a Child Vaccination Project Among Asian Americans in Philadelphia, Pa		
2.8 Are the unit costs of resources from the best available source?	Yes	The federal contract price was used for vaccine costs, and the other costs were informed by the literature
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	A stochastic risk analysis was undertaken in the cost estimates. Scenario analyses were conducted but these were limited given that no probabilistic sensitivity analyses were considered.
2.11 Has no potential financial conflict of interest been declared?	Unclear	No mention of conflicts
2.12 Overall assessment: **Potentially serious limitations**		

Appendix I – Health economic model

No economic modelling was undertaken 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 Community Engagement. Journal of community health 46(2): 343-348	- Education non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Reason for exclusion
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.*
de Cock, Caroline, van Velthoven, Michelle, Milne-Ives, Madison et al. (2020) Use of Apps to Promote Childhood	- Systematic review that did not include any additional relevant papers

Study	Reason for exclusion
Vaccination: Systematic Review. JMIR mHealth and uHealth 8(5): e17371	
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
Smith, Kenneth J, Nowalk, Mary Patricia, Lin, Chyongchiou J et al. (2017) Cost effectiveness of a practice-based intervention to improve vaccination rates in adults less than 65-years-old. Human vaccines & immunotherapeutics 13(10): 2207-2212	- Vaccine not routine in this age group in the UK
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	- Study did not consider increasing uptake

Study	Reason for exclusion
vaccination to prevent whooping cough cost-effective in Australia?. Human vaccines & immunotherapeutics 14(9): 2263-2273	
van Hoek, Albert Jan, Campbell, Helen, Amirthalingam, Gayatri et al. (2016) Cost-effectiveness and programmatic benefits of maternal vaccination against pertussis in England. The Journal of infection 73(1): 28-37	- Study did not consider increasing uptake
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
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	- Exclude - not a cost-effectiveness analysis
Spencer, Jennifer C, Brewer, Noel T, Trogdon, Justin G et al. (2020) Cost-effectiveness of Interventions to Increase HPV Vaccine Uptake. Pediatrics 146(6)	- Exclude - system was too different to the UK context