National Institute for Health and Care Excellence

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Draft for consultation

Vaccine uptake in the general population

[C] Evidence reviews for reminders interventions to increase the uptake of routine vaccines

NICE guideline <number>

Evidence review underpinning recommendations 1.1.1, 1.2.5, 1.2.12, 1.2.13, 1.3.1, 1.3.7-1.3.10, 1.3.13- 1.3.17, 1.3.19-1.3.22, 1.3.25, 1.3.29- 1.3.31 and 1.3.35 in the NICE guideline

November 2021

Draft for Consultation

These evidence reviews were developed by the Guideline Updates Team

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ISBN:

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1.1 Review question

What are the most effective reminders 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 professionals 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 Travellers and migrants) have lower levels of vaccination than the general public and additional or different actions may be required to increase their vaccination rates.

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

1.1.2 Summary of the protocol for reminders interventions

Table 1 PICO table for reminders 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	Interventions including, but not confined to: Vaccination reminders aimed at individuals including:

	• 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
	
	Vaccination reminders aimed at providers including:
	
	• Reminder and recall systems (aimed at provider)
	  • clinical alerts and prompts
	  • national alerts to local teams
	  • local recall initiatives

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

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

1.1.3 Methods and process

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

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

The following additional methods apply 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. Table 2 in the multicomponent review (evidence review H) summarises where these studies have been analysed.
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 required, it 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 be 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. Interrupted time series and before and after studies were also analysed separately by study type.
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.

Qualitative evidence

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

Reminders review specific methods:

1. For this review the term 'reminders' is used to include both the initial call/ invitation to be vaccinated when a vaccination is due and the reminder/ recall contact when a vaccination is overdue unless the text states otherwise. Reminders could be delivered by telephone, letter, postcard, text message, automatic electronic telephone calls (autodialer), or within a secure online patient portal system. Reminders could also be delivered in person. For example, a care provider giving a face-to-face reminder during a home visit or a clinic visit. The reminders could vary with regards to the type, number and be combined with other types of reminders interventions (for example, letter and phone reminders). The reminders could include an invitation to schedule a vaccination appointment.
2. Studies of intervention versus control were included if the controls were the following:
    - No reminder intervention
    - Usual practice. Studies did not need to specify what was normal care was. Ideally, they would say that this did not include reminders. Studies were downgraded for risk of bias if they said the control arm could include reminders in some clinics.
    - A control intervention such as general text on a non-vaccine related topic for a text message reminder intervention or a control non- vaccine related letter for a letter reminder.
    - Part of the interventions cancelled each other out (such as 2 arms including education, or an active control such as reminders about another vaccination).
3. For this review, the committee agreed that there were sufficient RCTs and cluster RCTs such that we did not need to include other study types.
4. The Jacobson Van 2018 Cochrane review used as part of the review of reminder interventions for individuals, parents (or carers) used the Cochrane Risk of Bias tool version 1 for assessing risk of bias. This guideline uses the Cochrane Risk of bias tool 2. There may be discrepancies because of the differences between tools, but these have been kept to a minimum as much as possible during the judgment of overall risk of bias stage which was carried out in both cases by the GUT.
5. Data was retained from the Cochrane review without editing unless specified. For Chao 2015, the data was re-extracted to limit it to 9-17 year olds and exclude 18-26 year olds.
6. In the Cochrane review, study risk of bias was judged to be low, some concerns, or high. Our equivalent rating system is low, moderate, or high.
7. In this evidence review, data from cluster RCTs has not been pooled and has been analysed separately from other RCTs. This methodology is consistent with the Cochrane review on reminders that is included in this evidence review (Jacobson Vann 2018). This is the reason they give for presenting data of cluster RCTs separately: "While studies of health practice interventions, such as reminder or recall, can minimize contamination by randomizing at the practice level rather than the individual level, and many of these studies did that, reminder or recall of vaccines cannot avoid the effect on household members who may undergo vaccination as a result. That behaviour may affect the measured outcomes of the study, but our meta-analysis could not control or adjust for

this effect on household members." The committee agreed with this conservative approach.

8. In some cases, studies reported adjusted odds ratios and did not provide the information to allow conversion to a RR to enable calculation of the absolute risk. These studies are marked in the GRADE table by the absence of an absolute risk.
9. The pregnancy review includes studies on reminders that are specific to pregnancy and includes a wider range of study types. Those reminder studies involving pregnant women that are not RCT or cluster RCT are not included in this review.
10. A mixed methods summary was made which combined the main reminder-related findings from the qualitative barriers and facilitators review (evidence review B) with the relevant quantitative results from this review. Findings relating to reminders were identified from review B and the ones that were considered to be most important were summarised in section 1.1.6. These findings spanned the age groups and life stages and were further summarised to produce a diagram with key barriers and facilitators to vaccine uptake that related to reminders. Where possible links were made between barriers and corresponding facilitators that had been raised in the findings themselves or that were logically linked. So, for example, if a barrier concerned certain types of reminders not being accessible for a certain population and there was quantitative evidence from a study comparing different types of reminders then the results of this study were summarised and placed in a box linked to the relevant barrier or facilitator. At this point the quantitative evidence was mapped onto the qualitative evidence. If a study could not be linked to a barrier or facilitator then it was shown in separate box at the side of the diagram.

1.1.4 Effectiveness evidence

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

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

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

Of the SRs that met the inclusion criteria all but 4 were subsequently excluded (see methods for more details of this process; the numbers above have taken this process into account and only include the 4 SRs). The 4 SRs were sufficiently well matched to a particular review question to be included as directly applicable evidence and were judged to be high-quality (following a ROBIS quality assessment). One of the 4 SRs was specifically relevant to this review question (Jacobson Vann 2018).

Of the included primary studies, 67 met the criteria for inclusion in the reminders review. Since 59 RCTs and cRCTs met the criteria for inclusion in the reminders review the decision was made to limit this reviews to RCT and cRCT study designs only. All non-RCT or non-cluster RCTs that looked at reminder interventions were therefore excluded even if they met the review inclusion criteria otherwise.

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 59 included studies.

The Jacobson Vann (2018) SR was used as a source of references and data and contained 28 of the 59 reminder RCTs and cRCTs.

1.4.1 Included studies

Fifty-three studies targeted individuals, parents or carers, and/or healthcare providers. They were a mix of RCTs and cRCTs. They looked at reminder interventions versus controls (usual practice) or reminder interventions (alone or in combination) compared to other interventions to increase vaccine uptake.

The studies were as follows:

- Forty-two studies (37 RCTs and 5 cluster RCTs) looked at reminder interventions aimed at individuals, parents or carers compared to control. These studies looked at: postcards, reminder letters, reminders by telephone, autodialer, text or electronic message, classroom recall, home visits, customised reminders, non-customised reminders, or combinations of these.
- Thirteen studies (10 RCTs and 3 cluster RCTs) looked at reminder interventions aimed at individuals, parents/ carers compared to other reminder interventions. These studies looked at comparing a health belief worded postcard to a neutrally worded postcard, customised reminders to non-customised reminders, texts plus an appointment scheduling reminder to texts only, motivational text messages to self-regulatory text messages, outreach to autodialer reminders, autodialer reminders plus outreach to autodialer reminders, letter reminders to autodialer, 3 autodialer reminders to 1 autodialer reminder, autodialer plus letters to autodialer, reminders by autodialer and mail to reminders by mail, centrally organised reminders by mail or autodialer and mail to primary care practice webinar training on vaccination reminders, phone to letter, phone to letter and phone, letter to letter and phone, postcard to letter, and text message to calendar reminders.
- One cluster RCT looked at interventions aimed at individuals, parents/ carers compared to non-reminder interventions. This study looked at comparing reminder letters with information plus vaccinations at immunisation centres to education and vaccinations at school.
- Two studies (1 RCT and 1 cluster RCT) looked at reminder interventions aimed at individuals, parents/ carers compared to those aimed at providers to increase vaccine uptake. One study looked at comparing patient reminders (by mail) to provider reminders (by phone calls to health visitors), and the other compared patient reminders (tracking and outreach) to a provider reminder.
- Thirteen studies (9 RCTs and 4 cluster RCTs) looked at reminder interventions aimed at providers to increase vaccine uptake. These studies looked at comparing hospital staff reminders to GP reminders, letter reminders to GPs to control, nurses assessing patients and reminding physicians to control, electronic medical record reminders to control, electronic reminders to control, computer or paper reminders to control, provider identification and reminders to control, physician reminders to automatic vaccine orders, and hospital staff reminders versus GP reminders.

Note: The numbers of studies listed above is greater than the includes study numbers because there were nineteen 3-arm studies, eight 5-arm studies, and one 5-arm study.

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

1.1.4.2 Excluded studies

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

1.1.5 Summary of studies included in the effectiveness evidence

Reminder interventions

Systematic review

Short Title	Population	Interventions and comparators	Relevant outcomes
Jacobson Vann 2018	• 70 RCTs (including 15 cluster RCTs), 5 controlled before and after (CBA) studies[1]. [Our review included 28 of the RCTs and cluster RCTs.][4] • The databases were searched from their inception to January 2017. • Participants included children, from birth to 18 years, or adults who receive immunizations in any setting, including academic or non-academic, and developed or developing countries[2]. They excluded studies of patients who were hospitalized for the study duration. • Vaccinations included the flu vaccination[3]	• Patient reminder or recall interventions or both, that reminded patients of upcoming immunizations or immunization visits that were due (reminders) or overdue (recall). • Reminder and recall systems could be delivered by telephone, letter, postcard, text message, automatic electronic telephone calls (autodialer), within a secure online patient portal system, or in person (but not during a clinic visit). •Control activities were no-intervention control groups, standard practice activities that did not include immunization-focused patient reminder or recall interventions, media-based activities aimed at promoting immunizations, and simple practice-based immunization awareness campaigns.	• Receipt of immunizations for individual vaccinations or combinations of vaccinations.

1. Data not extracted for CBAs for this review as there were a large number of RCTs.
2. Studies looking at non-OECD countries were excluded as not within the scope of this review.
3. Studies looking specifically at flu vaccination were excluded and data on flu vaccination was not extracted from included studies that looked at several vaccines because flu vaccination is out of scope of the guideline.
4. The included studies are listed in the detailed evidence table for this Cochrane review in appendix D.

1 ***Primary studies***

2 **Table 2 Summary of the characteristics of the primary studies of reminder interventions aimed at individuals, parents or carers**
3 **(including those that were reported in the systematic review).**

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Alto 1994	USA	446	RCT	Family practice residency clinic	Children older than 2 months, but less than 7 years	Postcard reminder to parents, indicating types of immunizations needed by child and urging parents to make appointment and phone calls to parents of unimmunized children 6 weeks after postcard intervention	No special contact	General childhood vaccines	Vaccine uptake
Bjornson 1999	Canada	614	RCT	Paediatric clinics	Children up to 18 months	Postcard reminders to parents that their child's immunization was due soon, and requesting that they make arrangements with their usual immunisation provider to receive this service.	No reminder	General childhood vaccines	Vaccine uptake
Campbell 1994	USA	288	RCT	Paediatric continuity clinic in teaching hospital in Rochester, New York	Infants from birth to 7 months	**Intervention 1**: Letter reminding parents of an appointment with age specific interventions. **Intervention 2**: postcard reminder of appointment.	No reminder or postcard	DTP (Diphtheria, tetanus, pertussis)	Vaccine uptake
CDC 2012	USA	878	RCT	Montana Medicaid programme and Montana Department of public health and human services	Children 19-23 months old	One state-generated reminder letter about missed vaccinations (vaccinations not specified)	No letter	General childhood vaccines	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Chao 2015	USA	12,205 [6,981 9-17 year olds]	RCT	Kaiser Permanente Southern California Health Plan	9-26 year old females[3]	Customised reminder letter in English or Spanish sent to parents of 9-11 year olds and patients if 12-26 years old.	Usual care in individual clinical practices (no details provided)	HPV (Human papillomavirus) (2nd dose)	Vaccine uptake
Coley 2018	USA	162452	RCT	Community - addresses in New York State area (excluding New York city)	11 to 13 year olds	Reminder letter informing parents to talk to their child's provider about HPV vaccines and the CDC's HPV Vaccine for Preteens and Teens information sheet.	Control letter- no details given.	HPV	Vaccine uptake
Daley 2002	USA	1,234	RCT	Primary care clinic of The Children's Hospital, Denver.	Children aged 6 weeks to 22 months	Letter (English or Spanish) and phone call from vaccine registry giving information about PCV and encouraging parents to make appointments. Clinic trainees instructed in dosing schedule and indications for PCV.	No intervention (clinic did not routinely contact people to remind them)	PVC (Pneumococcal conjugate)	Vaccine uptake
Daley 2004[10]	USA	420	RCT	Pediatric primary care clinic of inner-city teaching hospital, Denver, Colorado	Children aged 5 to 17 months	Postcard reminder with phone call if not seen or scheduled to be seen at clinic	Standard care (including quality improvement initiative, chart prompts, and provider reminders)	General childhood vaccines	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Dini 2000	USA	1,227 enrolled	cRCT	Public health clinics in Denver metropolitan area	Babies aged 60-90 days	**Intervention 1**: computerised phone messages (autodialer), then letters before immunisation date. **Intervention 2:** autodialer only **Intervention 3**: letters only	No notification	Vaccinations due up to 24 months of age	Vaccine uptake
Dombkowski 2014	USA	12,762 enrolled	RCT	Local health departments in greater Detroit area,	Children aged 7-19 months	**Intervention 1**: Letter sent to parents of children not up to date at 7 months (specific vaccines listed) **Intervention 2**: Letter sent to parents of all children at 12 months for vaccines due after 1st birthday (regardless of vaccination status) **Intervention 3**: Letter sent to parents of children not up to date at 19 months	No letters (3 groups: 7 months, 12 months and 19 months)	Early childhood vaccines	Vaccine uptake
Ferson 1995	Australia	239	RCT	Primary schools in Eastern Sydney	5-6 year olds	**Intervention 1**: Telephone call, letter and leaflet to parents. **Intervention 2**: Letter and leaflet	No control group	Measles, mumps and DTP	Vaccine uptake
Frank 2004	Australia	5418	RCT	General practices	Children aged 1 year, 10-16 years and people aged over 65 years	Automatic electronic record preventative care reminder system	No electronic reminder	Pneumonia and MMR (Measles, mumps and rubella) vaccines	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Franzini 2000	USA	2086	cRCT	Private paediatric practices	Children aged 1 year old or less	**Intervention 1**: Postcard delivered through the US mail with reminder of the data of their return appointments. **Intervention 2**:Automated phone call (autodialer)	No control group	Diphtheria, tetanus and pertussis vaccine	Vaccine uptake
Hambidge 2009	USA	811	RCT	Denver Health Medical Centre and 3 of its affiliated community health centres	Infants from birth to 15 months of age	Stepped intervention of case management or patient navigators, telephone reminders, telephone and postcard recall, and home visitation.	Not specified	All needed childhood immunisations at 15 months of age	Vaccine uptake
Hawe 1998	Australia	11982	RCT	Geographical area (provincial city in Australia)	Children aged 15 months and living in area	**Intervention 1**: Health belief model reminder postcard for vaccination **Intervention 2**: A reminder card that had neutral wording	No control group	Measles	Vaccine uptake
Hess 2013	USA	11982	cRCT	Pharmacies	People aged 60 years or over	Manual phone calls: two phone scripts to educate about risk of developing shingles	No phone calls	Shingles	Vaccine uptake
Hoekstra 1999	USA	565	RCT	Geographical area (Chicago)	Infants aged 6 months	Manual phone calls by bilingual clerk involving reminder to parents about upcoming and missed immunisations and voucher incentive.	Voucher incentive only	Not specified.	Vaccine uptake
Hofstetter 2015	USA	2054	RCT	4 paediatric practices in an ambulatory care network	Infants aged 9.5 – 10.5 months	**Intervention 1**: scheduling plus appointment text message reminders arm, routine automated phone appointment reminder.	No control group	MMR	Vaccine uptake, offers of vaccination

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
						Intervention 2: appointment text message reminder-only arm, routine automated phone appointment reminder. **Intervention 3**: No text message reminders, routine automated phone appointment reminder.			
Hogg 1998	Canada	111[a]	RCT	A private medical centre	Children aged 5 years or younger	**Intervention 1:** Computer-generated customised reminder sent by post. **Intervention 2:** Non-customised reminder sent by post.	Usual care (no reminders)	MMR, Hib (Haemophilus influenzae type b), tetanus, influenza, MMR boosters, DPT ROPV[16]	Vaccine uptake
Hurley 2018	USA	678	RCT[11]	Geographical area (Denver)	Adults aged 19-64 and over 65 year olds, including those at high risk of disease	Automated phone calls (up to 2) followed by a postcard.	Usual care (no reminders)	Pneumonia	Vaccine uptake
Hurley 2019	USA	449	RCT[11]	Community practices	Adults aged 19-64 and over 65 year olds[15]	Automated phone calls (up to 2) followed by a postcard.	Usual care (no reminders)	Pneumonia, influenza[13] and Tdap (Tetanus, dipteria, pertussis)[14]	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Irigoyen 2000	USA	1,662	RCT	Community-based paediatric practices	Children aged 6 weeks to 15 months	**Intervention 1**: Bilingual postcards (English and Spanish) indicating need for vaccination and encouraging parent to make an appointment. Weekly postcards.[4] **Intervention 2:** limited reminders (up to 3 postcards)	No intervention	DTap	Vaccine uptake
Kempe 2001	USA	603	RCT	Urban children's hospital-based teaching clinic, Denver.	Children aged 5 to 17 months	**Intervention 1**: Postcard (indicating vaccinations needed and asking parents to call for an appointment) and attempts to call parents; provider prompts on child's chart. **Intervention 2**: Provider prompts only	No control group	All vaccines required by 7,12, and 19 months.	Vaccine uptake
Kempe 2012	USA	263	RCT	Schools	Boys aged 11 or 12 and enrolled in paediatric clinic	School recall (pass sent to student, phone call to classroom or a staff member of health centre walking into their classroom to escort them to the clinic.	No reminders	Meningococcus	Vaccine uptake
Kempe 2016	USA	929	cRCT	Paediatric practices	Adolescents aged 11 to 17 and had first dose of HPV	Parent's choice of up to 2 recall methods (text, e-mail, or automated telephone message).	No reminders or recalls	HPV	Vaccine uptake
Kempe 2015	USA	18235	cRCT	Community	Children aged 19 to 35 months	**Intervention 1:** Centrally organised reminders by autodialer and mail (2	Primary care practice webinar	General for age group	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
						telephone calls and 2 postcards). **Intervention 2:** Centrally organised reminders by mail (1 letter and 3 postcards).	training on vaccination reminders.		
Klassing 2018	USA	311 [71 over 65 year olds]	RCT	Pharmacies	People aged 18 years and older with asthma or COPD[15]	**Intervention 1:** phone reminder **Intervention 2:** letter reminder	No reminder	Pneumococcal and influenza[13]	Vaccine uptake
LeBaron 2004	USA	3,050	RCT	Atlanta, Georgia (used immunisation registry)	Children aged 1 to 14 months	**Intervention 1:** automated phone call (autodialer) and postcard (Spanish available) if contact by phone unsuccessful. **Intervention 2**: phone call from outreach worker, postcard if no phone and home visit if not vaccinated after 30 days. Repeated monthly until contact made.[5] **Intervention 3:** autodialer and outreach (as detailed above)	Standard practice (in some practices this included non-automated recall postcards).	Age appropriate vaccines	Vaccine uptake
Lieu 1997	USA	321	RCT	Kaiser Permanente, a group model health maintenance organization	Children who have reached 20 months old	Personalized letter and brochure in English and Spanish	No letter	MMR	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Lieu 1998	USA	648 (randomised participants only)	RCT	Non-profit group model HMO, Northern California	20 month old children	**Intervention 1**: automated phone message and letter 1 week later. **Intervention 2**: automated phone message (personalised to child with phone numbers for appointments, Spanish or English options) **Intervention 3**: letter only **Intervention 4**: letter then phone message one week later	No intervention (group not randomised)[6]	Any vaccination required by 24 month birthday	Vaccine uptake
Linkins 1994	USA	8,002	RCT	Counties and county health departments in urban and rural Georgia	Children less than 2 years old	Automated phone reminders; (general or specific messages) for 7 days until contact made; another call the next week if immunisation visit not made.	No intervention	Childhood vaccines	Vaccine uptake
Loo 2011	USA	3227	RCT	2 office locations within an urban academic medical centre.	People aged 65 years and older	**Intervention 1:** electronic medical record reminders with panel management (assisted patients and physicians in completing the targeted practice behaviours) **Intervention 2:** electronic medical record reminders without panel management	Existing electronic medical records without the new reminders.	Pneumonia and influenza[13]	Vaccine uptake
Menzies 2020	Australia	1594	RCT	General practices, immunisation clinics,	Children aged less than 16 months	**Intervention 1:** SMS text message reminders only.	No reminder	Not specified. Age	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
				Aboriginal Medical Services, Community Health Centre.		**Intervention 2:** Personalised calendar reminder only. **Intervention 3:** SMS text message and personalised calendar (both interventions).		appropriate vaccinations	
Morgan 1998	UK	451	RCT	County of South Glamorgan	Children aged 3 to 15 months who had not completed primary course of vaccination by 9 months	**Intervention 1:** a non-directive telephone call to the child's health visitor to confirm the child's personal details and immunisation status.[2] **Intervention 2:** a single mailed reminder to the child's parents together with a questionnaire about immunization status.	No reminder	Diphtheria, pertussis, tetanus, polio, and Haemophilus influenzae type b immunisation	Vaccine uptake
O'Leary 2015	USA	4,587	RCT	Urban-suburban private paediatric and safety-net practices in Colorado	11 to 17 year olds	Brief text messages with script sent to parents reminding that vaccination, check-up or both due. Reply options: request to have clinic call to book appointment, plan to call clinic or stop texts.	Usual care (no reminders)	HPV, MCV4 (Meningococcal Conjugate) and Tdap[19]	Vaccine uptake
Otsuka 2013	USA	2590	RCT	Primary care clinic	Aged 60 years and over and did not have herpes zoster vaccine recorded	**Intervention 1:** Electronic vaccination alert for patients with an active personal health record **Intervention 2:** Postal vaccination alert for patients without an active personal health record	**Control 1**: Standard care for patients with an active personal health record **Control 2:** Standard care for patients	Shingles	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
							without an active personal health record		
Rand 2015	USA	3,812	RCT	Managed care organization; 39 primary care practices.	11 to 16 year olds	Up to 4 text messages to parents, initial message allowed opt out, then first reminder text indicated adolescent due for HPV and asked parent to make an appointment.	Initial message with opt out, then different adolescent health topic message	HPV (first, second and third doses)[1]	Vaccine uptake
Rand 2017	USA	749	RCT	Urban primary care practices in Rochester, NY	11 to 17 year olds	**Intervention 1:** autodialer message to parents that next HPV vaccination due (multiple attempts at contact) **Intervention 2:** text messages to parents (multiple reminders)[7]	Control groups for each intervention (not described)	HPV vaccination (2nd and 3rd doses only)	Vaccine uptake
Rodewald 1999	USA	3,015	cRCT	Primary care practices	Children aged 0-12 months	**Intervention 1**: tracking (of eligible children) with outreach to provide reminders. **[Intervention 2**: provider prompts (flags on medical record with nurse follow up)][2] **Intervention 3** tracking (of eligible children) with outreach to provide reminders and provider prompts	No interventions	Age appropriate vaccinations including DTP, OPV (polio), MMR, and Hib.	Vaccine uptake
Stehr Green 1993	USA	222	RCT	Public clinics in Georgia	Children younger than 2 years old.	Autodialer with message that vaccination due, importance of	No intervention	Childhood vaccines	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
						vaccine and to bring child to clinic.			
Stolpe 2019	USA	22301	RCT	Reminders were from pharmacies	Adults aged 65 years or older	Reminder using an autodialer plus a reminder unrelated to vaccination using an autodialer	A reminder unrelated to vaccination using an autodialer (control)	Pneumococcal, shingles	Vaccine uptake
Suh 2012	USA	1,600	RCT	Suburban private pediatric practices in metropolitan Denver	11 to 18 year olds	Up to 2 letters separated by 2 autodialer telephone calls. Targeting family (letters and calls) and adolescents (calls).	Usual care (no reminder-recall)	Targeted adolescent vaccinations Tdap, MCV4, or first dose of HPV1 vaccine for females[20]	Vaccine uptake
Szilagyi 2006	USA	3,006	RCT	Urban primary care practices located in Rochester, New York (USA),	11 to 14 year olds	Autodialer reminder message	Unclear (no details provided)	Td (Tetanus-diphtheria toxoids booster), HepB[9]	Vaccine uptake
Szilagyi 2011	USA	7,546	cRCT	Urban primary care practices serving adolescents in Rochester, New York.	11 to 15 year olds	Population-based approach with progressively more intensive intervention, based on need. Involves tracking, reminder or recall phone calls or letters (if o phone number), and finally home visits.	Standard care	Tdap, MCV4, and HPV doses[21]	Vaccine uptake
Szilagyi 2013	USA	4,115	cRCT	Primary care practices in	10.5 to 17 year olds	**Intervention 1:** letters to ask parents to call for appointment (in English and Spanish) at 10	Standard care (some practices used	Tdap, MCV4, and	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
				counties in upstate NY		week intervals for target vaccines and HPV dose 1, 5 week for later doses of HPV. **Intervention 2**: autodialer reminders in English or Spanish, same content and frequency as letters	visit or immunisation reminders or recall)	HPV doses[21]	
Szilagyi 2020	USA	62118	RCT	Practices in Colorado and the New York State counties area, excluding New York City	11 to 17 years of age, not had HPV vaccine	**Intervention 1:** 1 automated telephone centralized reminder and recall calls from the state immunization information systems (IISs) **Intervention 2**: 2 automated telephone centralized reminder and recall calls from the state IISs **Intervention 3:** 3 automated telephone centralized reminder and recall calls from the state IISs	No reminders	HPV	Vaccine uptake
Terrell-Perica, 2001	USA	4315	RCT	Community	People eligible for a pneumococcal vaccine[17]	Reminder letter	No intervention	Pneumococcal, influenza[18]	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Tollestrup 1997	USA	425	RCT	County health department in urban area in western Washington state	Children under 5 years old	1-2 postcard reminders	No intervention	DTP	Vaccine uptake
Tull 2019	Australia	4386	RCT	Schools	Aged 10.5 to 12 years	**Intervention 1:** motivational SMS message, contains notice that children are at risk of preventable diseases once vaccinated **Intervention 2:** self-regulatory SMS message: only notifies of reminder to vaccinate and book.	No reminder	HPV	Vaccine uptake
Vivier 2000	USA	264	RCT	Primary care clinics at Hasbro Children's Hospital – Rhode Island Hospital	Children under 6 years old	**Intervention 1**: phone reminders made by clinic receptionists in English or Spanish, several attempts **Intervention 2**: letter reminder encouraging parent to call clinic for appointment as vaccination overdue. **Intervention 3**: sequential mail and telephone reminder	No intervention	All needed vaccinations	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Wilkinson 2019	USA	1282	cRCT	5 primary care clinical sites	Aged 11–17 years who had previously received a dose of the HPV vaccine.	Automated CDSS reminders via CHICA to recommend the 2nd and 3rd doses of HPV vaccine for eligible adolescents.	Usual practice, (vaccination recommendations were manually obtained by nurses who looked them up in CHIRP).	HPV	Vaccine uptake, offers of vaccination
Winston 2007	USA	6,106 (2,395 older adults)	RCT	Managed care network general medicine clinics; Atlanta, Georgia	Older than 65 years for older adult group; 18 years and older for chronic disease group[8]	Phone reminder by nurse saying vaccine being recommended and covered by health plan; appointment scheduling possible during call.	Usual care (did not receive a study introductory letter)	Pneumococcal vaccination	Vaccine uptake

1. Data was not presented separately for the different doses for all participants in the paper. ITT data was obtained by Cochrane review authors from study authors.
2. This study is also included in the provider reminder interventions (see Table 3).
3. Data was extracted for 9-17 year olds only, excluding 18-26 year olds.
4. Data used in Cochrane review came from continuous reminders intervention arm only.
5. Data used in the Cochrane review came from the autodialer and combination of autodialer and outreach arms only. We have also included the outreach arm in our analyses.
6. Control group was not used because it was not randomised. Data for interventions 1 and 4 were pooled as phone and letter reminders in the analysis.
7. Participants chose text message or autodialer before randomisation into intervention or control arm so interventions cannot be compared.
8. Data was not extracted for the chronic disease group as they do not match the scope of this review question.
9. Data was not extracted for HepB as this is not on the UK routine schedule for adolescents.
10. This study is called Daley 2004b in the Jacobson Vann Cochrane review.
11. The Hurley 2018 and 2019 studies are related but do not appear to have overlapping study populations.
12. This arm is included in the access review instead of this review because it is an opportunistic vaccination.

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes

13. Data was not extracted for influenza vaccination because it is not within the scope of this review and is covered by another guideline.
14. Data was not extracted for the Tdap vaccination as it was not being given people who would receive it on the UK routine schedule.
15. Data was extracted for the over 65 year olds only as we do not routinely offer the pneumococcal vaccine to younger ages in the UK.
16. Only data for MMR and Hib are included in this review. Data was not extracted for adult tetanus, influenza, or DPT ROPV vaccination because they were not relevant to this review. We did not include the data for MMR boosters because it was not clear at what age they were given.
17. The median age of the participants was 65 years.
18. Only data for pneumococcal vaccine was included in this review. The data for influenza vaccine was not relevant to this review.
19. Only the MCV4 and HPV vaccination data were included. The Tdap and MCV booster vaccines were not included because they are not on the UK routine vaccination schedule for this age group.
20. Only the MCV4 and HPV 1st dose were included because Tdap is not on the UK vaccination schedule for this age group.
21. Only the MCV4 and HPV vaccines were included because Tdap is not on the UK vaccination schedule for this age group.

a. Hogg 1998: There were 719 families in total but only 111 families were relevant to this review because they had children aged 5 years of age or younger.

1 For the full evidence tables, please see Appendix D.

2 **Table 3 Summary of the characteristics of the primary studies of reminder interventions at heath care providers.**

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Control group	Vaccine(s)	Relevant outcomes
Dexter 2004	USA	829	RCT	Hospital, general medicine wards	People aged 65 years and older or people who were at risk of disease[4]	**Intervention 1:** Pop-up message with orders for required vaccine, physician could accept. **Intervention 2**: Standing order	No control group	Pneumococcal, influenza[3]	Vaccine uptake
McIntyre 2003	Australia	131	RCT	Hospital and general practice	People aged 65 years and older	**Intervention 1**: Hospital reminder: of a memo left in the patient's	No control group	Pneumococcal, influenza[3]	Vaccine uptake

					admitted to hospital	medical notes and a verbal (face-to-face) reminder to ward staff (nursing and medical). **Intervention 2**: GP reminder: a reminder to the patient's usual family doctor. This was posted to the family doctor on the day of discharge from hospital.			
Morgan 1998	UK	451	RCT	County of South Glamorgan	Children aged 3 to 15 months who had not completed primary course of vaccination by 9 months	**Intervention 1:** a non-directive telephone call to the child's health visitor to confirm the child's personal details and immunisation status. **[Intervention 2:** a single mailed reminder to the child's parents together with a questionnaire about immunization status.[2]]	No reminder	Diphtheria, pertussis, tetanus, polio, and Haemophilus influenzae type b immunisation	Vaccine uptake
Rodewald 1996	USA	1835	RCT	Emergency department and 54 primary care practices	Aged 6 to 36 months and attending emergency department.	**Intervention 1:** primary care reminder –1 week after admission, the child's GP was sent a letter. If there was a chance that they might not be up to date with vaccinations, this was flagged up. **Intervention 2:** emergency department opportunistic vaccination-parents of children who were not likely to be up to	No intervention	Study reported: diphtheria, tetanus, pertussis, polio, and Hib	Vaccine uptake

						date with their vaccinations were offered vaccines][2]			
Rodewald 1999	USA	3,015	cRCT	Primary care practices	Children aged 0-12 months	**[Intervention 1** tracking (of eligible children) with outreach to provide reminders][1] **Intervention 2**: provider prompts (flags on medical record with nurse follow up) **Intervention 3**: tracking (of eligible children) with outreach to provide reminders and provider prompts	No interventions	Age appropriate vaccinations including DTP, OPV, MMR, and Hib.	Vaccine uptake
Shevlin 2002	USA	534	RCT	Hospital	Adults eligible for pneumonococcal vaccination	Provider-reminder system initiated by nurses on pneumococcal vaccination rates in the inpatient areas of the hospital.	No education or organizational changes	Pneumococcal vaccination	Vaccine uptake
Szilagyi 2015	USA	3520	cRCT	85 primary care practice	11 to 17 years old who were eligible to be vaccinated	Provider prompts: displayed on the initial screen that health care providers viewed upon opening each patient's electronic medical chart.	Standard of care, which did not include prompts.	Tdap, MCV4, HPV, influenza[5]	Vaccine uptake
Szilagyi 1996	USA	1789	RCT	Paediatric clinic and Neighbourhood Health Centre	Children eligible for childhood vaccinations	No Missed Opportunities: medical records highlighted if a vaccination was due and a record of whether the vaccine was given	Usual care	DTaP, polio, MMR, Hib-B	Vaccine uptake
Zimet 2018	USA	648	cRCT	Paediatric clinics	11 to 13 year olds	**Intervention 1**: computer-generated reminders with a suggested script for recommending the	Usual practice control (usual method)	HPV	Vaccine uptake

						vaccines (elaborated prompt) **Intervention 2**: computer-generated messages reminding providers of MenACWY, HPV, and Tdap vaccination eligibility (simple prompt)			

1. This study is also included in the reminders interventions aimed at individuals for intervention 1 (see Table 2).
2. Intervention 2 of Rodewald 1996 is included in the access review (it is not in this review).
3. The influenza vaccine data was excluded because it did not fit the protocol.
4. Data from participants aged 65 years and over and participants at high risk could not be extracted separately so the study was downgraded for directness.
5. The influenza vaccine data was excluded because it did not fit the protocol. Tdap data was excluded because it is not on the UK vaccination schedule for this age group.

1 For the full evidence tables, please see Appendix D.

1.1.6 Summary of the evidence

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

Quantitative evidence

Reminders interventions aimed at individuals, parents or carers to increase vaccine uptake compared to control

Table 4 Summary of effectiveness findings for reminders interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Patient reminders (summary) reminder versus control (RR >1 favours reminder) **Pooled result**							
44 (See the 3 subgroups below)	RCT	292169	RR 1.17 (1.12, 1.22)	19 per 100	23 per 100 (22, 24)	Increased with patient reminders.	Very low
0-5 year olds							
24[a]	RCT	33222	RR 1.14 (1.07, 1.21)	36 per 100	41 per 100 (39, 44)	Increased with patient reminders.	Very low
11-18 year olds							
12[b]	RCT	222210	RR 1.14 (1.07, 1.20)	21 per 100	23 per 100 (22, 25)	Increased with patient reminders.	Very low
65 and over							
8[c]	RCT	36737	RR 1.64 (1.25, 2.17)	2 per 100	4 per 100 (3, 5)	Increased with patient reminders.	Very low
Patient reminders: who it was sent by: reminder versus control (RR >1 favours reminder) (same studies as previous meta-analysis)							
Reminder from a pharmacy (RR >1 favours reminder)							
2 (Klassing 2018,	RCT	22372	RR 1.08 (0.90, 1.29)	1 per 100	1 per 100 (1, 2)	The studies could not differentiate change in vaccine uptake between patient reminders or control.	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Stolpe 2019)							
Reminder from GP or primary care clinic (RR >1 favours reminder)							
11[d]	RCT	14506	RR 1.50 (1.19, 1.89)	14 per 100	21 per 100 (17, 27)	Increased with patient reminders.	Very low
Reminder from a regional health authority (RR >1 favours reminder)							
14[e]	RCT	221563	RR 1.12 (1.05, 1.19)	18 per 100	20 per 100 (19, 22)	Increased with patient reminders.	Very low
Reminder from a specialist clinic (RR >1 favours reminder)							
10[f]	RCT	12963	RR 1.16 (1.04, 1.29)	50 per 100	58 per 100 (52, 65)	Increased with patient reminders.	Very low
Reminder from school nurse or school-based health centre (RR >1 favours reminder)							
3 (Ferson 1995, Kempe 2012, Tull 2019)	RCT	4752	RR 1.45 (0.97, 2.17)	83 per 100	121 per 100 (81, 180)	The studies could not differentiate change in vaccine uptake between patient reminders or control.	Very low
Reminder from a regional health insurance company (RR >1 favours reminder)							
3 (Chao 2015, Lieu 1997, Rand 2015)	RCT	14419	RR 1.25 (1.11, 1.40)	37 per 100	46 per 100 (41, 52)	Increased with patient reminders.	Very low
CLUSTER RCTs: Patient reminders: (summary) reminder versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Dini 2000)[h]	Cluster RCT	1838	RR 1.20 (1.07, 1.35)	41 per 100	49 per 100 (44, 55)	Increased with patient reminders.	Low
1 (Franzini 2000)[h]	Cluster RCT	1138	RR 1.30 (1.20, 1.40)	64 per 100	83 per 100 (76, 89)	Increased with patient reminders.	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Rodewald 1999)[h]	Cluster RCT	2741	RR 1.19 (1.14, 1.25)	74 per 100	88 per 100 (84, 92)	Increased with patient reminders.	High
11-18 year olds							
1 (Szilagyi 2011)[h]	Cluster RCT	7546	RR 1.35 (1.21, 1.51)	12 per 100	16 per 100 (15, 18)	Increased with patient reminders.	Moderate
1 (Szilagyi 2013)[h]	Cluster RCT	4115	RR 1.04 (0.96, 1.14)	36 per 100	37 per 100 (35, 41)	Increased with patient reminders.	Low
Patient reminders: (summary for HPV doses) reminder versus control (RR >1 favours reminder)							
Dose 1							
7 (Coley 2018, O'Leary 2015, Rand 2017 (2 comparisons), Suh 2012, Szilagyi 2020 (2 comparisons))	RCT	194242	RR 1.10 (1.08, 1.12)	18 per 100	20 per 100 (20, 21)	Increased with patient reminders.	Very low
Dose 2							
5 (Chao 2015, Coley 2018, O'Leary 2015, Rand 2017 (2	RCT	170780	RR 1.24 (1.2, 1.28)	6 per 100	7 per 100 (7, 8)	Increased with patient reminders.	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
comparisons))							
Dose 3							
5 (Chao 2015, Coley 2018, O'Leary 2015, Rand 2017)	RCT	170780	RR 1.35 (1.24, 1.47)	1 per 100	1 per 100 (1, 1)	Increased with patient reminders.	Very low
Patient reminders: postcard versus control (RR >1 favours reminder) **Pooled result**							
5 (See subgroups below)	RCT	164,520	RR 1.14 (1.02, 1.28)	14 per 100	16 per 100 (14, 18)	Increased with postcard.	Very low
0-5 year olds							
4 (Bjornson 1999, Campbell 1994, Irigoyen 2000, Tollestrup 1997))	RCT	2,098	RR 1.18 (0.97, 1.43)	56 per 100	66 per 100 (54, 80)	The studies could not differentiate change in vaccine uptake between postcard or control.	Very low
11-18 year olds							
1 (Coley 2018)	RCT	162,422	RR 1.16 (1.13, 1.19)	14 per 100	16 per 100 (15, 16)	Increased with postcard.	High
CLUSTER RCTs: Patient reminders: postcard versus control (RR >1 favours reminder)							
0-5 year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Franzini 2000)[h]	Cluster RCT	824	RR 1.25 (1.15, 1.37)	64 per 100	80 per 100 (73, 87)	Increased with postcard.	Moderate
Patient reminders: letter versus control (RR >1 favours reminder)							
Pooled result							
12 (See subgroups below)	RCT	24982	RR 1.24 (1.10, 1.39)	25 per 100	31 per 100 (27, 35)	Increased with letter.	Very low
0-5 year olds							
8(Campbell 1994, CDC 2012, Dombkowski 2014 (3 comparisons), Lieu 1997, Vivier 2000)	RCT	11726	RR 1.13 (1.02, 1.26)	53 per 100	60 per 100 (54, 67)	Increased with letter.	Low
11-18 year olds							
1 (Chao 2015)	RCT	6981	RR 1.24 (1.17, 1.30)	54 per 100	66 per 100 (63, 70)	Increased with letter.	Low
65 and over							
3 (Klassing 2018, Otsuka 2013, Terrell-Perica 2001)	RCT	6275	RR 1.72 (0.87, 3.41)	3 per 100	5 per 100 (3, 11)	The studies could not differentiate change in vaccine uptake between letter reminder or control.	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
CLUSTER RCTs: Patient reminders: letter versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Dini 2000)[h]	Cluster RCT	969	RR 1.18 (1.02, 1.36)	41 per 100	48 per 100 (42, 56)	Increased with letter.	Low
11-18 year olds, MCV4							
1 (Szilagyi 2013)[h]	Cluster RCT	2692	RR 1.05 (1.01, 1.10)	73 per 100	76 per 100 (73, 80)	Increased with letter.	Moderate
11-18 year olds, HPV dose 1							
1 (Szilagyi 2013)[h]	Cluster RCT	2692	RR 1.04 (0.94, 1.15)	36 per 100	37 per 100 (34, 41)	The study could not differentiate change in vaccine uptake between letter reminder or control.	Low
11-18 year olds, HPV dose 2							
1 (Szilagyi 2013)[h]	Cluster RCT	2692	RR 1.06 (0.95, 1.19)	30 per 100	32 per 100 (29, 36)	The study could not differentiate change in vaccine uptake between letter reminder or control.	Low
11-18 year olds, HPV dose 3							
1 (Szilagyi 2013)[h]	Cluster RCT	2692	RR 1.07 (0.99, 1.16)	47 per 100	50 per 100 (47, 55)	The study could not differentiate change in vaccine uptake between letter reminder or control.	Low
CLUSTER RCTs: Patient reminders: customised or not customised letter reminders versus control (RR >1 favours reminder)							
0-5 year olds, customised reminders, MMR							
1 (Hogg 1998)	Cluster RCT	45	Not estimable[8]	N/A[8]	N/A[8]	Not interpretable[8]	Moderate
0-5 year olds, customised reminders, Hib							
1 (Hogg 1998)	Cluster RCT	33	RR 1.06 (0.07, 15.60)	6 per 100	6 per 100 (0, 92)	The study could not differentiate change in vaccine uptake between letter reminder or control.	Very low
0-5 year olds, not customised reminders, MMR							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Hogg 1998)	Cluster RCT	61	Not estimable[8]	N/A[8]	N/A[8]	Not interpretable[8]	Moderate
0-5 year olds, not customised reminders, Hib							
1 (Hogg 1998)	Cluster RCT	42	RR 0.23 (0.01, 5,35)	6 per 100	1 per 100 (0, 31)	The study could not differentiate change in vaccine uptake between letter reminder or control.	Low
Patient reminders: telephone versus control (RR >1 favours reminder) **Pooled result**							
4 (See subgroups below)	RCT	2686	RR 1.78 (1.22, 2.61)	11 per 100	19 per 100 (12, 28)	Increased with telephone.	Very low
0-5 year olds							
2 (Ferson 1995, Vivier 2000)	RCT	234	RR 2.27 (1.12, 4.63)	18 per 100	40 per 100 (20, 81)	Increased with telephone.	Moderate
65 and over							
2 (Klassing 2018, Winston 2007)	RCT	2452	RR 1.59 (0.93, 2.75)	10 per 100	16 per 100 (9, 27)	The studies could not differentiate change in vaccine uptake between telephone reminder or control.	Very low
Patient reminders: autodialer versus control (RR >1 favours reminder) **Pooled result**							
6 (See subgroups below)	RCT	79288	RR 1.1 (0.99, 1.23)	21 per 100	23 per 100 (21, 26)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Very low
0-5 year olds							
2 (Linkins 1994, Stehr-	RCT	8199	RR 1.25 (1.11, 1.41)	29 per 100	36 per 100 (32, 41)	Increased with autodialer.	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Green 1993)							
11-18 year olds							
3 (Rand 2017, Szilagyi 2006, Szilagyi 2020)	RCT	48788	RR 1.03 (0.98, 1.07)	36 per 100	37 per 100 (36, 39)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Low
65 and over							
1 (Stolpe 2019)	RCT	22301	RR 1.03 (0.80, 1.33)	1 per 100	1 per 100 (1, 1)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Very low
Patient reminders: 1 to 3 autodialer versus control (RR >1 favours reminder)							
HPV dose 1, 1 reminder versus control							
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.06 (1.03, 1.08)	Not calculable[9]	Not calculable[9]	Increased with autodialer.	Very low
HPV dose 1, 2 reminders versus control							
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.01 (0.98, 1.03)	Not calculable[9]	Not calculable[9]	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Low
HPV dose 1, 3 reminders versus control							
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.03 (1.01, 1.06)	Not calculable[9]	Not calculable[9]	Increased with autodialer.	Low
HPV dose 3, 1 reminder versus control							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.02 (1.00, 1.04)	Not calculable[9]	Not calculable[9]	Increased with autodialer.	Low
HPV dose 3, 2 reminder versus control							
1 (Szilagyi 2020)	RCT	62118	RR 1.02, (1.00, 1.04)	Not calculable[9]	Not calculable[9]	Increased with autodialer.	Moderate
HPV dose 3, 3 reminder versus control							
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.02 (1.00, 1.05)	Not calculable[9]	Not calculable[9]	Increased with autodialer.	Low
Patient reminders: autodialer versus control (shingles vaccine) (RR >1 favours reminder)							
65 and over							
1 (Stolpe 2019)	RCT	22301	RR 0.92 (0.69, 1.22)	1 per 100	1 per 100 (1, 1)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Very low
CLUSTER RCTs: Patient reminders: autodialer versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Dini 2000)[h]	Cluster RCT	961	RR 1.21 (1.05, 1.39)	41 per 100	49 per 100 (43, 57)	Increased with autodialer.	Low
1 (Franzini 2000)[h]	Cluster RCT	743	RR 1.35 (1.24, 1.47)	64 per 100	86 per 100 (79, 94)	Increased with autodialer.	Moderate
11-18 year olds, MCV4							
1 (Szilagyi 2013)[h]	Cluster RCT	2719	RR 1.01 (0.96, 1.05)	73 per 100	73 per 100 (70, 76)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Moderate
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)	Interpretation	Quality
1 (Szilagyi 2013)[h]	Cluster RCT	2719	RR 1.05 (0.95, 1.16)	36 per 100	38 per 100 (34, 42)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Moderate
11-18 year olds, HPV dose 2							
1 (Szilagyi 2013)[h]	Cluster RCT	2719	RR 1.06 (0.94, 1.18)	30 per 100	32 per 100 (29, 36)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Moderate
11-18 year olds, HPV dose 3							
1 (Szilagyi 2013)[h]	Cluster RCT	2719	RR 1.08 (0.94, 1.23)	22 per 100	24 per 100 (21, 27)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Moderate
65 and over							
1 (Hess 2013)[h]	Cluster RCT	11982	RR 3.62 (2.60, 5.03)	1 per 100	3 per 100 (2, 4)	Increased with autodialer.	Moderate
Patient reminders: text or 'electronic' message versus control (RR >1 favours reminder)							
7 (See subgroups below)	RCT	14809	RR 1.09 (1.02, 1.17)	63 per 100	68 per 100 (64, 73)	Increased with text or 'electronic message'.	Low
0-5 year olds							
2 (Hofstetter 2015, Menzies 2020)	RCT	2846	RR 1.04 (0.99, 1.10)	66 per 100	68 per 100 (65, 72)	The studies could not differentiate change in vaccine uptake between text or 'electronic message' or control.	Moderate
11-18 year olds							
4 (O'Leary, Rand 2015, Rand	RCT	11289	RR 1.10 (1.01, 1.20)	67 per 100	74 per 100 (68, 80)	Increased with text or 'electronic message'.	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
2017, Tull 2019)							
65 and over							
1 (Otsuka 2013)	RCT	674	RR 2.67 (1.58, 4.50)	5 per 100	13 per 100 (8, 22)	Increased with text or 'electronic message'.	High
Patient reminders: text or 'electronic' message versus control: MCV4 vaccine (RR >1 favours reminder)							
11-18 year olds							
1 (O'Leary 2015	RCT	4587	RR 1.09 (1.01, 1.18)	34 per 100	37 per 100 (34, 40)	Increased with text or 'electronic message'.	High
Patient reminders: telephone + mail versus control (RR >1 favours reminder)							
0-5 year olds							
7[d]	RCT	4935	RR 1.15 (1.00, 1.32)	30 per 100	34 per 100 (30, 39)	Increased with telephone + mail.	Low
Patient reminders: autodialer + mail versus control (RR >1 favours reminder) **Pooled result**							
3 (See subgroups below)	RCT	6661	RR 1.58 (1.22, 2.04)	5 per 100	8 per 100 (6, 11)	Increased with telephone + mail.	High
11-18 year olds							
1 (Suh 2012)	RCT	1596	RR 1.73 (1.42, 2.12)	15 per 100	26 per 100 (22, 32)	Increased with telephone + mail.	High
65 and over							
2 (Hurley 2018, Hurley 2019)	RCT	5065	RR 1.36 (0.82, 2.25)	2 per 100	3 per 100 (2, 5)	The studies could not differentiate change in vaccine uptake between autodialer + mail or control.	Low
Patient reminders: autodialer + mail versus control: MCV vaccine (RR >1 favours reminder)							
11-18 year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Suh 2012)	RCT	1596	RR 1.50 (1.32, 1.72)	29 per 100	44 per 100 (39, 51)	Increased with telephone + mail.	High
CLUSTER RCTs: Patient reminders: autodialer + letter (mail) versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Dini 2000)[h]	Cluster RCT	949	RR 1.23 (1.07, 1.41)	41 per 100	50 per 100 (44, 58)	Increased with autodialer + letter	Low
Patient reminders: outreach reminder versus control (RR >1 favours reminder)							
0-5 year olds							
2 (Hambidge 2009, LeBaron 2004)	RCT	2700	RR 1.2 (1.08, 1.33)	34 per 100	40 per 100 (36, 45)	Increased with outreach reminder.	Low
CLUSTER RCTs: Patient reminders: class room recall (recalled 1 or 2 times via a note sent to classroom, a call to the classroom, or an escort from the classroom) versus control (RR >1 favours reminder)							
11-18 year olds							
1 (Kempe 2012)	RCT	263	RR 1.60 (1.23, 2.07)	38 per 100	60 per 100 (46, 78)	Increased with reminders.	High
CLUSTER RCTs: Patient reminders: tracking, telephone or mail, home visits if needed versus control (RR >1 favours reminder)							
11-18 year olds, meningococcal							
1 (Szilagyi 2011)	Cluster RCT	7546	RR 1.26 (1.19, 1.33)	37 per 100	46 per 100 (44, 49)	Increased with reminders.	Moderate
11-18 year olds, HPV 1st dose							
1 (Szilagyi 2011)	Cluster RCT	7546	RR 1.35 (1.21, 1.51)	12 per 100	16 per 100 (15, 18)	Increased with reminders.	Moderate
11-18 year olds, HPV 2nd dose							
1 (Szilagyi 2011)	Cluster RCT	7546	RR 1.43 (1.29, 1.57)	15 per 100	22 per 100 (19, 24)	Increased with reminders.	Moderate
11-18 year olds, HPV 3rd dose							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Szilagyi 2011)	Cluster RCT	7546	RR 1.50 (1.34, 1.68)	12 per 100	17 per 100 (16, 20)	Increased with reminders.	Moderate
CLUSTER RCTs: Patient reminders: reminder of preference versus control (RR >1 favours reminder)							
11-18 year olds							
1 (Kempe 2016)[i]	Cluster RCT	929	RR 1.14 (1.07, 1.22)	Not calculable[9]	Not calculable[9]	Increased with reminders.	Moderate
Patient reminders: calendar reminder versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Menzies 2020)	RCT	792	RR 0.94 (0.86, 1.03)	74 per 100	69 per 100 (64, 76)	The study could not differentiate change in vaccine uptake between calendar reminder or control.	Low
Patient reminders: calendar reminder + text message versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Menzies 2020)	RCT	798	RR 1.02 (0.94, 1.1)	74 per 100	75 per 100 (69, 81)	The study could not differentiate change in vaccine uptake between calendar reminder + text message or control.	Low

a) Alto 1994, Bjornson 1999, Campbell 1994, CDC 2012, Daley 2002, Daley 2004, Dombkowski 2014 (3 comparisons), Ferson 1995, Hambidge 2009, Hoekstra 1999, Hofstetter 2015, Hogg 1998, Irigoyen 2000, Kempe 2001, LeBaron 2004, Lieu 1997, Linkins 1994, Menzies 2020, Morgan 1998, Stehr-Green 1993, Tollestrup 1997, Vivier 2000
b) Chao 2015, Coley 2018, Kempe 2012, O'Leary 2015, Rand 2015, Rand 2017 (2 comparisons), Suh 2012, Szilagyi 2006, Szilagyi 2020 (2 comparisons), Tull 2019.
c) Hurley 2018, Hurley 2019, Klassing 2018, Otsuka 2013 (2 comparisons), Stolpe 2019, Terrell-Perica 2001, Winston 2007.
d) Alto 1994, Hogg 1998, Hurley 2018, Hurley 2019, Otsuka 2013 (2 comparisons), Rand 2017 (2 comparisons), Stehr-Green 1993, Szilagyi 2006, Winston 2007
e) Bjornson 1999, CDC 2012, Coley 2018, Dombkowski 2014, (3 comparisons) Hoekstra 1999, LeBaron 2004, Linkins 1994, Morgan 1998, Szilagyi 2020 (2 comparisons), Terrell-Perica 2001, Tollestrup 1997
f) Campbell 1994, Daley 2002, Daley 2004, Hambidge 2009, Hofstetter 2015, Irigoyen 2000, Kempe 2001, O'Leary 2015, Suh 2012, Vivier 2000
g) Cluster RCT data is unadjusted.
h) Cluster RCT data has been adjusted by the investigators.

1

1 ***Reminders interventions aimed at individuals, parents/ carers compared to other reminder interventions***

2 **Table 5 Summary of effectiveness findings for reminders interventions compared to other reminder interventions**

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Patient reminders: health belief worded postcard versus neutrally worded postcard (RR >1 favours health belief model)							
0-5 year olds							
1 (Hawe 1998)	RCT	258	RR 1.18 (1.01, 1.37)	67 per 100	79 per 100 (68, 92)	Increased with health belief postcard.	Moderate
Patient reminders: customised reminders versus non-customised reminders (RR >1 favours customised reminders)							
0-5 years, MMR							
1 (Hogg 1998)	RCT	54	Not estimable[1]	Not calculable[1]	Not calculable[1]	Not interpretable[5]	Moderate
0-5 years, Hib							
1 (Hogg 1998)	RCT	41	RR 4.59 (0.20, 106.18)	Not calculable[2]	Not calculable[2]	The study could not differentiate change in vaccine uptake between customised reminders or non-customised reminders.	Very low
Patient reminders: texts + appointment scheduling reminder versus texts only (RR >1 favours texts + appointment scheduling reminder)							
0-5 year olds							
1 (Hofstter 2015)	RCT	1372	RR 1.06 (0.98, 1.15)	61 per 100	65 per 100 (60, 70)	The study could not differentiate change in vaccine uptake between texts + appointment scheduling reminder or texts only.	Moderate
Patient reminders: motivational text message versus self-regulatory text message (RR >1 favours motivational text message)							
11-18 year olds							
1 (Tull 2019)	RCT	2860	RR 0.99 (0.97, 1.02)	90 per 100	89 per 100 (87, 92)	The study could not differentiate change in vaccine uptake between motivational text message or self-regulatory text message.	Moderate
Patient reminders: outreach versus autodialer (RR >1 favours outreach)							
0-5 year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (LeBaron 2004)	RCT	1523	RR 0.92 (0.81, 1.05)	40 per 100	37 per 100 (32, 42)	The study could not differentiate change in vaccine uptake between outreach reminder or autodialer.	Very low
Patient reminders: autodialer + outreach versus autodialer (RR >1 favours autodialer + outreach)							
0-5 year olds							
1 (LeBaron 2004)	RCT	1527	RR 0.95 (0.84, 1.08)	40 per 100	38 per 100 (34, 43)	The study could not differentiate change in vaccine uptake between autodialer + outreach or autodialer.	Very low
Patient reminders: autodialer + outreach versus outreach (RR >1 favours autodialer + outreach)							
0-5 year olds							
1 (LeBaron 2004)	RCT	1524	RR 1.03 (0.90, 1.17)	37 per 100	38 per 100 (33, 43)	The study could not differentiate change in vaccine uptake between autodialer + outreach or outreach.	Very low
Patient reminders: letters versus autodialer (RR >1 favours letters)							
0-5 year olds							
1 (Lieu 1998)	RCT	327	RR 1.02 (0.80, 1.30)	44 per 100	45 per 100 (35, 57)	The study could not differentiate change in vaccine uptake between letters or autodialer.	Very low
CLUSTER RCTs: Patient reminders: letter versus autodialer (RR >1 favours letters)							
11-18 year olds, MCV4							
1 (Szilagyi 2013)	Cluster RCT	2819	RR 1.05 (1.00, 1.09)	73 per 100	77 per 100 (73, 80)	Increased with letter reminder.	Moderate
11-18 year olds, HPV dose 1							
1 (Szilagyi 2013)	Cluster RCT	2819	RR 0.99 (0.90, 1.09)	38 per 100	37 per 100 (34, 41)	The study could not differentiate change in vaccine uptake between letter or autodialer.	Low
11-18 year olds, HPV dose 2							
1 (Szilagyi 2013)	Cluster RCT	2819	RR 1.03 (0.92, 1.14)	32 per 100	33 per 100 (30, 37)	The study could not differentiate change in vaccine uptake between letter or autodialer.	Low
11-18 year olds, HPV dose 3							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Szilagyi 2013)	Cluster RCT	2819	RR 1.02 (0.89, 1.16)	24 per 100	24 per 100 (21, 28)	The study could not differentiate change in vaccine uptake between letter or autodialer.	Low
CLUSTER RCTs: Patient reminders: 3 autodialer reminders versus 1 autodialer reminder (RR >1 favours							
HPV dose 1							
2 (Szilagyi 2020 (2 comparisons))[a]	Cluster RCT	31015	RR 0.98 (0.95, 1.01)	35 per 100	35 per 100 (33, 36)	The study could not differentiate change in vaccine uptake between 3 autodialer reminders or 1 autodialer reminder.	Low
HPV series completion							
2 (Szilagyi 2020 (2 comparisons))[a]	Cluster RCT	31015	RR 0.98 (0.95, 1.02)	29 per 100	28 per 100 (28, 30)	The study could not differentiate change in vaccine uptake between 3 autodialer reminders or 1 autodialer reminder.	Low
Patient reminders: autodialer + letters versus autodialer (RR >1 favours autodialer + letters)							
0-5 year olds							
1 (Lieu 1998)	RCT	486	RR 1.27 (1.04, 1.55)	44 per 100	55 per 100 (45, 68)	Increased with autodialer and letters.	Low
CLUSTER RCTs: Patient reminders: autodialer + letters versus autodialer (RR >1 favours autodialer + letters)							
0-5 year olds							
1 (Dini 2000)[a]	Cluster RCT	868	RR 1.02 (0.89, 1.16)	49 per 100	50 per 100 (44, 57)	The study could not differentiate change in vaccine uptake between autodialer + letter or autodialer.	Very low
Patient reminders: autodialer + letters versus letters (RR >1 favours autodialer + letters)							
0-5 year olds							
1 (Lieu 1998)	RCT	483	RR 1.25 (1.02, 1.52)	44 per 100	56 per 100 (45, 68)	Increased with autodialer + letters.	Low
CLUSTER RCTs: Patient reminders: autodialer + letter versus letter (RR >1 favours autodialer + letters)							
0-5 year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Dini 2000)[a]	Cluster RCT	876	RR 1.04 (0.91, 1.19)	48 per 100	50 per 100 (44, 57)	The study could not differentiate change in vaccine uptake between autodialer + letter or letter.	Very low
Patient reminders: reminders by autodialer and mail versus reminders by mail (RR >1 favours autodialer and mail)							
0-5 year olds							
1 (Kempe 2015)	RCT	9049	RR 1.02 (0.91, 1.13)	13 per 100	13 per 100 (12, 14)	The study could not differentiate change in vaccine uptake between autodialer and mail or reminders by mail.	Very low
Patient reminders: phone versus letter (RR >1 favours phone)							
0-5 year olds							
1 (Vivier 2000)	RCT	123	RR 0.93 (0.39, 2.26)	14 per 100	13 per 100 (6, 32)	The study could not differentiate change in vaccine uptake between phone or letter.	Very low
Patient reminders: phone versus letter and phone (RR >1 favours phone)							
0-5 year olds							
1 (Vivier 2000)	RCT	130	RR 0.78 (0.34, 1.78)	17 per 100	13 per 100 (6, 31)	The study could not differentiate change in vaccine uptake between phone or letter and phone.	Very low
Patient reminders: letter versus letter and phone (RR >1 favours letter)							
0-5 year olds							
1 (Vivier 2000)	RCT	133	RR 0.83 (0.38, 1.84)	17 per 100	14 per 100 (7, 32)	The study could not differentiate change in vaccine uptake between letter or letter and phone.	Very low
Patient reminders: text message versus calendar reminder (RR >1 favours text message)							
1 (Menzies 2020)	RCT	796	RR 1.11 (1.02, 1.21)	70 per 100	77 per 100 (72, 85)	Increased with text message.	Moderate
Patient reminders: postcard versus letter (RR >1 favours postcard)							
0-5 year olds							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Campbell 1994)	RCT	183	RR 0.96 (0.76, 1.21)	62 per 100	60 per 100 (47, 75)	The study could not differentiate change in vaccine uptake between postcard or letter.	Very low
Patient reminders: text message versus calendar reminder (RR >1 favours text message)							
0-5 year olds							
1 (Menzies 2020)	RCT	796	RR 1.11 (1.02, 1.21)	70 per 100	77 per 100 (72, 85)	Increased with text message.	Moderate
a. Cluster RCT data was not adjusted for clustering. 1. The effect size was not estimable because there was no vaccine uptake in either arm. 2. It was not possible to calculate absolute risks because there was no vaccine uptake in the non-customised events arm.							

Reminders interventions aimed at individuals, parents/ carers compared to those aimed at providers to increase vaccine uptake

Table 6 Summary of effectiveness findings for reminders interventions aimed at individuals, parents/ carers compared to those aimed at providers to increase vaccine uptake

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Patient reminder (mail) versus provider reminder (phone call to health visitor) (RR >1 favours patient reminder)							
0-5 year olds							
1 (Morgan 1998)	RCT	312	RR 0.88 (0.62, 1.25)	30 per 100	26 per 100 (19, 38)	The study could not differentiate change in vaccine uptake between patient reminder or clinician reminder.	Very low
CLUSTER RCTs: Patient reminder (tracking and outreach) versus provider reminder (RR >1 favours patient reminder)							
0-5 year olds							
1 (Rodewald 1999)[a]	Cluster RCT	1374	RR 1.25 (1.20, 1.31)	76 per 100	95 per 100 (91, 99)	Increased with patient reminder (tracking and outreach).	High

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
CLUSTER RCTs: Patient reminders: centrally organised reminders by mail or autodialer and mail versus primary care practice webinar training on vaccination reminders (RR >1 favours mail +/- autodialer)							
0-5 year olds							
1 (Kempe 2015)[a]	Cluster RCT	18235	RR 1.38 (1.27, 1.5)	9 per 100	13 per 100 (12, 14)	Increased with centrally organised reminders by mail or autodialer and mail.	Low

a. Cluster RCT data was not adjusted for clustering.

Reminders interventions aimed at providers to increase vaccine uptake

Table 7 Summary of effectiveness findings for reminders interventions aimed at providers

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider reminders (summary) reminder versus control (RR >1 favours reminder) (all were reminders to primary care staff)							
5 (See subgroups below)	RCT	10152	RR 1.27 (0.89, 1.83)	15 per 100	19 per 100 (14, 28)	The studies could not differentiate change in vaccine uptake between clinician reminders or control.	Very low
0-5 year olds							
3 (Frank 2004, Morgan 1998, Rodewald 1996)	RCT	2476	RR 1.00 (0.94, 1.07)	43 per 100	43 per 100 (40, 46)	The studies could not differentiate change in vaccine uptake between clinician reminders or control.	Very low
65 and over							
2 (Frank 2004, Loo 2011)	RCT	7676	RR 1.73 (1.49, 2.01)	6 per 100	10 per 100 (8, 11)	Increased with reminder.	Very low
CLUSTER RCTs: Provider reminders: (summary) reminder versus control (OR >1 favours reminder)							
CORNET study							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Szilagyi 2015)[a]	Cluster RCT	1920	OR 1.08 (0.82, 1.42)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between reminder or control.	Low
GR-PBRN study							
1 (Szilagyi 2015)[a]	Cluster RCT	1600	OR 1.15 (0.64, 2.06)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between reminder or control.	Low
1 (Wilkinson 2019)[a]	Cluster RCT	1285	OR 1.52 (0.88, 2.62)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between electronic reminder or control.	Very low
1 (Zimet 2018)[a]	Cluster RCT	648	OR 1.11 (0.50, 2.47)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between electronic reminder or control.	Low
Provider reminders: letter to GP versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Rodewald 1996)	RCT	1215	RR 1.0 (0.94, 1.07	75 per 100	75 per 100 (71, 80)	The studies could not differentiate change in vaccine uptake between letter to GP or control.	Low
CLUSTER RCTs: Provider reminder: Provider reminder: nurses assessing and reminding physicians versus control (RR >1 favours reminder)							
65 and over							
1 (Shevlin 2002)[b]	Cluster RCT	355	RR 8.15 (3.87, 17.16)	5 per 100	38 per 100 (18, 80)	Increased with reminder.	Very low
Provider reminders: electronic medical record versus control (RR >1 favours reminder)							
2 (See subgroups below)	RCT	8645	RR 1.66 (1.44, 1.91)	6 per 100	10 per 100 (9, 11)	Increased with electronic medical record reminder	Low
0-5 year olds							
1 (Frank 2004)	RCT	969	RR 1.25 (0.84, 1.86)	8 per 100	10 per 100 (7, 15)	The study could not differentiate change in vaccine uptake between electronic medical record or control.	Very low
65 and over							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
2 (Frank 2004, Loo 2011)	RCT	7676	RR 1.73 (1.49, 2.01)	6 per 100	10 per 100 (8, 11)	Increased with electronic medical record reminder.	Low
CLUSTER RCTs: Provider reminder: electronic reminder versus control (RR >1 favours reminder)							
11-18 year olds							
1 (Wilkinson 2019)[a]	Cluster RCT	1285	RR 1.52 (0.88, 2.62)	65 per 100	98 per 100 (57, 169)	The study could not differentiate change in vaccine uptake between electronic reminder or control.	Very low
1 (Zimet 2018)[a]	Cluster RCT	524	RR 1.11 (0.5, 2.47)	15 per 100	17 per 100 (7, 37)	The study could not differentiate change in vaccine uptake between electronic reminder or control.	Low
CLUSTER RCTs: Provider reminder: computer or paper reminder versus control, MCV4 (OR >1 favours reminder)							
11-18 year olds							
1 (Szilagyi 2015)[a,c]	Cluster RCT	Not provided	OR 1.08 (0.82, 1.42)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between computer or paper reminder or control.	Low
1 (Szilagyi 2015)[a,d]	Cluster RCT	Not provided	OR 1.15 (0.64, 2.06)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between computer or paper reminder or control.	Low
CLUSTER RCTs: Provider reminders: HPV doses, computer or paper reminder versus control (OR >1 favours reminder)							
Dose 1							
1 (Szilagyi 2015)[a,c]	Cluster RCT	Not provided	OR 0.96 (0.59, 1.56)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between computer or paper reminder or control.	Low
1 (Szilagyi 2015)[a,d]	Cluster RCT	Not provided	OR 0.92 (0.60, 1.41)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between computer or paper reminder or control.	Low
Dose 2							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1 (Szilagyi 2015)[a,c]	Cluster RCT	Not provided	OR 1.01 (0.57, 1.78)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between computer or paper reminder or control.	Low
1 (Szilagyi 2015)[a,d]	Cluster RCT	Not provided	OR 1.06 (0.64, 1.76)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between computer or paper reminder or control.	Low
Dose 3							
1 (Szilagyi 2015)[a,c]	Cluster RCT	Not provided	OR 1.13 (0.68, 1.88)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between computer or paper reminder or control.	Low
1 (Szilagyi 2015)[a,d]	Cluster RCT	Not provided	OR 0.93 (0.64, 1.35)	Not calculable[1]	Not calculable[1]	The study could not differentiate change in vaccine uptake between computer or paper reminder or control.	Low
Provider identification and reminders versus control (RR >1 favours reminder)							
Pooled[2]							
1 (Szilagyi 1996	RCT	1789	RR 1.00 (0.94, 1.08)	64 per 100	64 per 100 (60, 69)	The study could not differentiate change in vaccine uptake between provider identification and reminders versus control.	Low
0-5 years, paediatric continuity clinic							
1 (Szilagyi 1996	RCT	878	RR 1.05 (0.95, 1.15)	65 per 100	68 per 100 (62, 75)	The study could not differentiate change in vaccine uptake between provider identification and reminders versus control.	Low
0-5 years, neighbourhood health centre							
1 (Szilagyi 1996	RCT	911	RR 0.96 (0.87, 1.07)	62 per 100	60 per 100 (54, 66)	The study could not differentiate change in vaccine uptake between provider identification and reminders versus control.	Low
Provider reminders: physician reminders versus automatic vaccine order (RR >1 favours physician reminder)							
65 and over							
1 (Dexter 2004)	RCT	829	RR 0.61 (0.51, 0.72)	51 per 100	31 per 100 (26, 37)	Increased with automatic vaccine order.	Low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider reminders: hospital staff reminder versus GP reminder (RR >1 favours hospital staff reminder)							
65 and over							
1 (MacIntyre 2003)	RCT	128	RR 1.22 (0.92, 1.62)	55 per 100	67 per 100 (51, 89)	The study could not differentiate change in vaccine uptake between hospital staff reminder or GP reminder.	Very low

a. Cluster RCT data was adjusted by the investigators for clustering.
b. Cluster RCT data was not adjusted for clustering.
c. CORNET study
d. GR-PBRN study

1. The absolute risks are not calculable because the number of participants who received a vaccine was not provided.
2. This data can be pooled because each intervention arm had a separate control arm.

1 See appendix F for full GRADE tables

2

Sensitivity analyses (removing studies at high risk of bias)

Reminders interventions aimed at individuals or parents/carers to increase vaccine uptake

Table 8 GRADE table for reminders interventions compared to control without studies at high risk of bias

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Patient reminders (summary) reminder versus control (RR >1 favours reminder) **Pooled result**							
35 (See the 3 subgroups below)	RCT	274955	RR 1.16 (1.11, 1.21)	19 per 100	22 per 100 (21, 23)	Increased with reminder.	Very low
0-5 year olds							
19[a]	RCT	29033	RR 1.12 (1.05, 1.2)	36 per 100	40 per 100 (37, 43)	Increased with reminder.	Very low
11-18 year olds							
9[b]	RCT	209256	RR 1.10 (1.04, 1.17)	20 per 100	22 per 100 (21, 23)	Increased with reminder.	Very low
65 and over							
7[c]	RCT	36666	RR 1.75 (1.30, 2.36)	2 per 100	4 per 100 (3, 5)	Increased with reminder.	Very low
Patient reminders: who it was sent by: reminder versus control (RR >1 favours reminder) (same studies as previous meta-analysis)							
Reminder from a pharmacy							
1 (Stolpe 2019)	RCT	22301	RR 1.03 (0.8, 1.33)	1 per 100	1 per 100 (1, 1)	The study could not differentiate change in vaccine uptake between reminder or control.	Very low
Reminder from GP or primary care clinic (RR >1 favours reminder)							
9[e]	RCT	13757	RR 1.55 (1.14, 2.09)	13 per 100	21 per 100 (15, 28)	Increased with reminder.	Very low
Reminder from a regional health authority (RR >1 favours reminder)							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
10[f]	RCT	217477	RR 1.12 (1.04, 1.20)	18 per 100	20 per 100 (19, 22)	Increased with reminder.	Very low
Reminder from school nurse or school-based health centre (RR >1 favours reminder)							
2 (Tull 2019, Kempe 2012)	RCT	4648	RR 1.29 (0.87, 1.93)	85 per 100	109 per 100 (74, 164)	The studies could not differentiate change in vaccine uptake between school nurse / school-based health centre or control.	Very low
Reminder from a regional health insurance company (RR >1 favours reminder)							
2 (Lieu 1997, Rand 2015)	RCT	1925	RR 1.34 (1.01, 1.76)	15 per 100	20 per 100 (15, 26)	Increased with reminder.	Low
Patient reminders: (summary for HPV doses) reminder versus control (RR >1 favours reminder)							
Dose 1							
3 (Coley 2018, Szilagyi 2020 (2 comparisons))	RCT	193493	RR 1.11 (1.09, 1.13)	17 per 100	19 per 100 (19, 19)	Increased with reminder.	Low
Dose 2							
1 (Coley 2018)	RCT	162422	RR 1.28 (1.23, 1.34)	5 per 100	6 per 100 (6, 7)	Increased with reminder.	High
Dose 3							
1 (Coley 2018)	RCT	162422	RR 3.64 (1.01, 13.03)	0.004 per 100	0.01 per 100 (0.004, 0.05)	Increased with reminder.	High
Patient reminders: postcard versus control (RR >1 favours reminder) **Pooled result**							

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
4 (Bjornson 1999, Campbell 1994, Irigoyen 2000, Coley)	RCT	164347	RR 1.09 (0.99, 1.19)	14 per 100	15 per 100 (14, 17)	The studies could not differentiate change in vaccine uptake between postcard reminder or control.	Very low
0-5 year olds							
3 (Bjornson 1999, Campbell 1994, Irigoyen 2000)	RCT	1925	RR 1.03 (0.97, 1.10)	58 per 100	60 per 100 (57, 64)	The studies could not differentiate change in vaccine uptake between postcard reminder or control.	Low
Patient reminders: letter versus control (RR >1 favours reminder)							
Pooled result							
10 (See subgroups below)	RCT	17957	RR 1.3 (1.11, 1.52)	20 per 100	26 per 100 (22, 30)	Increased with reminder.	Low
0-5 year olds							
8 (Campbell 1994, CDC 2012, Dombkowski 2014 (3 separate arms), Hogg	RCT	11726	RR 1.13 (1.02, 1.26)	34 per 100	39 per 100 (35, 43)	Increased with reminder.	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
1998, Lieu 1997, Vivier 2000)							
65 and over							
2 (Otsuka 2013, Terrell-Perica 2001)	RCT	6231	RR 2.23 (1.72, 2.88)	3 per 100	6 per 100 (4, 7)	Increased with reminder.	Moderate
Patient reminders: telephone versus control (RR >1 favours reminder) Pooled result							
2 (Vivier 2000, Winston 2007)	RCT	2526	RR 2.20 (1.31, 3.69)	8 per 100	18 per 100 (11, 30)	Increased with reminder.	Moderate
0-5 year olds							
1 (Vivier 2000)	RCT	234	RR 4.73 (1.03, 21.45)	3 per 100	13 per 100 (3, 60)	Increased with reminder.	Moderate
65 and over							
1 (Winston 2007)	RCT	2452	RR 2.01 (1.60, 2.52)	8 per 100	17 per 100 (13, 21)	Increased with reminder.	Moderate
Patient reminders: autodialer versus control (RR >1 favours reminder) Pooled result							
5 (Linkins 1994, Stehr-Green 1993,	RCT	78930	RR 1.09 (0.97, 1.23)	21 per 100	23 per 100 (20, 61)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Szilagyi 2006, Szilagyi 2020)							
11-18 year olds							
2 (Szilagyi 2006, Szilagyi 2020)	RCT	48788	RR 1.01 (0.99, 1.04)	36 per 100	37 per 100 (36, 38)	The studies could not differentiate change in vaccine uptake between autodialer reminder or control.	Low
Patient reminders: text or 'electronic' message versus control (RR >1 favours reminder)							
Pooled result							
6 (Hofstetter 2015, Menzies, O'Leary, Rand 2015, Tull 2019, Otsuka 2013)	RCT	14418	RR 1.06 (1.00, 1.13)	64 per 100	68 per 100 (64, 72)	The studies could not differentiate change in vaccine uptake between text / 'electronic' message reminder or control.	Moderate
11-18 year olds							
3 (O'Leary, Rand 2015, Tull 2019)	RCT	10898	RR 1,06 (0.97, 1.14)	68 per 100	73 per 100 (66, 78)	The studies could not differentiate change in vaccine uptake between text / 'electronic' message reminder or control.	Very low
Patient reminders: telephone + mail versus control (RR >1 favours reminder)							
0-5 year olds							
5[d]	RCT	2844	RR 1.24 (0.98, 1.56)	19 per 100	24 per 100 (19, 30)	The studies could not differentiate change in vaccine uptake between telephone + mail reminder or control.	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Patient reminders: outreach reminder versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Hambidge 2009)	RCT	807	RR 1.33 (1.12, 1.59)	39 per 100	44 per 100 (37, 53)	Increased with reminder.	Moderate

a) Alto 1994, Bjornson 1999, Campbell 1994, CDC 2012, Daley 2002, Daley 2004, Dombkowski 2014 (3 comparisons), Hambidge 2009, Hofstetter 2015, Hogg 1998, Irigoyen 2000, Kempe 2001, Lieu 1997, Linkins 1994, Menzies 2020, Stehr-Green 1993, Vivier 2000
b) Coley 2018, Kempe 2012, O'Leary 2015, Rand 2015, Suh 2012, Szilagyi 2006, Szilagyi 2020 (2 comparisons), Tull 2019.
c) Hurley 2018, Hurley 2019, Otsuka 2013 (2 comparisons), Stolpe 2019, Terrell-Perica 2001, Winston 2007.
d) Alto 1994, Daley 2002, Daley 2004, Kempe 2001, Viver 2000
e) Alto 1994, Hogg, 1998, Hurley 2018, Hurley 2019, Otsuka 2013 (2 comparisons), Stehr-Green 1993, Szilagyi 2006, Winston 2007
f) Bjornson 1999, CDC 2012, Coley 2018, Dombkowski 2014 (3 comparisons), Linkins 1994, Szilagyi 2020 (2 comparisons), Terrell-Perica 2001
g) Campbell 1994, Daley 2002, Daley 2004, Hambidge 2009, Hofstetter 2009, Irigoyen 2000, Kempe 2001, O'Leary 2015, Suh 2012, Vivier 2000
h) Campbell 1994, Daley 2002m, Daley 2004, Hambidge 2009, Hofstetter 2015, Irigoyen 2000, Kempe 2001, O'Leary 2015, Suh 2012, Vivier 2000.

1 *Reminders interventions aimed at providers to increase vaccine uptake*

2 **Table 9 GRADE table for reminders interventions aimed at providers**

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Interpretation	Quality
Provider reminders (summary) reminder versus control (RR >1 favours reminder)							
0-5 year olds							
1 (Rodewald 1996)	RCT	1215	RR 1.00 (0.98, 1.03)	95 per 100	95 per 100 (93, 98)	The studies could not differentiate change in vaccine uptake between provider reminders or control.	Low

3 See appendix F for full GRADE tables

Qualitative evidence

Qualitative evidence referring the reminders for individuals, parents and carers (if appropriate)

Relevant findings taken from the barriers to and facilitators for vaccine uptake in evidence review B. For more details and additional findings please refer to this review.

Table 10 Summary of the key qualitative findings for reminders for individuals, parents and carers (if appropriate)

Population to be vaccinated	Finding	Confidence
People aged 65 years and older	People aged 65 years and over say that vaccines are not for them, they are either for children or for people older than they are. Also, if they agree to a vaccine, that is an admission of illness or old age. Therefore, they reject vaccines	Moderate
Pregnant women	Pregnant women say that telephone reminders from midwives are influential in convincing them to accept vaccines.	Moderate
Pregnant women	Some pregnant women are not aware that vaccines are part of routine healthcare during pregnancy.	Moderate
0-5 year olds	Afro-Caribbean and Somali parents* tolerated repeated opportunistic invitations to vaccinate or reminder cards for missed vaccinations because they realised that it was in the best interests of their child. * People who had lived in the UK for an average of 11 years.	Moderate
0-5 year olds	Parents and health visitors felt that parents are overwhelmed by the complex vaccination schedule and would prefer to have more time to consider vaccination with reminders to prompt them.	High confidence
0-5 year olds	Practice nurses were aware that it is easy for a parent to forget about immunisations and thought it was important for the practice to send reminder letters about appointments	Low
0-5 year olds (Travellers)	Parents who live on caravan sites and travel frequently have difficulty obtaining vaccination appointments. People on caravan sites said that appointment cards and information on vaccines does not reach them. This is a particular problem for people living on illegal camping sites who must change location every few weeks. Some have also been told by the surgery that they need a fixed address to secure an appointment.	Moderate
0-5 year olds	Some parents* perceived vaccination reminders as pressure to comply and thought they had no choice in vaccination * Parents from Pakistan or Somalia who had lived in the UK for an average of 11 years	Low
0-5 year olds (specific to the COVID-19 pandemic)	Nurses had to phone parents during the pandemic to encourage them to attend vaccination sessions as many were worried about attending practices during the lockdown. Some nurses reported that this was time consuming. However, they also thought it was beneficial because they could discuss other concerns that parents had about immunisations	Low

Population to be vaccinated	Finding	Confidence
11-18 year olds	Language and literacy can be a barrier to accessing written information and gaining informed consent. Immigrant parents* who spoke English as a second language stated that they were unable to understand the written information they were given about the vaccine. Some relied on their child to explain it while others sought information in their own language. Parents may also be unaware of the availability of information in languages other than English if this not publicised. *Immigrants were mothers from Somalia who had a migration date from 1990 or 2006 migration waves.	High
Studies spanning multiple age/ life stage categories	Language barriers can make communication between healthcare workers and parents who are from abroad difficult and this is compounded by the lack of availability of translators at consultations and information in languages other than English. Polish and Romanian immigrant parents* report difficulties in understanding medical terminology and would like information to be provided in their own language. Healthcare providers report that interpreting services are difficult to organise, can be impersonal and increase the time needed for a consultation, but agree that face to face communication using interpreters is preferable for certain groups who have low levels of literacy (such as Roma Romanian Traveller communities) and have a culture of oral communication. In addition, language difficulties can make it hard to obtain accurate vaccination histories for immigrants. *Polish and Romanian immigrants living in the UK (average time living in the UK was 11 years for Polish people and 9 years for Romanians in one study, 3 years or less in another study)	HIgh
Studies spanning multiple age/ life stage categories	Low levels of literacy act as a barrier preventing some Travellers and immigrants* from understanding written information about vaccines and appointment letters. Romanian Roma and some Romanians have low literacy levels and may struggle to read information even when it is translated into their native language. Low levels of literacy may also be found in older members of other Traveller communities, which may include the current generation of parents. As a result, Travellers and providers agree that simple written information with pictures may prove useful but verbal information is preferable. *Romanian immigrants living in the UK for 3 years or less	Moderate
Travellers, Polish and Romanian immigrants (all ages/ life stages)	Recall and reminder systems may need tailoring for Traveller and Polish and Romanian immigrant communities* to achieve maximum levels of vaccination. • Polish and Romanian families may miss appointments because they regularly visit their home countries. • Standard recall and reminder systems do not account for people who travel regularly, children who	Moderate

Population to be vaccinated	Finding	Confidence
	do not attend school, people who are not registered with GP, and those who rely on communal mailboxes. • Providers report identifying and targeting families that are hard to immunise by phone or text. Invitation letters and information are provided by schools. Midwives, health visitors and support workers remind people during home visits. Travellers said they received face-to-face reminders during appointments with healthcare staff. *Polish and Romanian immigrants living in the UK (average time living in the UK was 11 years for Polish people and 9 years for Romanians)	
Studies spanning multiple age/ life stage categories	In CQC 'outstanding' GP practices an escalating system of contact was used to help catch non-responders. Initially people received email, texts or letters (often automated), but if they did not book an appointment they were called by a member of the admin staff, then the practice nurse and finally the GP if this continued. Different approaches worked with different people, for example the elderly were thought to respond to contact from their GP.	Moderate
Studies spanning multiple age/ life stage categories	The CQC 'outstanding' GP practices noted the importance of planning ahead was emphasised across all interviews as important facilitator for vaccine uptake. <u>This involved identifying eligible children in advance and contacting parents to make appointments</u> and ensuring records are up to date to facilitate identification. For example, one practice booked the 8 week vaccinations at the 6 week baby check, another discussed childhood vaccinations at antenatal clinics where vaccination for pregnancy were administered.	Moderate
Note: where findings are more complex and cover multiple facilitators the relevant interventions for the reminders review are underlined.		

Qualitative evidence referring the reminders for providers

Relevant findings taken from the barriers to and facilitators for vaccine uptake in evidence review B. For more details and additional findings please refer to this review.t B.

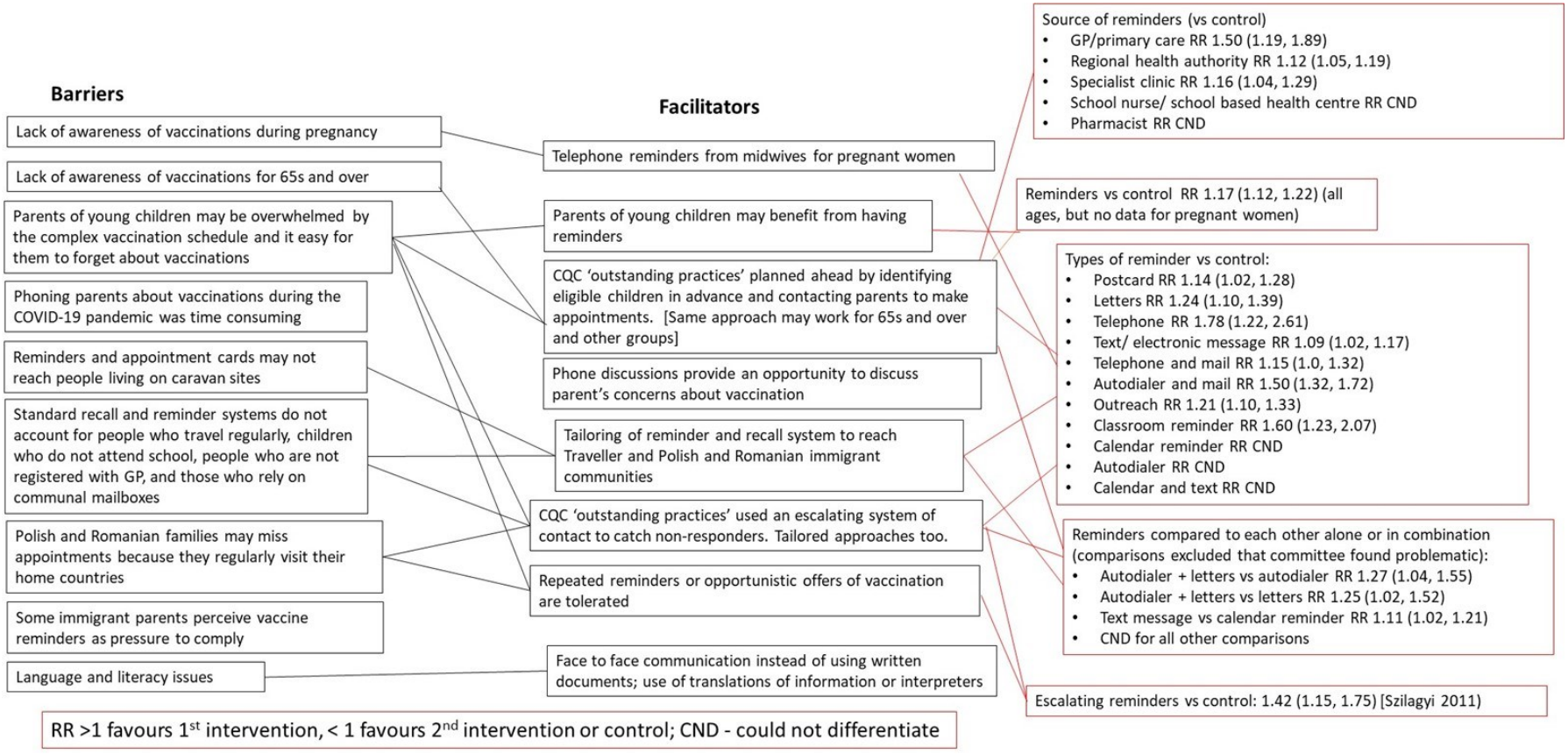
Table 11 Summary of the qualitative findings for provider reminders

Population to be vaccinated	Finding	Confidence
Studies spanning multiple age/ life stage categories	The CQC 'outstanding' GP practices report having well trained, designated staff who were up to date with current guidance on vaccinations was linked to increased uptake by staff. The designated individuals, including administrative staff as well as nurses, were responsible for vaccinations and accountable to practice managers. Regular training events and updates on the latest guidance were in place in all practices <u>and having the latest vaccine guidance embedded in the IT system to automatically prompt clinicians was thought to be helpful</u>	Moderate confidence, downgraded once for adequacy
Note: where findings are more complex and cover multiple facilitators the relevant interventions for the reminders review are underlined.		

Mixed methods summary of the quantitative and qualitative evidence for reminders for individuals, parents or carers (as appropriate)

The barriers and facilitators in the diagram are summarised versions of the findings that were considered to be the most important from the qualitative evidence relating to reminders presented in Table 10. Possible links between barriers and corresponding facilitators are shown in the diagram, with the quantitative evidence mapped onto the related qualitative themes. See section 1.1.3 Methods and process for more details.

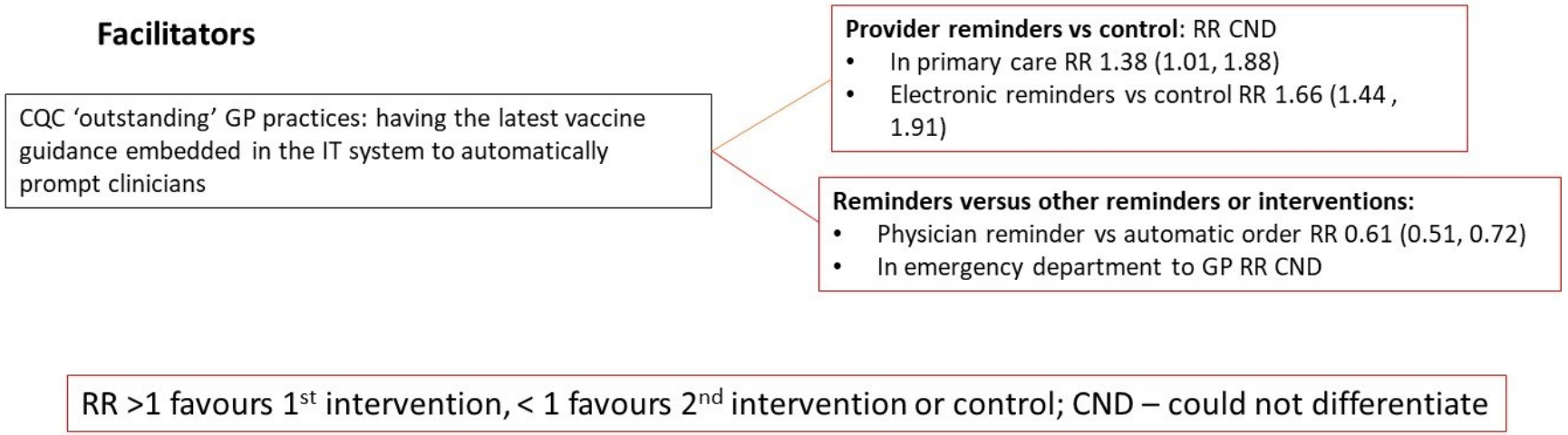
Figure 1 Diagrammatic summary of the barriers and facilitators to vaccine uptake with interventions mapped onto the facilitators they relate to. RR= risk ratio.



Mixed methods summary of the quantitative and qualitative evidence for reminders for providers

The barriers and facilitators in the diagram are summarised versions of the findings that were considered to be the most important from the qualitative evidence relating to reminders presented in Table 11. Possible links between barriers and corresponding facilitators are shown in the diagram, with the quantitative evidence mapped onto the related qualitative themes. See section 1.1.3 Methods and process for more details.

Figure 2 Diagrammatic summary of the barriers and facilitators to vaccine uptake with interventions mapped onto the facilitators they relate to. RR= risk ratio. (No barriers were raised in the qualitative evidence that directly applied to provider reminders.)



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 inclusion criteria for any review question. Inclusion was restricted to cost-utility analyses from OECD countries comparing interventions to increase vaccine uptake for vaccines in the UK immunisation schedule as described in the green book. Four published economic analyses were included in the evidence synthesis.

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

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

1.1.7.1 Included studies

Of the 11 cost-utility and cost-effectiveness papers included across the guideline, 3 were judged to be most relevant to this question on reminders and are included in this review. 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

Across all the review questions included in the guideline, 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 of these studies looked at the 4 Pillars Program compared with no program, one looked at a contingency management scheme and one looked at a community outreach initiative. None of the identified cost-utility studies looked at reminder interventions.

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 across all the review questions included in the guideline. Of the six studies in children/adolescents, two reported cost-benefit ratios as an outcome, with the remaining four studies reporting a form of cost per additional vaccination. All studies were rated as only partially applicable, and had potentially serious limitations, so may be of limited value in informing recommendations. Three of these studies reported outcomes for reminder interventions.

Reminders (patient)

Study	Comparators	Incremental cost	Incremental outcomes	Cost-effectiveness	Uncertainty	Applicability	Limitations
Dini 2000 US Public sector Three reminder/recall interventions; (A) telephone and letter reminders, (B) telephone reminders only, (C) letter reminders only Children 60-90 days who had received the first dose of DTP and/or polio vaccines	(D) no reminders	Compared with control (D) (A) $4738 (£4,945 2021 GBP) (B) $4300 (£4,488 2021 GBP) (C) $2254 (£2,352 2021 GBP)	Immunisation coverage at 24 months compared with control=40.9%: (A): 9.3% (B): 8.4% (C): 7.3% Any intervention: 8.3% Immunisation coverage at 24 months in subjects]with confirmed receipt of the	Cost per additional child in Group A completing the immunization series by 24 months was $226 (£236 2021 GBP). After discounting for start-up costs, the cost for each additional child completing the series was $79 (£82 2021 GBP) by 24 months of age.	No sensitivity analyses were conducted, no uncertainties were explored.	Partially applicable	Potentially serious limitations

Study	Comparators	Incremental cost	Incremental outcomes	Cost-effectiveness	Uncertainty	Applicability	Limitations
			intervention compared with control=46.8%: (A): 14.2% (B): 9.8% (C): 10.0% Any intervention: 11.3%				
Franzini 2000 US Private medical providers Appointment reminders by mail (postcard) or autodialer Children <12 months old who are eligible for their first, second or third diphtheria/tetanus/pertussis vaccine	No reminder	Cost per visit compared with control Study cost: Mail: $17.69 (£18.46 2021 GBP) Autodialer: $8.37 (£8.74 2021 GBP) Physicians cost: Mail: $9.52 (£9.94 2021 GBP) Autodialer: $3.48 (£3.63 2021 GBP) Cost with registry: Mail: $9.52 (£9.94 2021 GBP) Autodialer: $3.48 (£3.63 2021 GBP))	Additional number of children immunised compared with control per 1000 children: Mail: 161 Autodialer: 224 Number of children immunised per 1000 children: Mail: 797 Autodialer: 860 Control: 636	Incremental cost per child immunised (compared with control): Study cost: Mail: $23.84 (£24.88 2021 GBP) Autodialer: $9.77 (£10.20 2021 GBP) Physicians cost: Mail: $12.82 (£13.38 2021 GBP) Autodialer: $4.06 (£4.24 2021 GBP) Cost with registry: Mail: $12.82 (£13.38 2021 GBP) Autodialer: $4.06 (£4.24 2021 GBP)	Sensitivity analyses were conducted around life expectancy of the autodialer and costs surrounding the autodialer.	Partially applicable	Potentially serious limitations

Study	Comparators	Incremental cost	Incremental outcomes	Cost-effectiveness	Uncertainty	Applicability	Limitations
Lieu 1997 US Private healthcare provider Reminder/recall - personalised letters with the recommended schedule and a request to book an appointment. Children who had reached 20 months of age and had not received the MMR vaccine.	Usual care - no routine recall letter	Total cost of recall intervention was $5,031 per year (£5,602 2021 GBP)	54% of the intervention group and 35% of the control group received the MMR vaccination by 24 months of age. The relative effectiveness of the intervention was 1.55. It was calculated in the paper that an additional 4% of the population would be immunised if the recall letters strategy was implemented.	Cost per child appropriately immunised (i.e. receiving the MMR vaccine by age 24 months): $4.04 (£4.50 2021 GBP)	Sensitivity analyses were performed to evaluate how projected CE varied depending on key assumptions; relative effectiveness, baseline coverage rate, cost of computer time. An alternative scenario was used to project cost-effectiveness of using a telephone autodialer for recall messages instead of letters, with certain costs altered but effectiveness kept constant.	Partially applicable	Potentially serious limitations

1

1.1.9 Economic model

The committee discussed the use of direct conversations to reach parents of infants that are behind on their vaccinations, and since this is anticipated to have a potential resource impact a costing analysis was undertaken. This analysis used assumptions around staff time, costs and uptake numbers. The cost per additional person vaccinated (i.e. receiving all the relevant vaccination at a single vaccine appointment) when this direct contact intervention is used is estimated to be £8.40. Further details of this analysis are provided in Appendix I.

1.1.10 Unit costs

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

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

1.1.11 The committee's discussion and interpretation of the evidence

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

1.1.11.1 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 professionals 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 committee noted that the quality of the evidence for reminders aimed at individuals, parents and carers or providers was generally low or very low. This was due to:

- High levels of inconsistency in the meta-analyses. Inconsistency was expected when pooling all reminders for individuals, parents and carers versus control. This is because there is heterogeneity between the interventions which included letters, phone calls and outreach interventions. There was also inconsistency between the effects of interventions of the same type, such as postcards versus control. This may reflect differences in the contents of the reminders, or the

numbers of reminders used. Some of this heterogeneity may also exist because the initial invitations for vaccination were included in the same analysis as the recall interventions that were used when the vaccine was overdue. The populations therefore varied between studies.

- Many studies being judged to be at moderate to high risk of bias. These studies had poor randomisation processes or lacked information about participant randomisation and allocation. Some also had a lack of information about assessor blinding and how the data was collected, or the study did not follow a clearly defined process for collecting data that (for example, using data from a single registry).

The committee agreed with the authors of the Cochrane review (Jacobson Vann, 2018) that results from cluster RCTs should be presented separately to RCT data, and without meta-analysis because it was unclear whether the adjustments made for clustering by the individual trials accounted sufficiently for the effects on the vaccination rates of family members if they were also included in the trial. In addition, where trials presented unadjusted results it was unclear how suitable adjustments for the effects family could be made by the reviewers as the size of this effect was undetermined.

Data was only available for one of the outcomes specified in the protocol (vaccine uptake). None of the studies presented data on the numbers of vaccination offers from providers or the numbers of people who develop the diseases the vaccines are aimed at preventing. The committee did not think this was a major issue, as they thought that the most important outcome was vaccine uptake as this directly represents how many people were vaccinated following each type of intervention.

Reminders for individuals or parents/carers

In this review the term ‘reminders’ included both the initial invitation/call to be vaccinated and the reminder/recall if vaccination was overdue unless otherwise specified.

Most studies were based in the USA, and vaccine uptake in the studies was low compared to vaccine uptake in the UK. The committee did not believe this was due to the location of the studies, as vaccine uptake in the USA is comparable to the UK. Instead, this may be partly explained by the grouping of initial invitation studies (prompting people who are due to be vaccinated, for example Goodyear-Smith 2012) and recall studies (prompting people who are overdue to be vaccinated, for example Daley 2004) in the same analyses in this review. The committee expected uptake to be higher for the studies where the intervention was an initial invitation and lower for the studies that were recalling people who were overdue for vaccinations. This is because recall studies often involve people who are more difficult to reach or have decided against being vaccinated. Some studies included both initial invitation and recall in the same intervention arm (Hoekstra 1999), while others reported them separately (Dombkowski 2014).

Some studies involved primary practices that had a population that were known historically to have a low vaccine uptake. For example, Campbell 1994 involved children from predominantly poor urban areas, of which 71% received Medicaid. The committee also discussed how shorter follow-up periods are likely to be associated with lower rates of vaccine uptake. These factors together may account for some of the heterogeneity seen in many of the meta-analyses.

Although there were a few studies that compared the wording of one reminder to another, the committee thought that the evidence was insufficient to determine the most effective wording to encourage vaccination. For example, Hawe 1998

compared a health belief worded postcard to a neutrally worded postcard. However, there were differences between the 2 postcards other than the style of wording, with each including different facts and only the health belief worded postcard mentioning that the vaccine was free. The committee agreed that these components, in addition to the style of wording, could be influential. With limited evidence on the most effective wording styles in both this review and the education review (evidence review E), the committee decided to make a research recommendation aimed at establishing the effectiveness and acceptability of different types of content in a vaccination invite letter (see evidence review E – Appendix K). This should provide greater understanding of whether there is a particular way of wording a vaccination invite that could encourage more people to be vaccinated.

The committee noted that many of the studies were relatively old and the methods of invitation and recall they used did not reflect the use of modern technology. For example, there were more studies that used autodialers than text messages whereas text messages are now used more commonly than autodialers in current practice. As such, the committee did not think the interventions used in the studies were an accurate reflection of the methods of invitation and recall used by UK practice.

There was a lot of evidence for reminders aimed at increasing vaccination of 0-5 year olds and 11-18 year olds, and funnel plots indicated that there were no evidence of publication bias. However, there were fewer studies that looked at people aged 65 years and older and none were identified that targeted pregnant women. The committee therefore used their expertise to decide whether any interventions could also be applied to the groups where there was limited or no evidence (see the advantages and disadvantages section below for more details).

There was also little qualitative evidence for the barriers and facilitators for uptake that referred to reminders aimed at individuals, parents or carers in evidence review B (reproduced in the qualitative evidence section above).

Reminders for providers

There was very little evidence available for provider reminders, particularly in relation to reminders for GPs. With regards to provider reminders used in Shevlin 2002 and Dexter 2004, the committee agreed that standing orders (automatic vaccine orders) are not applicable to the UK.

The committee thought that the studies that had reminders for hospital and emergency department staff had relevance to the “every contact counts” principle. This form of reminder means that every time people visit a hospital it can be used an opportunity to check whether vaccinations are up to date even though hospitals and emergency departments are not involved with organising routine vaccinations. (Opportunistic identification and offers of vaccination are discussed in more detail in evidence review A on the identification and recording of eligibility and status and in evidence review D on increasing vaccine uptake by improving access.)

There was no evidence on the effectiveness of reminders for providers relating to vaccination of pregnant women. There was also no data available about offers of vaccination or cases of disease. In the committee’s experience there is variability with regards to the numbers of offers that GPs and other providers make. This gap in the data meant that it was unclear whether the use of a provider reminder translated into an increase in offers of vaccination by the providers. If there were no increase in offers, then it would not be surprising if the intervention also failed to be effective in increasing uptake.

There was very little qualitative evidence for the barriers and facilitators for uptake that referred directly to reminders aimed at providers in evidence review B (reproduced in the qualitative evidence section above).

1.1.11.3 Advantages and disadvantages

Invitations and reminders for individuals, parents or carers (as appropriate)

The committee decided to make recommendations for the use of reminders for all age groups and life stages. This is because the meta-analyses demonstrated that reminders increase uptake versus control for all subgroups for which there was data. This matched the committee's experience that it is important that people are informed when their vaccinations are due or overdue to prompt them to seek vaccination. For people to not be issued invitations or reminders was considered counterproductive.

For vaccine recommendations to be effective at increasing uptake there needs to be named people in charge of the vaccination programmes. This includes ensuring that eligible people are identified, that invitations and reminders are sent at appropriate times and using appropriate methods, and that vaccination clinics or appointments are organised and vaccines administered. This also involves ensuring that there is co-ordination between providers and other groups who are involved in commissioning and organising vaccinations. The committee thought that each organisation that is involved in the process of administering vaccination or organising vaccinations should have a named immunisation lead or group of leads. These people would not necessarily carry out the vaccine related tasks themselves but would retain overall responsibility for their successful and timely completion. This is particularly important in settings such as GP practices to ensure that the recommendations made in this guideline and the requirements of the GP contract concerning vaccination are fulfilled. The committee had already made a recommendation about having named lead (see evidence review A for more details) and based on the evidence in this review concerning the effectiveness of invitations and reminders they added these actions to it.

The committee were aware that the process of coordinating invitations and reminders differs across the country. They agreed that the process of reminding people about vaccinations should be coordinated at the local level among providers and it should be made clear which group or groups are responsible for sending reminders in each local area to prevent duplication of effort and confusion. The committee thought that the merging of Clinical Commissioning Group (CCGs) in some areas may make this co-ordination easier.

Some of the studies reported that large numbers of recipients could not be contacted. Some participants had telephones that could not receive text messages, some telephone numbers were out of date, and some addresses were incorrect. In addition, the committee noted that some recipients might have difficulties in reliably receiving mail and that this method of contact might not be suitable for groups such as Travellers who may move frequently and have communal mailboxes. In contrast, other studies only included people with current contact details. Taking these points into account, the committee specifically recommended that contact details of recipients should be kept up to date in their medical records and that preferred methods of contact should be ascertained and recorded. As the initial method of contact should be the least resource intensive options (such as a text message or email), the committee thought it would be helpful to be able to choose from a list of suitable methods to contact a particular individual. The qualitative evidence highlighted the importance of language and literacy issues as additional barriers to vaccine uptake. It is therefore useful if literacy issues or language requirements are

also stated in the medical records to facilitate effective contact with these individuals, their families and carers (as appropriate). (See also evidence review A for more discussion about the importance of keeping medical records up to date and evidence review E for more discussion about language and literacy barriers to uptake.)

The committee agreed that it is important to invite eligible people to be vaccinated in advance of the vaccination due date. The committee noted that most types of reminders were effective at increasing uptake compared to control, including postcards, letters, phone calls, texts, outreach, and combinations of reminders (phone call and mail, autodialer message and letter). In addition, most of the results could not differentiate between different types of reminders, although these results were often based on data from single studies. Some comparisons also had conflicting results, such as autodialer and letters compared to autodialer or letters, where there were differences between the results from the RCTs and the cRCTs. This made it hard to draw firm conclusions about the benefits of these combination interventions.

The 2019 GP contract lists letters, emails, phone calls, texts or the digital personal child health record 'red book' as appropriate methods of reminders and recall. The committee agreed with these methods and noted that in their experience there was a move towards using text message reminders but that other methods of contact, such as by email, are also acceptable and may prove more suitable for certain individuals. However, they noted that the digital 'red book' is not currently available in all areas and so this was not included in the recommendations as a method of reminders. They also suggested that contact could be made via the local CHIS on behalf of the GP, in areas where they are commissioned to do this,. The committee discussed other methods of invitations and reminders and highlighted how reminders communicated face-to-face are also likely to be effective for some groups. This form of reminder is commonly used by midwives to recommend vaccination during antenatal appointments.

The committee were interested in understanding what made a successful reminder intervention (mode of messages, contents, choice of wording, signature from trusted person etc.) but the interventions reviewed were very varied and, in many cases, did not specify details about the contents the of reminder messages. The evidence was also less clear concerning who should provide the reminder for different groups of people. There was a lot of heterogeneity between the studies but when the results were pooled, reminders from GPs or primary care, regional health authorities and specialist clinics were more effective at increasing vaccine uptake than control. Reminders from a regional health insurance company were also more effective than control but this evidence was not relevant to UK practice. However, although reminders were clearly effective, there was not sufficient evidence to determine which is the most effective source of the reminder to increase vaccine uptake.

The quantitative evidence highlighted the importance of reminders but did not provide a clear indication of who should send the reminder or what the reminder should say. As a result, the committee used a combination of the their experience, the qualitative findings, the 2019 GP contract section on vaccination reminders (see p93 onwards) and the 2020/2021 enhanced service specifications for pertussis vaccination of pregnant women and pneumococcal vaccination to develop recommendations.

The committee discussed whether the invitation should come from a healthcare practitioner who is known to the recipient such as a GP or practice nurse. It was noted that the Health Belief Model reminder in Hawe 1998 (which was more effective at increasing vaccine uptake than a neutrally worded reminder) included the signature of the GP. The committee agreed that this could have been significant

because the qualitative evidence (evidence review B) suggested that receiving advice from a trusted source is important and that GPs and practice nurses are often trusted because they have established a relationship with the recipient. In addition, in the committee's experience a letter from a specific GP is more effective that a generic invitation or reminder from a centralised source, such as a CCG. The committee noted that the inclusion of a signature from a GP or other healthcare professional who is known to the recipient would also be possible if the reminder was sent out at a CCG level.

Although receiving invites and reminders from a GP or nurse may be effective for many people, there are some people who do not have a long-term relationship with a specific GP. People in rural areas may also have more contact with the same practitioner than people in larger inner-city practices. In addition, people with young children, chronic conditions and the elderly are more likely to use primary care regularly than other age groups and are therefore more likely to have good relationships with staff at their GP surgery. The committee also noted that the medical records used to generate reminders may not reflect the GP an individual has most contact with. With this in mind, they decided to specify that a recognised provider or service should issue invitations and reminders for vaccinations rather than a named individual provider. This was a weaker 'consider' recommendation because of the lack of strong quantitative evidence of benefit and due to differences in the format and sources of reminders between regions that might make it hard to implement this recommendation successfully in some areas. Specifically, they noted that some areas use standardised reminders from a more centralised service that may be difficult to personalise, whilst in other areas reminders are provided by GP practices directly. The qualitative evidence also indicated that other health professionals (such as midwives) are trusted and may have more contact with certain groups of people such as school aged children, very young children and pregnant women. As a result, the committee included a range of healthcare professionals in the recommendation.

The committee discussed the contents of the invitations, including what information they should provide about the vaccinations. They made recommendations about this during the examination of evidence for education/ information interventions (see evidence review E for more details about the recommendations and the committee discussions about education/ information.)

The committee noted that there was an absence of evidence for the effectiveness of vaccine reminders for pregnant women but agreed that the same process of invitation, reminder and then additional reminders should apply to pregnant women as to the other groups where there was more evidence. However, women usually have more contact with their midwives during pregnancy than GPs and as a result, they can also receive in person reminders from their midwife during these appointments. The committee agreed that ideally there would be at least one mention of vaccinations at an early stage in the pregnancy followed by discussions nearer 16-weeks into the pregnancy. The green book recommends pertussis vaccination during a 16- 32 week window. The committee noted it can still be given later, although it may only protect the baby indirectly by protecting the mother from infection after this stage. The committee made 2 recommendations about inviting pregnant women for vaccination. The first was included in the invitations section of the guideline and was aimed at ensuring that maternity services and other healthcare professionals, such as health visitors and GPs, who have contact with pregnant women invite them for vaccination. It is expected that this would an in-person invitation during a consultation, but it could be by another method if more appropriate. They included a second recommendation in the section on opportunistic identification to highlight the importance of midwives offering vaccinations opportunistically during antenatal

appointments. In both cases, if the vaccination cannot be carried out during that contact then the committee agreed that it would be appropriate to signpost the person to vaccination services instead.

The committee agreed that although many people respond to invitations for vaccination, other do not or fail to attend scheduled clinics or vaccination appointments, and in these cases a reminder is required. The committee recommended that these people should be identified and be sent a reminder. This reminder could be the same format as the initial invitation or could be another option with a similar level of intensity. However, as it may be the case that the original invitation had not been received, they agreed that receipt of the reminder invitation should be confirmed.

When discussing reminders, the committee noted that the urgency of the recall for missed vaccinations varies for different groups of people. They thought that:

- If a parent of a child aged 0-5 years does not respond to an invitation for vaccination, recall should be an automatic process and sent soon after a vaccination is missed. The committee thought that further delay may validate deferring vaccination in the minds of some parents. This could lead to the parents delaying subsequent vaccinations, which would expose the child to a higher risk of contracting the diseases the vaccines aim to protect against.
- For people aged 65 years and over, reminders are less time sensitive because these people can be vaccinated for shingles and pneumonia over a period of several years. The optimal time period for these vaccinations was unclear from the evidence and so the committee decided against recommending a specific time scale for this.

The committee did not include time limits for reminders for the above groups, however the short time window for the reminder for parents of 0-5 year olds is implicit because they did set time limits for escalation of contact (see below) for this group.

For pregnant women, pertussis vaccination is recommended between 16-32 weeks in the green book. The committee therefore agreed that reminders/offers should be given in person by antenatal care providers (including midwives and GPs) at every antenatal appointment and opportunistically during contact with GPs after the initial vaccination invitation or offer of vaccination if the woman remains unvaccinated.

If the person still does not respond after being sent a reminder, the committee agreed that there should be an escalating system of contact to remind people about vaccinations that are due. By this the committee meant that initial methods of inviting and reminding people to be vaccinated should not be labour intensive or costly (such as using text messages or emails). For people who continue not to respond, escalating reminders may involve for example, a phone call from a GP receptionist initially, then a phone call from the practice nurse if needed and finally the GP until the person is vaccinated or declines vaccination. The committee agreed that using practice nurses and GPs to deliver reminders is more costly than using a receptionist and would divert them from seeing other people and so these staff members would not be used unless other reminders failed. The committee thought that this approach was suitable for all of the age groups and life stages who are vaccinated based on the routine schedule, although the people providing the reminder may vary.

Using escalation of contact was supported by the qualitative evidence, with a study of CQC ‘outstanding’ GP practices reporting that this is used as a facilitator to increase vaccine uptake. There was also some quantitative evidence to support this. Two quantitative studies (Szilagyi 2011 and Hambidge 2009) also favoured forms of

escalating contact over control. However, it is unclear whether a more intensive method of contact is more effective than other forms of reminders as there was limited evidence comparing different types of reminder interventions. Although there was limited evidence, the committee were still confident that direct contact was useful as this can enable questions about the vaccination to be addressed and thus facilitate uptake. Taking the limited evidence into account and the increased cost of more direct contact, the committee made a weaker 'consider' recommendation in relation to escalation of contact to a direct phone call for pregnant women and older people (see future proofing the recommendations for a definition of this term and the rationale for not using people aged 65 and over in the recommendation). They agreed that when contact is made it is important to identify the reasons for a lack of response, and to try to address any barriers to vaccination, such as a lack of information, concerns about vaccine safety or problems with accessing vaccination services. However, given the importance of vaccinations to protect babies and young children from infectious disease that could kill them or make them very sick the committee made a stronger recommendation for a conversation with parents or carers (as appropriate) of children aged 5 or under who have not responded to a reminder. They also agreed that because of the number of vaccinations for babies and young children it was essential that any delay in vaccination was identified and tackled rapidly. For is reason they recommended that the conversation is held if the delay is approaching 1 month for babies; 2 months for toddlers and 3 months for young children who miss their preschool boosters.

In addition to escalation of contact, the committee included the option to take a multidisciplinary approach because involving other healthcare professionals such as health visitors could increase the number of opportunities for a reminder to be delivered and therefore increase the likelihood of the vaccinations being accepted. Social workers and key workers could also be included as part of the multidisciplinary team as they may be able to facilitate vaccination of the individuals they work with, but the committee noted that they might not feel equipped to discuss vaccinations. (However, the committee recommendations on vaccine education for, social care practitioners and healthcare practitioners who do not provide vaccinations may help to overcome this difficulty. See evidence review E for more details) Although the committee thought that a multidisciplinary approach may help facilitate vaccination for some people, they thought it was important to highlight that people's wishes should be respected if they still decide against vaccination for themselves or their children.

The committee discussed that there is no evidence from the studies or from their experience that reminders do harm in most cases. However, the committee were concerned that escalating contact for recipients who do not want to be vaccinated could lead to them hardening their anti-vaccination views and could waste resources. The committee therefore recommended that declined vaccinations should be recorded on the individuals' medical record and no further invitation for that vaccination should be offered. However, the committee noted that in many cases when contact is made and people refuse vaccination, it is hard to judge whether this is an informed choice or due to misunderstandings, a lack of information or unwillingness to engage with the healthcare provider. The committee agreed that in the case of adults they would accept a clear refusal, but where childhood vaccinations are concerned they would ensure that the GP or a senior nurse has a conversation with the parents before accepting a refusal. They included a statement in the recommendations to emphasise that people who decline vaccinations should be made aware that if they change their mind then they can receive the vaccination at any time. They also recommended that the reason that vaccination was declined is recorded because this could provide information for future discussions to try to

address why the person declined vaccination and overcome any barriers. If this information is available at a population level this could help public health teams locally or nationally when designing strategies to increase vaccine uptake by targeting key barriers for the general population or specific subgroups.

Inviting people to vaccinations, and reminding them when necessary is a key part of the routine vaccination programme. The committee agreed that it is also crucial that any vaccination offers and administered vaccinations are recorded. They were confident that the necessary recommendations had been made about this based on the evidence in the identification review (see evidence review A). Recommendations on what should happen when someone is identified opportunistically were also made in the identification review and the committee were satisfied that these covered the important stages that followed on from the recommendations about opportunistic invitations made in this review.

Reminders for routinely offered school-based programmes

The committee agreed that although school-aged vaccination programmes have sufficiently different processes that they require a separate set of recommendations, the main stages of the process are the same as for the other age groups/ life stages and involve an initial invitation for vaccination, a reminder and then an escalation of contact for non-responders. Based on their experience, initial invitations including consent forms are sent via the school on behalf of the immunisation providers. The qualitative evidence highlighted the importance of the immunisation provider working with the school to send the invitations, and to organise and run the vaccination clinics (see evidence review B). The committee made a recommendation to reflect this as part of evidence review D on improving access. In addition, the qualitative evidence in evidence review B and evidence review J highlighted that young people also wanted to be involved in decision making about consenting for vaccinations. The committee therefore noted that the format of the invitation should be accessible to parents, young people and secondary school-aged children.

In the cases where a consent form is not returned, then the provider should send a reminder. Even with invitations and standard reminders, there will still be some young people who do not return a consent form. The committee discussed other ways to encourage these families to return consent forms and thought that contact from other health and social care providers who already know the family, such as school nurses, could be helpful. In addition, they considered the use of incentives for the return of consent forms as part of the discussions about the acceptability and effectiveness of specific interventions and made a recommendation for this (see evidence review J for more details). If consent has still not been received, then a more direct method of contact (a phone call) can be made prior to vaccination day or even on vaccination day if there is time.

The committee revisited the qualitative evidence (evidence review B) about gaining consent for vaccination of adolescents. They noted that some adolescents are Gillick competent. NHS.uk defines this as the following: ‘Children up to the age of 16 can consent to their own treatment if they are assessed to have the competence and understanding to appreciate what it’. In these cases, the committee agreed that the adolescents could consent to accept the vaccination directly rather than requiring consent from a family member or carer. However, the qualitative evidence suggested that some school immunisation providers lacked confidence in their ability to assess Gillick competence and were uncomfortable about going against the wishes of family members or carers if there was a conflict between them and the adolescent. The committee agreed that this could be problematic and that the immunisation providers should be trained to deal with these issues. These issues are discussed further, and

additional recommendations are made in relation to the assessment of Gillick competence, in evidence review J.

As part of the escalation process for school-based vaccinations, the committee agreed that if they are not able to make contact to obtain consent using a phone call, then it may be appropriate to involve other health and social care providers who may already be involved with the family to help gain consent.

Where young people miss their vaccinations it is essential that there is a system in place to ensure that they are identified and invited again for vaccination. The committee agreed that providers should have a system in place to ensure that pupils can catch up with missed vaccinations. They discussed this issue further in the access review (evidence review D) and made a recommendation there for catch up sessions to be offered to young people who are not up to date with their routine vaccinations. The school based catch-up sessions could take place later in the same school year or in subsequent years. Alternatively, catch up sessions could be held outside the school in other premises such as clinics or community centres.

Reminders for providers

There was little evidence for the effectiveness of provider reminders and although they were effective for vaccinations for people aged 65 years and over the pooled results could not differentiate uptake when provider reminders were used compared to control. However, when the provider reminders were limited to those using electronic medical record there was an increase using the reminders versus control. The committee discussed how providers use electronic reminders in practice. They noted that GPs may receive multiple reminders and cease to pay attention to them. Nevertheless, the committee agreed that healthcare professionals sometimes take notice of these prompts. They therefore included them in the recommendations as part of the process for opportunistic identification of eligible people (see evidence review A for more detail about opportunistic vaccinations).

The committee also looked at evidence on a multicomponent intervention that included provider prompts, (with assessment and feedback) and was effective at increasing vaccine uptake (Fiks 2013, see evidence review H for more details). Other recommendations the committee had made as part of the infrastructure review (evidence review G) covered the use of assessment and feedback for providers and the committee agreed that the evidence from this study provided additional support for the recommendation about using provider prompts.

The committee highlighted that midwives based in medical practices use the same computer system as GPs and could therefore use a similar system of clinical prompts to remind them to offer vaccinations to pregnant women, or to signpost them to vaccinations if they cannot administer them at that time. In hospitals, vaccination status is sometimes logged in antenatal records and reminders could potentially be flagged there.

In some cases, it may be appropriate for one healthcare professional to send a reminder to another on behalf of a patient to trigger the second professional to invite the individual for vaccination. For example, medical staff in hospitals or specialist clinics may be in a position to provide a GP with additional information about a person’s medical condition that makes it clear that vaccination is indicated despite perceived contraindications that would otherwise prevent the GP from offering this service. This is particularly important for babies discharged from neonatal intensive care units and special care baby units.

1.1.11.4 Cost effectiveness and resource use

The economic evidence identified for reminder interventions was not used directly by the committee to make recommendations, as they agreed that were not sufficiently applicable as to provide reliable evidence (all the studies were from the US and over 20 years old). The committee used their expertise and experience, and where relevant a costing exercise, to help inform discussion around the resource impact of the recommendations made.

Reminders for individuals, parents or carers

Some of the recommendations discussed by the committee were unlikely to have any considerable resource implications, for example the committee recommended providing vaccination reminders in an appropriate format, which would likely be via a system already used at the provider location (e.g. text messages, mail). Another recommendation the committee made was on what the content of the reminder messages should be, which is anticipated to be of low resource impact. For example, including links to additional information about the vaccinations, including an invitation to book appointments, and making the message more personalised (using routinely available information).

The committee discussed the importance of ensuring patient records are up to date to facilitate contact, which is straightforward for those individuals that have a stable address and contact details, but may require more intensive outreach for groups who have frequent changes of address. This may involve collecting up to date contact information by contacting people by phone but may also require in person visits to for some hard to reach individuals which would be more resource intensive. However, the committee noted that this would be in a small proportion of the population, and would often consist of people from hard to reach/underserved groups who it was agreed are important to access, as these same groups often had lower vaccination rates. The collection of contact information is not only necessary for vaccine reminders, but for various health care needs, so any resource impact would be shared across these areas and have a broader benefit than just for vaccination reminders.

The committee recommended that, for people who live in care homes or residential settings, the invitation for vaccination is sent to the eligible person or carer as applicable. This recommendation is unlikely to require additional resources, and any issues around having the correct contact information for carers should be captured when ensuring patient records are up to date.

The committee discussed using an escalating series of reminders for patients that do not respond. They noted that there was an additional cost of these more intensive methods of contacting people, compared to those used earlier in the process, in particular an increase in the amount of staff time required. However, they were confident this represented an appropriate use of NHS resources because the group that would need to be contacted this way would be small, and would contain many people from groups or communities with lower vaccination rates, where it was felt to be very important to increase uptake. Use of escalating reminders would also require keeping a record of the reminders received by the individual, although this likely has a minimal resource impact as this information could be noted on the patient record when the reminder has been given.

The committee noted that it is important that vaccinations in infants and toddlers are given on time and wanted to recommend that a direct conversation should be held with parents/carers if these vaccinations are delayed. These direct conversations would be associated with additional costs for staff time and potential resource use, so

a costing analysis was undertaken and presented to the committee, detailed in Appendix I. Based on this analysis the average cost per additional person vaccinated when using this direct contact intervention was estimated to be £8.40. The committee felt that since this cost was below the £10.06 fee for service that GPs receive for delivering vaccination, this direct contact intervention would be a cost-effective use of resources. The committee also noted the very serious negative consequences of the disease being vaccinated against in this age group (and the associated high costs of treating those conditions) and were therefore confident that this recommendation would be an acceptable use of resources.

Reminders for pregnant women

The committee discussed vaccinations for pregnant women and recommended that midwives recommend vaccination to pregnant women during routine antenatal visits and identify pregnant women who have not been vaccinated to ensure they receive additional reminders at subsequent antenatal appointments. These reminders would not be associated with additional resource implications, as they would be given at regular antenatal appointments and midwives already have a patient record where vaccination status could be recorded and checked.

The committee also recommended that direct contact should be considered for pregnant women who do not respond to reminders. When the same costing analysis for direct conversations with parents/carers of 0-5 year olds is used with the vaccine uptake data for pregnant women (assuming reminder are equally effective in this population), the cost per additional person vaccinated with direct contact is still below the £10.06 fee for service, indicating that direct conversations are a cost-effective use of resources. Additionally, because this recommendation suggests these direct conversations should only be considered, it is not possible to quantify the resource impact due to uncertainty on how much this intervention will be necessary in practice.

Reminders for routinely offered school-based programmes

The committee recommended that invitations and consent forms are sent to school-based children via the school, reminders provided if consent forms are not returned, and to consider directly contacting the parents before or on vaccination day to obtain consent if there has been no response. The committee indicated that this was current practice in schools that provide mass vaccination days, so these recommendations are unlikely to have a significant resource impact.

The committee discussed children who do not attend mainstream schools or would not be offered vaccination in their school setting and recommended that these children are sent an invitation to be vaccinated in a suitable setting. The committee noted that there would need to be a register of who those children are and how to contact their families to be able to send these invitations. Local authorities currently have a duty to know who those children are, and the committee agreed that the vaccination providers would simply be able to contact the local authority and have an email with the invitation forwarded to those children or their parents/carers.

Reminders for people who are not registered with a GP

The committee recommended that CHIS should send invitations for child vaccinations to people who are not registered with a GP such as travellers, newly arrived migrants or asylum seekers. CHIS already have a register of all children whether they are registered with a GP or not and sending out invitations for vaccinations is current practice in most CHIS, so this recommendation is unlikely to have significant resource implications.

Reminders for providers

The recommendations around reminders for providers discussed by the committee were unlikely to have any additional resource implications, for example the committee recommended that providers make use of existing system prompts to support opportunistic vaccination, and that they remind the individuals to book appointments to discuss vaccination or to be vaccinated, or to offer the vaccination at that time where possible.

1.1.11.5 Other factors the committee took into account

The committee discussed the importance of ensuring that people who live in care homes or other residential settings, or are housebound are also able to access vaccinations. In some of these cases invitations may need to be sent to someone other than the person eligible for vaccination if the person is unable to consent for themselves and the other person has legal responsibility for them (such as a power of attorney for health). Some of the people who live in care homes or other residential settings may be able to attend vaccination appointments, clinics or vaccination services in other settings such as at community pharmacies with varying levels of support. However, the committee agreed that this would not be the case for everyone and for those people it is essential that either they or their family members or carers (as propitiate) are aware of how to access home visits for vaccination. Other relevant recommendations the committee made as part of the access review concerned having a named lead to ensure that housebound people are identified and offered vaccinations and that home visits are considered for people who have difficulty travelling to vaccination services (see evidence review D for more details and committee discussions). This visit could include both discussing vaccinations and providing the vaccination at the same time, thereby facilitating vaccination for some harder to reach groups of people.

Reminders for people who are not registered with a GP

Some people such as some Travellers, Gypsy and Roma, migrants and asylum seekers may not be registered with a general practice and therefore will not receive vaccination reminders from this source. This is reflected in the qualitative evidence (evidence review B) and Table 10, which notes that some people have difficulty registering with a GP, and/ or navigating the UK health system. Children who are registered with Child health information services (CHIS) but not registered with a GP can be contacted by CHIS and invited via their family members or carers (as appropriate) for vaccination. However, the committee noted that some children will not be registered with CHIS and that adults who are eligible for vaccination and not registered at a GP may also need contacting. In these cases, the committee agreed that local authorities or community involvement could be considered to ensure that these people are identified and given opportunities to access vaccinations.

One of the barriers to vaccination for these people may be a lack of awareness that they can receive vaccinations without the need to be registered with a GP. It is therefore important that once these people are identified, they are informed of any vaccinations they are eligible for and given information on how to access them. In addition, the committee included asylum seekers in a recommendation for opportunistic identification of eligibility that is discussed in the identification review (evidence review A).

Invitations and reminders for children and young people who do not attend mainstream schools

Although school-based vaccination is the normal process for many young people, there are others who are home schooled, do not attend school regularly, or attend schools where vaccinations are not offered routinely, such as some faith based or independent schools. The committee noted that these groups of young people and those who are chronically unwell and in special schools, in young offender institutions or undergoing local authority tutoring are at higher risk of being under vaccinated. The committee agreed that particular care needs to be taken to ensure that these young people are invited for vaccination and chased up with reminders if they remain unvaccinated. In theory, the responsibility for vaccinating 11-18 years olds according to the routine schedule falls on the school-aged vaccination providers irrespective of whether the young person attends school or can be vaccinated at school. However, the committee were aware that in reality it is hard for this team to get the names and contact details of children who are not attending mainstream schools. The committee therefore made a recommendation aimed at commissioners of these services to ensure that that children/young people who do not attend mainstream school are invited for vaccination at another setting.

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 1.1.1, 1.2.5, 1.2.12, 1.2.13, 1.3.1, 1.3.7-1.3.10, 1.3.13- 1.3.17, 1.3.19-1.3.22, 1.3.25, 1.3.29- 1.3.32 and 1.3.36.

Other evidence supporting these recommendations can be found in the evidence reviews on the identification and recording of eligibility and status (evidence review

A), education interventions to increase uptake (evidence review E), acceptability and effectiveness of specific intervention (evidence review J) and multicomponent interventions to increase uptake (evidence review H).

1.1.13 References – included studies

1.1.13.1 Effectiveness

Systematic reviews

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1.1.13.2 Economic

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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)

18.	Type and method of review	☐ Diagnostic ☐ Prognostic ☐ Qualitative ☐ Epidemiologic ☐ Service Delivery ☒ Mixed method (all other quantitative reviews)		
19.	Language	English		
20.	Country	England		
21.	Anticipated or actual start date	January 2020		
22.	Anticipated completion date	October 2021		
23.	Stage of review at time of this submission	**Review stage**	**Started**	**Completed**
		Preliminary searches	☐	☐
		Piloting of the study selection process	☐	☐
		Formal screening of search results against eligibility criteria	☑	☐
		Data extraction	☐	☐
		Risk of bias (quality) assessment	☐	☐
		Data analysis	☐	☐

24.	Named contact	**5a. Named contact** Guideline Updates Team **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

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Appendix B – Literature search strategies

Systematic review search

An initial search to find 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 searches 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

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

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 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.

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

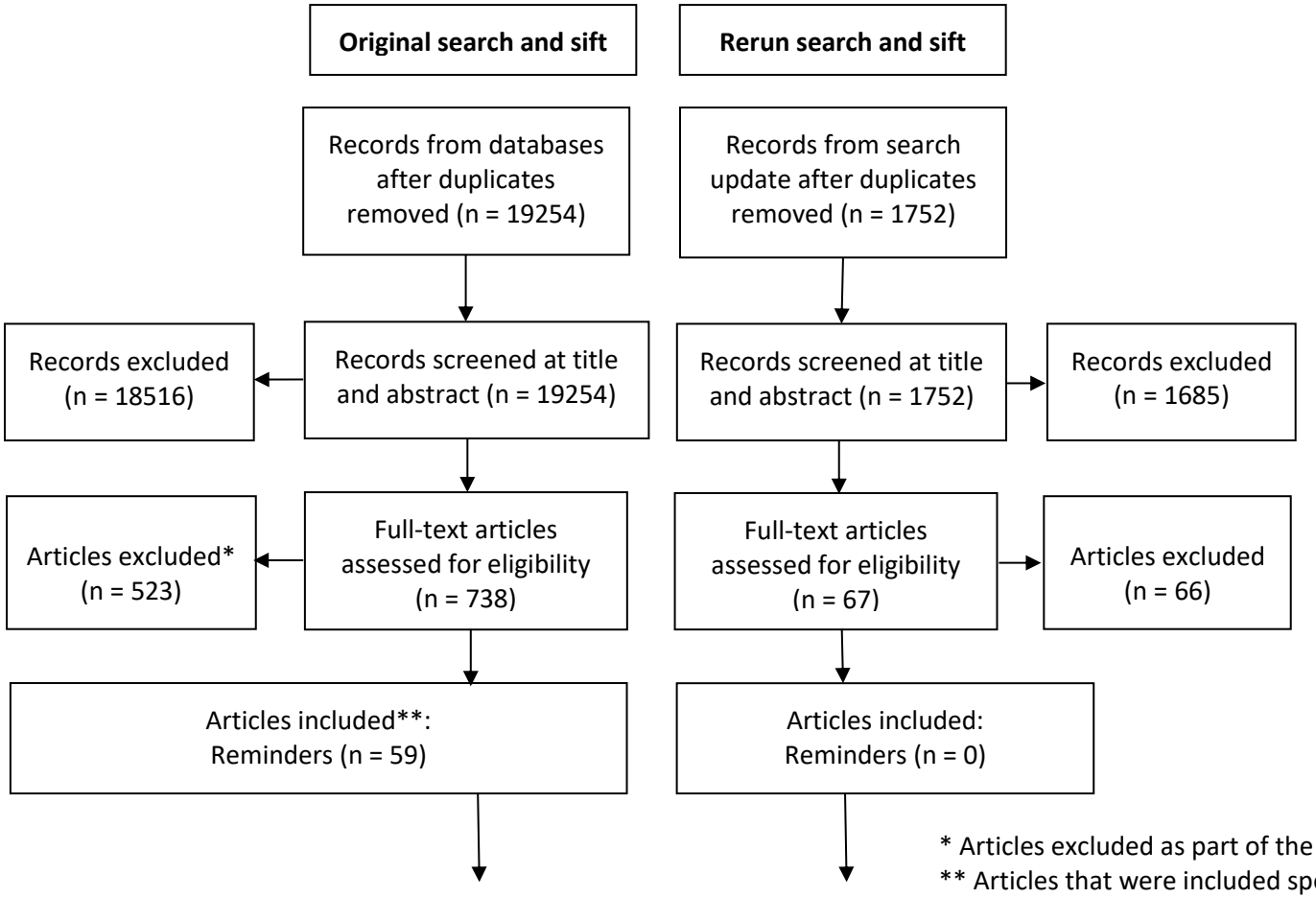
A single search to identify economic evidence for all review questions was run on 12th February 2020.The following databases were searched: Medline, Medline in Process, Embase, Econlit (all via the Ovid platform) NHS Economic Evaluation Database (NHS EED) and the Health Technology Assessment Database (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/

1 55 Quality-Adjusted Life Years/
2 56 Markov Chains/
3 57 exp Models, Economic/
4 58 cost*.ti.
5 59 (cost* adj2 utilit*).tw.
6 60 (cost* adj2 (effective* or assess* or evaluat* or analys* or model* or benefit* or
7 threshold* or quality or expens* or saving* or reduc*)).tw.
8 61 (economic* adj2 (evaluat* or assess* or analys* or model* or outcome* or benefit* or
9 threshold* or expens* or saving* or reduc*)).tw.
10 62 (qualit* adj2 adjust* adj2 life*).tw.
11 63 QALY*.tw.
12 64 (incremental* adj2 cost*).tw.
13 65 ICER.tw.
14 66 utilities.tw.
15 67 markov*.tw.
16 68 (dollar* or USD or cents or pound or pounds or GBP or sterling* or pence or euro or
17 euros or yen or JPY).tw.
18 69 ((utility or effective*) adj2 analys*).tw.
19 70 (willing* adj2 pay*).tw.
20 71 (EQ5D* or EQ-5D*).tw.
21 72 ((euroqol or euro-qol or euroquol or euro-quol or eurocol or euro-col) adj3 ("5" or
22 five)).tw.
23 73 (european* adj2 quality adj3 ("5" or five)).tw.
24 74 or/54-73
25 75 53 and 74
26
27

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

Appendix D Effectiveness evidence tables

Systematic reviews

Jacobson Vann, 2018

Bibliographic Reference	Jacobson Vann, Julie C; Jacobson, Robert M; Coyne-Beasley, Tamera; Asafu-Adjei, Josephine K; Szilagyi, Peter G; Patient reminder and recall interventions to improve immunization rates.; The Cochrane database of systematic reviews; 2018; vol. 1; cd003941

Study Characteristics

Study design	Systematic review
Study details	Dates searched February 2013 and 31 January 2017 (update of earlier review so included studies from earlier dates too) Databases searched Health Technology Assessment Database, NHS Economic Evaluation Database, CENTRAL, MEDLINE, Embase and CINAHL, Sources of funding Centers for Disease Control & Prevention, USA. For initial review only: Health Technology Assessment Programme, UK.
Inclusion criteria	Randomised controlled trials (RCT) Controlled before and after studies Interrupted time series Controlled, non-randomized studies Children from birth to 18 years Adults Who receive immunizations in any setting, including academic or non-academic, and developed or developing countries. Patient reminder or recall interventions These interventoions either reminded patients of upcoming immunizations or immunization visits that were due (reminders) or overdue (recall). The study included studies with multiple interventions if at least one study arm included immunization patient reminders or recall. Specific types of controls No-intervention control groups, standard practice activities that did not include immunization-focused patient reminder or recall interventions, media-based activities aimed at promoting immunizations, and simple practice-based immunization awareness campaigns.
Exclusion criteria	Observational studies Where the participants self-selcted to intervention groups Non-English language studies Travel immunizations Immunization orders or visits that did not also measure immunization status Studies that did not report relevant data
Outcome	Receipt of immunizations They accepted outcomes for individual vaccinations or standard combinations of recommended vaccinations, such as all recommended vaccinations by a specific date or age.
Number of studies included in the systematic review	75
Studies from the systematic review that are relevant	Alto 1994 Campbell 1994 CDC 2012 Chao 2015 Daley 2002

for use in the current review	Daley 2004b Dini 2000 Dombkowski 2014 Ferson 1995 Hambidge 2009 Irigoyen 2000 Kempe 2001 LeBaron 2004 Lieu 1997 Lieu 1998 Linkins 1994 O'Leary 2015 Rand 2015 Rand 2017 Rodewald 1999 Stehr-Green 1993 Suh 2012 Szilagyi 2006 Szilagyi 2011 Szilagyi 2013 Tollestrup 1997 Vivier 2000 Winston 2007
Studies from the systematic review that are not relevant for use in the current review	The remaining studies for the systematic review were not included because they were outside our date range (published before 1990), looked at reminders for flu vaccination, looked at interventions that fitted better in another section of our review of interventions to increase uptake or were not RCTs or cluster RCTs. Since there were a large number of RCTs for reminders interventions it was not necessary to include other study types in our analyses.
Additional comments	Randomized trials that allocated families, households, practices, or other clusters with trials that allocated individuals were not included in the meta-analysis.

1

Section	Question	Answer
Study eligibility criteria	Concerns regarding specification of study eligibility criteria	Low
Identification and selection of studies	Concerns regarding methods used to identify and/or select studies	Low
Data collection and study appraisal	Concerns regarding methods used to collect data and appraise studies	Low
Synthesis and findings	Concerns regarding the synthesis and findings	Low
Overall study ratings	Overall risk of bias	Low
	Applicability as a source of data	Partially applicable *(This review covers part of the reminders interventions listed in our protocol, but does not include reminders*

Section	Question	Answer
		aimed at providers. It also includes flu vaccination and non-OECD countries which are out of scope of this review.)

Reminders interventions primary studies

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

Alto, 1994

Bibliographic Reference	Alto, W A; Fury, D; Condo, A; Doran, M; Aduddell, M; Improving the immunization coverage of children less than 7 years old in a family practice residency.; The Journal of the American Board of Family Practice; 1994; vol. 7 (no. 6); 472-7

Study details

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

Bjornson, 1999

Bibliographic Reference	Bjornson, G L; Scheifele, D W; Lajeunesse, C; Bell, A; Effect of reminder notices on the timeliness of early childhood immunizations.; Paediatrics & child health; 1999; vol. 4 (no. 6); 400-5

Study details

Study location	Canada
Study setting	Clinics
Study dates	1997
Sources of funding	British Columbia Centre for Disease Control Society
Inclusion criteria	Children of a specific age Children who were due to receive their MMR vaccine (at 12 months of age) or DPT-inactivated polio vaccine (IPV)-Hib booster (at 18 months of age)
Intervention(s)	The reminder notices were brightly coloured postcards reminding parents that their child's immunization was due soon, and requesting that they make arrangements with their usual immunisation provider to receive this service. The text was tailored to each cohort and indicated the recommended vaccine for the upcoming age. Reminder notices were mailed up to four weeks before the earliest immunization

	due date for each cohort. Returned (undeliverable) postcards were noted, and the corresponding children were eliminated from follow-up.
Comparator	No reminder
Relevant outcome measures	Vaccine uptake MMR, diphtheria-pertussis-tetanus, inactivated polio, Haemophilus influenzae type b
Number of participants	614 in total: 308 children who were 12 months of age (MMR cohort) plus 306 children who were 18 months of age in the diphtheria-pertussis-tetanus, inactivated polio, Haemophilus influenzae type b cohort
Duration of follow-up	2 months after the initial due date for vaccination.
Loss to follow-up	77 in the reminder arm, 86 in the no reminder arm
Additional comments	Baseline characteristics of the 2 arms was not provided.

Study arms

Reminders (mailed notices) (N = 305)
No reminder (N = 309)

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	Some concerns *(Blinding was not mentioned. This may have affected the rigour with which data was collected.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Due to a lack of information about assessor blinding.)*
	Overall Directness	Directly applicable

Campbell, 1994

Bibliographic Reference	Campbell, J R; Szilagyi, P G; Rodewald, L E; Doane, C; Roghmann, K J; Patient-specific reminder letters and pediatric well-child-care show rates.; Clinical pediatrics; 1994; vol. 33 (no. 5); 268-72

Study details

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

Centers for Disease Control and Prevention, 2012

Bibliographic Reference	Centers for Disease Control and Prevention, (CDC); Evaluation of vaccination recall letter system for Medicaid-enrolled children aged 19-23 months--Montana, 2011.; MMWR. Morbidity and mortality weekly report; 2012; vol. 61 (no. 40); 811-5

Study details

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

Chao, 2015

Bibliographic Reference	Chao, Chun; Preciado, Melissa; Slezak, Jeff; Xu, Lanfang; A randomized intervention of reminder letter for human papillomavirus vaccine series completion.; The Journal of adolescent health : official publication of the Society for Adolescent Medicine; 2015; vol. 56 (no. 1); 85-90

Study details

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

Coley, 2018

Bibliographic Reference	Coley, Scott; Hoefer, Dina; Rausch-Phung, Elizabeth; A population-based reminder intervention to improve human papillomavirus vaccination rates among adolescents at routine vaccination age.; Vaccine; 2018; vol. 36 (no. 32ptb); 4904-4909

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA

Study setting	Community - addresses in New York State area (minus New York city)
Study dates	2015
Sources of funding	This intervention was supported by Prevention and Public Health Funds received through a cooperative agreement with the Centers for Disease Control and Prevention.
Inclusion criteria	Adolescents Aged 11 to 13 years. Live in a specific area New York State address, excluding New York City
Exclusion criteria	New York City address
Intervention(s)	The intervention targeted the parents/ guardian of eligible adolescents. The reminder intervention included a brief letter, signed by the Director of the New York State Department of Health (NYSDOH) Bureau of Immunization, urging parents to talk to their child's provider about HPV vaccines and the Centers for Disease Control and Prevention's HPV Vaccine for Preteens and Teens information sheet. The letter described the Advisory Committee on Immunization Practices HPV vaccine recommendation, stressed the safety and efficacy of the vaccine and the importance of ''getting the vaccine early, before exposure to the virus", and included a link to the NYSDOH website with information about HPV infection, HPV-related disease and HPV vaccines. The letter also listed a dedicated email address to contact with any questions or concerns.
Comparator	Control letter- no details given. Sent 6 months after the intervention letters.
Relevant outcome measures	Vaccine uptake HPV
Number of participants	Reminder arm: 81,558 participants. No reminder arm: 80,894 participants
Duration of follow-up	6 months
Loss to follow-up	None
Additional comments	For the overall meta-analysis, we used data for the uptake of the first dose of HPV. We also include a separate meta-analysis that has uptake data for the 1st, 2nd and 3rd doses.

Study arms

Reminder letter (N = 81558)
Control letter (N = 80894)

Characteristics

Arm-level characteristics

	Reminder letter (N = 81558)	**Control letter (N = 80894)**
Mean age *(years)* Variance was not provided		
Nominal	12.6	12.6

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(There was no information about allocation concealment, but due to the nature of the intervention (a reminder letter) this was unlikely to affect the outcomes measured by the trial.)*
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 *(Participants appeared to be unaware that they were part of a clinical trial and therefore knowing their allocation by receiving a reminder letter or control letter was not expected to affect the participant's decisions to vaccinate their children. There was no mention of personnel blinding, but this was also not expected to bias the results as the same processes were carried out for both arms of the trial (posting a letter).)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low *(Large numbers of randomised participants in both arms did not receive the intervention due to invalid addresses, however the numbers excluded were similar in both arms as were the baseline characteristics of the participants. Of the people with valid addresses a small and similar percentage in each arm did not receive the mailing. Results are available for all of participants who were expected to have received the letters. This was not expected to bias the results.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(Although there was a lack of information about assessor blinding because the outcomes were extracted from a single vaccination registry a lack of blinding was not expected to have affected the results.)*
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

Daley, 2004

Bibliographic Reference	Daley, M.F.; Steiner, J.F.; Kempe, A.; Beaty, B.L.; Pearson, K.A.; Jones, J.S.; Lowery, N.E.; Berman, S.; Quality improvement in immunization delivery following an unsuccessful immunization recall; Ambulatory Pediatrics; 2004; vol. 4 (no. 3); 217-223

Study details

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

systematic review	

Daley, 2002

Bibliographic Reference	Daley, Matthew F; Steiner, John F; Brayden, Robert M; Xu, Stanley; Morrison, Stephanie; Kempe, Allison; Immunization registry-based recall for a new vaccine.; Ambulatory pediatrics : the official journal of the Ambulatory Pediatric Association; 2002; vol. 2 (no. 6); 438-43

Study details

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

Dexter, 2004

Bibliographic Reference	Dexter, Paul R; Perkins, Susan M; Maharry, Kati S; Jones, Kathy; McDonald, Clement J; Inpatient computer-based standing orders versus physician reminders to increase influenza and pneumococcal vaccination rates: a randomized trial.; JAMA; 2004; vol. 292 (no. 19); 2366-71

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Hospital - general medicine wards
Study dates	1998 to 1999
Sources of funding	Agency for Healthcare Research and Quality, National Library of Medicine, Regenstrief Foundation, and the Indiana Genomics Initiative of Indiana University, which is supported in part by Lilly Endowment Inc.
Inclusion criteria	People aged 65 years and older **or** People who were at risk of disease Due to chronic illness
Exclusion criteria	People who had already received the vaccine
Intervention(s)	The authors used the hospital's Gopher physician order entry system and Gopher-Care rules to identify patients who were eligible for vaccination and to deliver standing orders or physician reminders. Following national recommendations the computer system considered a patient eligible for vaccination if: (1) there was no evidence of the vaccine being given during the required time frame; (2) the patient had one of the relevant chronic diseases; or

	(3) the patient was older than 65 years. The computer interventions for pneumococcal vaccine were active throughout the study. **Reminder group** For eligible patients in the physician reminder group, a pop-up message appeared with orders for the required vaccines each time a physician began a daily order-entry session during the first 5 days of hospitalisation and when they began a discharge order session at any time. A physician could accept a suggested order with 1 keystroke. However, all order sessions eventually required the physician to save the session with the F8 key and with the user's password. The computer system stopped sending pop-up reminder messages once it received a vaccine order.
Comparator	**Standing order group (automatic vaccination order)** With regards to standing orders, the system automatically produced vaccine orders at the time of discharge. These vaccines were administered by nurses. Different electronic input forms were required for entering daily orders, admitting orders, and discharge orders. Prior to the study, the executive committee at Wishard Memorial Hospital authorised nurses to administer vaccines in response to computer-generated standing orders and approved the protocol under which they were dispensed. All ward nurses were trained by nursing managers and were given printed protocols, which included questions to ask the patient about egg allergies (for the influenza vaccine), previous vaccination in the relevant time frame, and the patient's willingness to receive the vaccination. Nurses withheld the vaccination when a patient was unable to answer the screening questions, reported prior vaccinations or relevant allergies, or refused the vaccination. On the basis of the marked benefits and safety of the vaccinations, the institutional review board waived informed consent.
Relevant outcome measures	Vaccine uptake Pneumococcal vaccination
Number of participants	The computer system identified 829 patients (22% of patients hospitalised during the 14-month study) as eligible for pneumococcal vaccination. Of these, 406 of those patients were associated with the standing order group of physicians and 423 with the reminder group of physicians
Duration of follow-up	From admission to hospital to discharge.
Loss to follow-up	None
Additional comments	No baseline characteristics were provided. Participants were over 65 years old or high risk, but only the former would be eligible for this vaccine on the UK routine schedule. Data was not provided separately for these populations so the study was downgraded for directness. This study also included data for influenza vaccination. This data was excluded because it did not fit the protocol.

1

2 **Study arms**

Physician reminder (N = 423)
Nurse requests (N = 406)

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Blinding was not possible for the standing order and reminder physician teams. This could have influenced behaviour.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Due to a lack of blinding of personnel)*
	Overall Directness	Partially applicable *(This study included participants who were selected because they were considered at risk of disease and as a result not all participants were were older than 65 years.)*

Dini, 2000

Bibliographic Reference Dini, E F; Linkins, R W; Sigafoos, J; The impact of computer-generated messages on childhood immunization coverage.; American journal of preventive medicine; 2000; vol. 18 (no. 2); 132-9

Study details

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

Dombkowski, 2014

Bibliographic Reference Dombkowski, KJ; Costello, LE; Harrington, LB; Dong, S; Kolasa, M; Clark, SJ; Age-specific strategies for immunization reminders and recalls: a registry-based randomized trial; American journal of preventive medicine; 2014; vol. 47 (no. 1); 1-8

Study details

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

Ferson, 1995

Bibliographic Reference	Ferson, M J; Fitzsimmons, G; Christie, D; Woollett, H; School health nurse interventions to increase immunisation uptake in school entrants.; Public health; 1995; vol. 109 (no. 1); 25-9

Study details

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

Frank, 2004

Bibliographic Reference	Frank, Oliver; Litt, John; Beilby, Justin; Opportunistic electronic reminders. Improving performance of preventive care in general practice.; Australian family physician; 2004; vol. 33 (no. 12); 87-90

Study details

Study type	Randomised controlled trial (RCT)
Study location	Australia
Study setting	General practice
Study dates	1998 to 1999
Sources of funding	Medical Benefits Fund of Australia, SmithKlineBeecham
Inclusion criteria	Children of a specific age First dose of MMR at 1 year, second at 10-16 years People of a given age People aged over 65 years for the pneumococcal vaccination.
Exclusion criteria	None reported
Intervention(s)	Automatic electronic record preventative care reminder system for one 10 doctor general practice. GPs were not blinded.
Comparator	No electronic reminder.
Relevant outcome measures	Vaccine uptake MMR for children, pneumococcal vaccination for people aged over 65 years

Number of participants	4449 participants were eligible for pneumococcal vaccine. 969 participants were eligible for MMR vaccine.
Duration of follow-up	Not provided.
Loss to follow-up	None
Additional comments	The paper was very brief and no further details of methods were provided. The MMR data was partially applicable because we do not know what proportion of participants were 10-16 year olds.

1

2 **Study arms**

Pneumonia: reminders (N = 2079)
Pneumonia: no reminders (N = 2370)
MMR: reminders (N = 446)
MMR: no reminders (N = 523)

3

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	High *(Participants who had a last digit of 0-4 for their medical record number were put in the reminders group. Participants who had a last digit of 5-9 were put in the control group. This is not proper randomisation because it would have been possible to predict which group each participant would be allocated to.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Blinding of the healthcare professionals would not have been possible.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Due to the poor method or randomisation and lack of blinding of personnel.)*
	Overall Directness	Directly applicable *(For vaccination of over 65 year olds, but only partially applicable for 0-5 year olds as data included booster vaccinations for older children too.)*

Franzini, 2000

Bibliographic Reference	Franzini, L; Rosenthal, J; Spears, W; Martin, H S; Balderas, L; Brown, M; Milne, G; Drutz, J; Evans, D; Kozinetz, C; Oettgen, B; Hanson, C; Cost-effectiveness of childhood immunization reminder/recall systems in urban private practices.; Pediatrics; 2000; vol. 106 (no. 1pt2); 177-83

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Private paediatric practices
Study dates	1997 to 1998
Sources of funding	The Association of Teachers of Preventative Medicine, the National Centers for Disease Control
Inclusion criteria	Children of a specific age Aged 1 year old or less Eligible to be vaccinated
Exclusion criteria	None reported
Intervention(s)	Mail group: postcard delivered through the US mail reminding them of the data of their return appointments. Autodialer group: computer automated telephone message system.
Comparator	No reminder
Relevant outcome measures	Vaccine uptake Diphtheria, tetanus and pertussis vaccine
Number of participants	2086
Duration of follow-up	30 days
Loss to follow-up	None
Additional comments	Paper was a cost-effectiveness analysis and few details of the trial methodology were provided. No baseline characteristics were provided. For the summary reminder analysis we combined both arms to avoid double-counting.

Study arms

Postcard reminder or autodialer (N = 1657)
No reminder (N = 429)

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. Baseline characteristics were not provided so it was not possible to check the integrity of the randomisation process.)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Low *(Participants appeared to be unaware that they were part of a clinical trial. Therefore, knowing their allocation by receiving a reminder or not was not expected to affect the participant's vaccination decision. There was no mention of personnel blinding. However, this was also not expected to bias the results as the same processes were carried out for both arms of the trial.)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(There was no assessor blinding. There was no mention of a centralised computer system to record all the data automatically. Therefore, lack of blinding could have affected the willpower to collect data.)*
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 *(Due to a lack of information about the randomisation process and concerns about assessor blinding.)*
	Overall Directness	Directly applicable

Hambidge, 2009

Bibliographic Reference	Hambidge, Simon J; Phibbs, Stephanie L; Chandramouli, Vijayalaxmi; Fairclough, Diane; Steiner, John F; A stepped intervention increases well-child care and immunization rates in a disadvantaged population.; Pediatrics; 2009; vol. 124 (no. 2); 455-64

Study details

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

Hawe, 1998

Bibliographic Reference	Hawe, P; McKenzie, N; Scurry, R; Randomised controlled trial of the use of a modified postal reminder card on the uptake of measles vaccination.; Archives of disease in childhood; 1998; vol. 79 (no. 2); 136-40

Study details

Study type	Randomised controlled trial (RCT)
Study location	Australia
Study setting	The area of Ballarat (a provincial city in Australia)
Study dates	1988 to 1989
Sources of funding	National Health and Medical Research Council, Victorian Department of Health.
Inclusion criteria	Children of a specific age 15 months Live in a specific area Children were identified from the municipal council lists, which are based on birth notifications supplied by local hospitals.
Exclusion criteria	People who had already received the vaccine Families whose mail was returned undelivered Death of a participant
Intervention(s)	The intervention was a health belief model reminder postcard for vaccination. A series of four focus groups were conducted to pretest the health belief model card. These were held with parents from the target group considered to be hardest to reach with written messages—that is, people with low socioeconomic status, and minimal education. Parents were recruited for the focus groups by social and welfare workers in the surrounding municipalities—that is, areas outside the one within which the trial was to be conducted. As a result of these groups, the health belief model card was altered in a number of ways. Words such as “susceptible” were dropped because of parents’ limited understanding. The title of the person who sends the card (the Chief Health Surveyor) was also dropped because it was viewed as intimidating. The card was signed from the “Health Department” instead. The final card was addressed specifically to the parent (“Dear Mrs Quinn” instead of “Dear Parent”) and the child was referred to by name. Cards were sent in batches according to when a child became due for vaccination. A vaccination clinic was held one week after cards were sent. The next clinic was two weeks later. Parents who did not have their children vaccinated at either of these first two clinics were sent a second reminder card, which was the same type as the first card they had been sent. Another clinic was held a week after the second card had been sent. After this time the final proportion of children who had been vaccinated in both groups was determined.
Comparator	A reminder card that had neutral wording. Cards were sent in batches according to when a child became due for vaccination. A vaccination clinic was held one week after cards were sent. The next clinic was two weeks later. Parents who did not have their children vaccinated at either of these first two clinics were sent a second reminder card, which was the same type as the first card they had been sent. Another clinic was held a week after the second card had been sent. After this time the final proportion of children who had been vaccinated in both groups was determined.

Relevant outcome measures	Vaccine uptake Measles
Number of participants	11982
Duration of follow-up	4 weeks
Loss to follow-up	10 children in total, 5 from each group.

Study arms

Health belief reminder card (N = 90)
Neutrally worded reminder card (N = 83)

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

Hess, 2013

Bibliographic Reference	Hess, Rick; Impact of automated telephone messaging on zoster vaccination rates in community pharmacies.; Journal of the American Pharmacists Association : JAPhA; 2013; vol. 53 (no. 2); 182-7

Study details

Study type	Cluster randomised controlled trial
Study location	USA
Study setting	Pharmacies
Study dates	2006 to 2007

Sources of funding	Not provided
Inclusion criteria	People of a given age 60 years of age and over
Exclusion criteria	Participants who had incomplete or missing records Participants who did not have a local address
Intervention(s)	Two 30-second scripts were created to educate patients about their risk for developing shingles and invite them to speak to their pharmacist about vaccination opportunities. Two scripts were written to avoid delivering the same recorded message to recipients in back-to-back months. All calls were delivered monthly for 3 consecutive months to invention group households during the first week of each month. Script 1 was delivered in March and May 2007, while script 2 was delivered during April 2007. The scripts were recorded and sent as an incoming automated telephone call to households using cNotify, which is an outbound messaging tool. The pre-recorded message would play after the call was answered or left as a voice message if there was no answer. A Web-based administrative application was used to verify successful call delivery each month.
Comparator	The control group households received no phone calls.
Relevant outcome measures	Vaccine uptake Shingles
Number of participants	There were 11,982 people in the eligable population. These participants were divided between 8 pharmacies in the intervention group and 8 pharmacies in the control group.
Duration of follow-up	3 months
Loss to follow-up	N/A: Data was collected as a percentage of a selected population
Additional comments	This cluster RCT did not have adjusted data.

Study arms

Reminder (N = 5599)
No reminder (N = 6383)

Characteristics

Arm-level characteristics

	Reminder (N = 5599)	**No reminder (N = 6383)**
Age *(years (SD))*		
Mean/SD	72.9 (8.8)	71.8 (8.5)

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	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	Some concerns *(There was no blinding with regards to collecting the data.)*
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 *(Due a lack of assessor blinding.)*
	Overall Directness	Directly applicable *(Participants were 60 years or over, but the committee had previously agreed not to downgrade studies for relevance to the 65 years and older subgroup if they included people who were 60 years old.)*

Hoekstra, 1999

Bibliographic Reference	Hoekstra EJ; LeBaron CW; Johnson-Partlow T; Does reminder-recall augment the impact of voucher incentives on immunization rates among inner-city infants enrolled in WIC? Special Supplemental Program for Women, Infants, and Children.; The Journal of pediatrics; 1999; vol. 135 (no. 2 Pt 1)

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Community (area of Chicago)
Study dates	1996
Sources of funding	Centers for Disease Control and Prevention, US Department of Health and Human Services, Chicago Department of Public Health.
Inclusion criteria	Children of a specific age 6 months old
Intervention(s)	The area had a large proportion of Hispanic people. A telephone call by the bilingual study clerk was made to remind parents of all upcoming and missed immunizations. If 9 calls were unsuccessful in a month, 2 bilingual mailings were sent out, and the process was repeated each study month. Voucher incentive (both arms had this): At the visit, a study clerk entered vaccination dates from parent-provided documentation into a software program, which determined whether the child needed a vaccination according to the standards of the Advisory Committee on Immunization Practices, allowing a 30-day grace period. The family of a child whose immunizations could not be documented as up-to-date was

	referred to its health care provider and, instead of being given the usual 3-month supply of food vouchers, was given monthly vouchers until the child was appropriately vaccinated for age.
Comparator	Voucher incentive only.
Relevant outcome measures	Vaccine uptake The specific vaccines were not specified
Number of participants	565
Duration of follow-up	6 months
Loss to follow-up	None
Additional comments	The only population characteristic recorded was ethnic background.

1

2 **Study arms**

Reminder (N = 324)
No reminder (N = 241)

3 **Characteristics**

4 **Arm-level characteristics**

	Reminder (N = 324)	**No reminder (N = 241)**
Percentage that were Hispanic *(%)*		
Nominal	95	96

5

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	High *(Participants were allocated to an intervention based on a random selection of dates when the infant was brought for the WIC (Special Supplemental Nutritional Program for Women, Infants, and Children) certification visit at 6 months of age.)*
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	Some concerns *(Lack of blinding could bias measurement of outcome.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	High *(Due to the method of randomisation and lack of assessor blinding.)*
	Overall Directness	Directly applicable

Hofstetter, 2015

Bibliographic Reference	Hofstetter, A.M.; DuRivage, N.; Vargas, C.Y.; Camargo, S.; Vawdrey, D.K.; Fisher, A.; Stockwell, M.S.; Text message reminders for timely routine MMR vaccination: A randomized controlled trial; Vaccine; 2015; vol. 33 (no. 43); 5741-5746

Study details

Trial registration number and/ or trial name	NCT01199666
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	4 paediatric practices in an ambulatory care network affiliated with a large academic medical centre
Study dates	2011 to 2012
Sources of funding	Pfizer Medical Education Group
Inclusion criteria	Children of a specific age Age 9.5–10.5 months Previous visits within a specific period Had a participating clinic visit in the past 6 months and had a cellular phone number listed in the hospital registration system.
Exclusion criteria	None reported
Intervention(s)	There were 2 intervention arms: the scheduling plus appointment text message reminders arm and the appointment text message reminder-only arm. Parents in the scheduling plus appointment text message reminders arm received up to three automated weekly text message reminders to schedule the one-year appointment. The text messages, sent in either English or Spanish depending on the primary language specified in the electronic health record, included the clinic contact information and mentioned the child's need for important vaccines like measles following the first birthday. They also included the option to switch the language or "stop" future messages. If the child already had a scheduled one-year appointment before the start of the intervention (i.e., date of the first scheduling reminder), the parent was not sent any scheduling reminders unless that appointment was scheduled to occur before 361 days of age (i.e., outside the grace period for MMR vaccination). Once the intervention was initiated, any newly scheduled appointment after 11 months of age was deemed acceptable given the possibility of "early" (i.e., between 11 months and 361 days of age) scheduling by office staff, and no subsequent scheduling reminders were sent. Next, parents in both text messaging arms (scheduling plus appointment text message reminders and appointment text message reminder-only) received one automated text message two days before a scheduled one-year appointment, reminding them about the appointment, letting them know that the doctor would discuss needed vaccines, and asking them to remember to bring the child's vaccination card. The reminder was not sent if the child had already received MMR vaccine (unless given before 361 days of age).

Comparator	Those in the usual care arm received no text message reminders. Children in all arms received “usual care”, which included a routine automated telephone appointment reminder provided directly from the clinic network.
Relevant outcome measures	Vaccine uptake MMR Offers of vaccination For this study, we have assumed that 'visit attendance' is the same thing as 'offered vaccination'.
Number of participants	2054
Duration of follow-up	1 year
Loss to follow-up	None
Additional comments	We combined both arms that involved text message reminders for the overall meta-analysis. This was to avoid double-counting the control arm in the meta-analysis.

1

2 **Study arms**

Text message reminders and automated telephone reminder (N = 686)
Usual care: automated telephone reminder only (N = 682)
Text message and scheduling reminder with automated phone reminder (N = 686)

3 **Characteristics**

4 **Arm-level characteristics**

	Text message reminders and automated telephone reminder (N = 686)	**Usual care: automated telephone reminder only (N = 682)**	**Text message and scheduling reminder with automated phone reminder (N = 686)**
Sex: Female *(%)*			
Nominal	49	48	49

5

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

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Hogg, 1998

Bibliographic Reference	Hogg, W E; Bass, M; Calonge, N; Crouch, H; Satenstein, G; Randomized controlled study of customized preventive medicine reminder letters in a community practice.; Canadian family physician Medecin de famille canadien; 1998; vol. 44; 81-8

Study details

Study type	Randomised controlled trial (RCT)
Study location	Canada
Study setting	A private medical centre
Study dates	1990 to 1991
Sources of funding	The National Health Research & Development Program, Health Canada.
Inclusion criteria	Parents of young children Eligible patients had been registered for a minimum of 1 year and had made at least one visit to the office in the preceding 2 years.
Exclusion criteria	None reported
Intervention(s)	**Intervention 1:** The computer-generated customised letters sent to the first study group reminded patients of outstanding preventive procedures using nonmedical language in a standardized format. The letter began with a covering page followed by one page for each family member. For each family member, a paragraph outlined each preventive procedure for which the patient was eligible as determined by age, sex, family history, and previous illness. The tone was positive and nonthreatening. Mumps, for example, was described as being able to "cause important complications for young men." Dates family members had last received the procedures were provided so they could determine whether they were overdue. **Intervention 2:** The second study group received a form letter that outlined all the recommended preventive procedures for all ages and both sexes. The text explaining each preventive measure was identical to the text in the customised letter except the date the procedure was last done was not provided.
Comparator	The third study group received usual care with no reminders.
Relevant outcome measures	Vaccine uptake
Number of participants	There were 719 families in total but only 111 families were relevant to this review because they had children aged 5 years of age or younger.
Duration of follow-up	6 months after the reminders were sent.
Loss to follow-up	None
Additional comments	This study also had data for adult preventions, which were not extracted because they had nothing to do with the UK routine vaccination schedule (pap smears, mammograms, adult tetanus, faecal occult blood test).

	Furthermore, data on influenza vaccination was not relevant to this review. We did not include the data for MMR boosters because it was not clear at what age they were given. DPT ROPV is not a vaccine that is on the UK routine schedule so the data for this was omitted. The numbers of families referred to for the arms of this study were those who had children of age 5 or younger. This is because the vaccines for those families were relevant to this evidence review (MMR, Hib). There were no relevant baseline characteristics

Study arms

Families sent computer-generated, customised reminders (N = 38)
Families sent non-customised reminders (N = 37)
Families sent no reminders (N = 36)

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	Some concerns *(All data collection was not blinded and required effort.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Some concerns with data collection and lack of blinding.)*
	Overall Directness	Directly applicable

Hurley, 2019

Bibliographic Reference	Hurley, L.P.; Beaty, B.; Lockhart, S.; Gurfinkel, D.; Dickinson, L.M.; Roth, H.; Kempe, A.; Randomized controlled trial of centralized vaccine reminder/recall to improve adult vaccination rates in an accountable care organization setting; Preventive Medicine Reports; 2019; vol. 15; 100893

Study details

Trial registration number and/ or trial name	NCT02133391

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Community - practices in Colorado
Study dates	2016 to 2017
Sources of funding	Not provided
Inclusion criteria	People aged 65 years and older People of a given age Adults aged 19-64 and over 65 year olds.
Exclusion criteria	People who had already received the vaccine
Intervention(s)	**Autodialer calls and postcard.** Adults randomised to reminders were contacted up to three times over three to four months. Adults received up to two auto-dial phone calls followed by a postcard. Messages were personalized to include practice name and phone number and were delivered in both English and Spanish. Participants were able to select via dial tone whether they received the message in English or Spanish. Postcards were printed in both English and Spanish. If a person's phone number was missing or deemed incorrect, they were sent a postcard only. Phone numbers were considered valid if they went to a live answer or voicemail and no one called to say they should not have been contacted; they were considered incorrect if they were a fax number, a discontinued phone number, or had no dial tone. Returned postcards were considered to have incorrect addresses. Auto-dialer and postcards indicated that the individual may need one or more of two or three vaccines (influenza, Tdap, or pneumococcal) and prompted recipients to call their clinic to schedule an appointment to discuss their vaccine needs. The recalls did not specify what vaccines were needed. During the study, adults had various options to opt-out of the study including pressing a number on a phone dial pad at the time of the phone recall or leaving a voicemail or email via contact information provided in the recall message. Adults who became up to date on the vaccines of interest or who had opted out between rounds were not contacted further.
Comparator	The control arm received usual care that did not include any reminders from the study team to receive vaccines.
Relevant outcome measures	Vaccine uptake Pneumonia
Number of participants	449
Duration of follow-up	6 months
Loss to follow-up	None
Additional comments	The data for people aged 65 years and over was included because it matched the protocol and UK schedule, which does not routinely vaccinate people aged 16 to 65 years. We excluded data for influenza and pertussis vaccine because it did not match the UK routine vaccination schedule for the 65+ years age group and influenza vaccination is out of scope of this guideline. (There was no mention of pregnancy and pertussis vaccine.)

1

2 **Study arms**

Reminders (N = 307)

No reminders (N = 309)

1 **Characteristics**

2 **Arm-level characteristics**

	Reminders (N = 307)	No reminders (N = 309)
Sex: Female *(%)*		
Nominal	64	64
Age *(years)*		
MedianIQR	71 (67 to 78)	70 (67 to 74)

3

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 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 *(Lack of assessor blinding probably overcome by use of a single registry of immunisations for outcome data.)*
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 *(Although there was a lack of assessor blinding they used the Colorado Immunization Information System (CIIS) as a source of immunisations records and this was considered to be a reliable source of information.)*
	Overall Directness	Directly applicable *(Data could be extracted for people aged 65 and over.)*

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Hurley, 2018

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Bibliographic Reference	Hurley, Laura P; Beaty, Brenda; Lockhart, Steven; Gurfinkel, Dennis; Breslin, Kristin; Dickinson, Miriam; Whittington, Melanie D; Roth, Heather; Kempe, Allison; RCT of Centralized Vaccine Reminder/Recall for Adults.; American journal of preventive medicine; 2018; vol. 55 (no. 2); 231-239

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8 **Study details**

Trial registration number and/ or trial name	NCT02133391
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	People in the Denver area
Study dates	2015 to 2016
Sources of funding	Agency for Healthcare Research and Quality
Inclusion criteria	People aged 65 years and older People of a given age 19- 64 year olds People who were at risk of disease People 19–64 years with a high-risk condition for pneumonia
Exclusion criteria	People who had already received the vaccine
Intervention(s)	**Autodialer and postcard reminder intervention.** A method to reduce the burden of conducting a reminder/recall intervention at the practice level is to use an immunisation information system (IIS) so that reminder/recall can be conducted centrally. IISs are confidential, population-based, computerised databases that record and consolidate all vaccination doses administered by participating providers to people residing within a given geopolitical area. Adults randomised to the intervention arm were contacted up to three times over the course of 3–4 months. Adults received up to two auto-dial phone calls followed by a postcard. If a person's phone number was missing or was deemed incorrect, they were sent a postcard. Phone numbers were considered valid if they went to a live answer or voicemail and no one called to say they should not have been contacted; they were considered incorrect if they were a fax number, a discontinued phone number, or had no dial tone. Returned postcards were considered to have incorrect addresses. Auto-dialer and postcards indicated that the individual may need one or more of the three vaccines (influenza, Tdap, or a pneumococcal vaccine) and prompted recipients aged o65 years to call his/her clinic to schedule an appointment to discuss their vaccine needs; individuals aged Z65 years were prompted to either call his/her clinic to schedule an appointment or go to a retail pharmacy to receive vaccines they may need because of Medicare Part D covering Tdap vaccine for Medicare beneficiaries and not being available for seniors in the clinic setting. The recalls did not specify what vaccines were needed. They included the clinic name and phone number of each of the specific clinics. At any point during the study, adults could opt-out by pressing a number on the phone dial pad at the time of a phone recall, or leave a voicemail or e-mail with the number or email address provided in the message. Adults who became up-to-date on the vaccines of interest or who had opted out of the study between rounds were not contacted further.
Comparator	The control arm received usual care that did not include any reminders to receive vaccines.
Relevant outcome measures	Vaccine uptake Pneumonia
Number of participants	678
Duration of follow-up	3 to 4 months

Loss to follow-up	None
Additional comments	Only the data for people aged 65 years and over was extracted because adults aged under 65 are not a subgroup that are routinely vaccinated in the UK. We excluded data for influenza and pertussis vaccine because it did not match the protocol for the 65+ years age group and flu is out of scope of this guideline.

1 **Study arms**

Reminder (N = 2665)
No reminder (N = 2667)

2 **Characteristics**

3 **Arm-level characteristics**

	Reminder (N = 2665)	**No reminder (N = 2667)**
Sex: Female *(%)*		
Nominal	62	61

4

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 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 *(Although there was no blinding, this had been considered by the investigators. The Colorado Immunization Information System (CIIS) they used to record immunisations was considered a reliable source of information.)*
	Overall Directness	Directly applicable

5

Irigoyen, 2006

6

Bibliographic Reference	Irigoyen, Matilde M; Findley, Sally; Wang, Dongwen; Chen, Shaofu; Chimkin, Frank; Pena, Oscar; Mendonca, Eneida; Challenges and successes of immunization registry reminders at inner-city practices.; Ambulatory pediatrics : the official journal of the Ambulatory Pediatric Association; 2006; vol. 6 (no. 2); 100-4

Study details

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

Kempe, 2001

Bibliographic Reference	Kempe, A.; Lowery, N.E.; Pearson, K.A.; Renfrew, B.L.; Jones, J.S.; Steiner, J.F.; Berman, S.; Immunization recall: Effectiveness and barriers to success in an urban teaching clinic; Journal of Pediatrics; 2001; vol. 139 (no. 5); 630-635

Study details

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

Kempe, 2012

Bibliographic Reference	Kempe, Allison; Barrow, Jennifer; Stokley, Shannon; Saville, Alison; Glazner, Judith E; Suh, Christina; Federico, Steven; Abrams, Lisa; Seewald, Laura; Beaty, Brenda; Daley, Matthew F; Dickinson, L Miriam; Effectiveness and cost of immunization recall at school-based health centers.; Pediatrics; 2012; vol. 129 (no. 6); e1446-52

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	School
Study dates	2008 to 2009
Sources of funding	Centers for Disease Control and Protection
Inclusion criteria	Adolescents Aged 11 or 12 years On-site paediatric clinic Adolescents had to be enrolled in the clinic Had parental consent to be immunised Students in the intervention group were recalled if they had parental consent to receive $1 needed vaccine.
Exclusion criteria	People who had already received the vaccine Seventh and eighth graders The clinic was aimed at children who were considered most likely to need vaccination.
Intervention(s)	The study was divided into a demonstration project among girls and an RCT among boys. All girls were included in a demonstration project rather than an RCT because of the health centre's concern that an RCT might compromise their opportunity to complete the HPV series within the school year.

	Students in the intervention arm of the trial were recalled up to 2 times by 1 of 3 methods: a pass sent to the student in their classroom, a phone call to the classroom, or a staff member of the health centre walking into their classroom to escort them to the clinic.
Comparator	No reminders.
Relevant outcome measures	Vaccine uptake Meningococcus
Number of participants	263
Duration of follow-up	6 months
Loss to follow-up	None
Additional comments	Data for girls was excluded because this data was not randomised and was part of the demonstartion project. Data for the tetanus, diphtheria and pertussis vaccine was excluded to avoid double-counting. This is because this data was reported seperately but involved the same participants as those who received the meningococcal vaccine. Data for meningococcal vaccine was selected because this had a larger dataset: There were 263 participants for meningococcal vaccine but only 245 for tetanus, diphtheria and pertussis vaccine. Baseline characteristics for the boys who were randomised were not provided.

Study arms

Reminder (N = 133)
No reminder (N = 130)

Characteristics

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

Section	Question	Answer
Overall bias and Directness	Risk of bias judgement	Low *(Vaccinations were recorded in all 6 schools using the same computer system so a lack of assessor blinding was not considered to leasd to a risk of bias in practice.)*
	Overall Directness	Directly applicable

1

Kempe, 2016

2

Bibliographic Reference	Kempe, Allison; O'Leary, Sean T; Shoup, Jo Ann; Stokley, Shannon; Lockhart, Steven; Furniss, Anna; Dickinson, L Miriam; Barnard, Juliana; Daley, Matthew F; Parental Choice of Recall Method for HPV Vaccination: A Pragmatic Trial.; Pediatrics; 2016; vol. 137 (no. 3); e20152857

3 **Study details**

Other publications associated with this study included in review	O'Leary 2015 contains results reported from the patient-level RCT.
Trial registration number and/ or trial name	NCT01577979
Study type	Cluster randomised controlled trial
Study location	Colorado, USA
Study setting	A cluster randomized pragmatic trial, with randomization at the level of the practice, involving all paediatric practices (n=7) in Kaiser Permanente Colorado (KPCO) health system.
Study dates	2012 - 2014
Sources of funding	Centers for Disease Control and Prevention (grant 5U01IP000310-02).
Inclusion criteria	Adolescents Ages 11 and 17 who were enrolled at KPCO within the past 2 years Have received first dose of vaccine Had first HPV dose between January and June 2013.
Exclusion criteria	None reported
Intervention(s)	Parents of eligible adolescents receiving their first HPV vaccine at intervention practices were told by the medical assistant or nurse giving the vaccine that KPCO was doing a study to see how best to remind parents and adolescents about getting future HPV doses and asked if they wished to be recalled for future doses. Adolescents who were not accompanied by a parent were not asked to participate. Parents who wanted to receive reminders were given a short check-off form clarifying (1) which recall method they preferred (text, e-mail, automated telephone message), (2) if they also wanted a recall sent to their child, and (3) the contact information for their preferred method. Parents were told they could select up to 2 methods and that, if they wanted to have their adolescent reminded, they had to pick

	the same method for both. The number of recalls parents would receive was not specified. For recalls, KPCO used an Interactive Voice Response (IVR) system, which is capable of producing multiple automated recall messages. If a single recall method was chosen, a recall was sent on alternating weeks, for up to 3 recalls per 6 weeks. If 2 methods were chosen, 6 recalls were sent, 1 each week, alternating between the 2 preferred recall methods, for up to 6 weeks. Recalls for dose 2 began 9 weeks after dose 1 and for dose 3, 18 weeks after dose 2.
Comparator	Health clinics randomized to the usual care arm did not implement reminders or recalls for HPV vaccine.
Relevant outcome measures	Vaccine uptake
Duration of follow-up	6 months
Loss to follow-up	Intervention: N = 117, Control: N = 267
Additional comments	The O'Leary 2015 study appears to be part of the same study and may have overlapping data therefore it will not be included in the same meta-analysis as this study.

1 **Study arms**

Recall (N = 374)
Control (N = 555)

2 **Characteristics**

3 **Arm-level characteristics**

	Recall (N = 374)	Control (N = 555)
% Female		
Custom value	33%	36%
Mean age (SD)		
Mean/SD	13 (2.2)	13 (2.2)
Race / Ethnicity		
White		
Custom value	48%	53%
Black		
Custom value	14%	13%
Other		
Custom value	18	13
Hispanic		
Custom value	22	26

4

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

Section	Question	Answer
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Some concerns *(Single blinded design, study personnel aware of participant allocation.)*
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Some concerns *(More than twice as many lost to follow-up in the control group than intervention.)*
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Low *(Some concern in outcome assessment due to single blinded design - study personnel aware of participant allocation, but the assessors used KPCO administrative electronic medical record data and data from the Colorado Immunization Information System to asses the results for both study arms which should have reduced risk of bias.)*
5. Bias in selection of the reported result	Risk of bias for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Due to disproportionate losses to follow-up and risks associated with a lack of personnel blinding.)*
	Overall Directness	Directly applicable

Kempe, 2015

Bibliographic Reference	Kempe, Allison; Saville, Alison W; Dickinson, L Miriam; Beaty, Brenda; Eisert, Sheri; Gurfinkel, Dennis; Brewer, Sarah; Shull, Heather; Herrero, Diana; Herlihy, Rachel; Collaborative centralized reminder/recall notification to increase immunization rates among young children: a comparative effectiveness trial.; JAMA pediatrics; 2015; vol. 169 (no. 4); 365-73

Study details

Study type	Randomised controlled trial (RCT): The following comparison was organised as an RCT: centrally organised reminders by autodialer and mail (2 telephone calls and 2 postcards) versus Centrally organised reminders by mail (1 letter and 3 postcards). Cluster randomised controlled trial: The following comparison was organised as a cluster RCT: Centrally organised reminders by mail or autodialer and mail versus primary care practice webinar training on vaccination reminders.
Study location	USA
Study setting	Community
Study dates	2012
Sources of funding	Not mentioned
Inclusion criteria	Children aged 19 to 35 months with an address in one of the study counties and who appeared to need at least 1 immunization.

Exclusion criteria	Children who were up to date with all their vaccines.
Intervention(s)	**Intervention 1:** Centrally organised reminders by autodialer and mail (2 telephone calls and 2 postcards). **Intervention 2:** Centrally organised reminders by mail (1 letter and 3 postcards). Altogether, both interventions took place in 7 counties (clusters).
Comparator	Primary care practice webinar training on vaccination reminders. This intervention took place in 8 counties (clusters).
Relevant outcome measures	Vaccine uptake
Number of participants	18235
Duration of follow-up	6 months
Loss to follow-up	None
Additional comments	**Intervention 1:** The comparison of 'centrally organised reminders by mail or autodialer and mail' versus 'primary care practice webinar training on vaccination reminders' was organised as a cluster RCT with 7 counties for the former arm and 8 different counties for the latter. This data was not adjusted for clustering. Therefore, we adjusted this data using an ICC of 0.05. **Intervention 2:** The comparison of 'centrally organised reminders by autodialer and mail (2 telephone calls and 2 postcards)' versus 'centrally organised reminders by mail (1 letter and 3 postcards)' was organised as a standard RCT for children who were within those 7 counties. This is why this study has a risk of bias assessment for both RCTs and cluster RCTs. We used the data for number of children up to date with their vaccinations. This is because this is comparable data to other studies because this outcome is commonly collected. We did not include the data for number of children who received at least 1 vaccination. This is because the data included all general vaccines for the 0-5 years age group. Therefore, this data would not be comparable to other studies because this outcome was unique as far as we know. There were no relevant baseline characteristics.

1 **Study arms**

Centrally organised reminders by mail (1 letter and 3 postcards) (N = 4530)
Centrally organised reminders by autodialer and mail (2 telephone calls and 2 postcards) (N = 4519)
Primary care practice webinar training on vaccination reminders (N = 9186)

2
3 **Cochrane Risk of Bias tool for normal RCTs**

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

Section	Question	Answer
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(There was no blinding and details of how data was collected was not provided.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(There was no blinding and details of how data was collected was not provided.)*
Overall bias and Directness	Overall Directness	Partially applicable *(The vaccines were not specified and were general for children of that age.)*

1
2 **Cochrane Risk of Bias tool for cluster RCTs**

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	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(There was no blinding and details of how data was collected was not provided.)*
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 was no blinding and details of how data was collected was not provided.)*

Section	Question	Answer
Overall bias and Directness	Overall Directness	Partially applicable *(The vaccines were not specified and were general for children of that age.)*

Klassing, 2018

Bibliographic Reference	Klassing, Haley M; Ruisinger, Janelle F; Prohaska, Emily S; Melton, Brittany L; Evaluation of Pharmacist-Initiated Interventions on Vaccination Rates in Patients with Asthma or COPD.; Journal of community health; 2018; vol. 43 (no. 2); 297-303

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	3 pharmacies within a grocery store chain located within the Kansas City metropolitan area.
Study dates	2014
Sources of funding	American Pharmacists Association
Inclusion criteria	People of a given age People aged 18 years and over People who had specified disease(s) A possible diagnosis of asthma and/or COPD based on a dispensing history.
Exclusion criteria	Participants who only had 1 refill of a drug for asthma or COPD
Intervention(s)	There were 2 intervention arms: phone call intervention and a mailed letter intervention. A phone call script was utilized for the phone call intervention; patient specific questions were fielded on an individual basis. The letter intervention group received a standardized letter addressed to each specific patient. Both the phone call script and letter referenced the 2014 CDC immunization schedule and guidelines. All subjects were exposed to in-store advertising for the seasonal influenza vaccine and received flyers advertising on-site immunizations when picking up prescriptions during the study period.
Comparator	No reminder
Relevant outcome measures	Vaccine uptake Pneumococcal vaccine
Number of participants	311 (71 over 65 year olds)
Duration of follow-up	4 months

Loss to follow-up	96 were lost to follow up in the phone call arm, 149 in the letter arm and 180 in the control arm.
Additional comments	Data for influenza vaccination and data for people younger than 65 years of age was excluded because these are not included in the protocol for routine pneumococcal vaccination. Both reminder arms were combined in the summary meta-analysis to prevent double-counting of the control arm. The study aimed to look at people with asthma or COPD, but at the end of the intervention it was determined that large proportions of the participants did not have either condition.

1 **Study arms**

Reminder phone call (N = 41) **Reminder letter (N= 277)**
No reminder (N = 30)

2

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	High *(There were large numbers of participants lost to follow up across the arms (over half in all cases.)*
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low (*Outcomes were measured via the electronic pharmacy record and one phone call to the patient)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Due to the large loss to follow up.)*
	Overall Directness	Directly applicable

3

LeBaron, 2004

4

Bibliographic Reference	LeBaron, Charles W; Starnes, Debi M; Rask, Kimberly J; The impact of reminder-recall interventions on low vaccination coverage in an inner-city population.; Archives of pediatrics & adolescent medicine; 2004; vol. 158 (no. 3); 255-61

5

6 **Study details**

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

Lieu, 1997

Bibliographic Reference	Lieu TA; Black SB; Ray P; Schwalbe JA; Lewis EM; Lavetter A; Morozumi PA; Shinefield HR; Computer-generated recall letters for underimmunized children: how cost-effective?; The Pediatric infectious disease journal; 1997; vol. 16 (no. 1)

Study details

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

Lieu, 1998

Bibliographic Reference	Lieu, T A; Capra, A M; Makol, J; Black, S B; Shinefield, H R; Effectiveness and cost-effectiveness of letters, automated telephone messages, or both for underimmunized children in a health maintenance organization.; Pediatrics; 1998; vol. 101 (no. 4); e3

Study details

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

Linkins, 1994

Bibliographic Reference	Linkins, R W; Dini, E F; Watson, G; Patriarca, P A; A randomized trial of the effectiveness of computer-generated telephone messages in increasing immunization visits among preschool children.; Archives of pediatrics & adolescent medicine; 1994; vol. 148 (no. 9); 908-14

Study details

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

Loo, 2011

1

Bibliographic Reference	Loo, TS; Davis, RB; Lipsitz, LA; Irish, J; Bates, CK; Agarwal, K; Markson, L; Hamel, MB; Electronic medical record reminders and panel management to improve primary care of elderly patients; Archives of internal medicine; 2011; vol. 171 (no. 17); 1552-1558

2 **Study details**

Trial registration number and/ or trial name	NCT01313169
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	2 separate office locations within an urban academic medical centre.
Study dates	2009 to 2010
Sources of funding	Donald W. Reynolds Foundation
Inclusion criteria	People aged 65 years and older These people were the patients that the intervention was aimed at having vaccinated Live in a specific area The patients had to be registered with the practice and had at least 1 visit to the practice in the 18 months before the study start. Physicians in primary care practices In the Beth Israel Deaconess General Medicine and Primary Care Division who were the targets of the intervention to get them to increase their vaccination efforts
Exclusion criteria	None reported
Intervention(s)	**The 2 interventions were electronic medical record reminders with or without panel management.** Reminders were displayed in each patient's electronic medical record available at the point of care but also in summary form in the provider's panel list for patients older than 65 years to facilitate panel management. The new electronic medical record reminders were activated for both intervention arms at the study start. Most practicing faculty physicians were already familiar with EMR reminder functionality because EMR reminders for screening, preventive, and diabetes care were already in use at this centre before this study. An active geriatric reminder was displayed by a "geriatrics alerts" link on the patient's profile, the first screen visualized when opening a record. Clicking on this link would bring the user to a new screen, a geriatrics sheet displaying all the active geriatric EMR reminders and the last status for each reminder (Figure 1). Each reminder displayed was an active link, allowing the user to respond to the reminder by proceeding or declining the suggested action. By design, viewing or responding to a reminder was voluntary and completely at the discretion of the user. For the patients who were randomised to the panel manager arm, the panel manager assisted patients and physicians in completing the targeted practice behaviors. Their panel manager was an administrative assistant without any specific clinical training who spent half of his time working on this study. He was located off-site and communicated with physicians primarily through e-mail. The panel manager began by reviewing the EMR's geriatrics patient list for each assigned provider; the list displayed which patients had no health care proxy designated, were due for osteoporosis screening, or were due for pneumococcal or influenza vaccination. This work list was then forwarded to the practice to inform him or her of the items

	due and to obtain approval to contact the patient and facilitate completion of the items. If approved, up to 3 attempts were made to contact the patient by telephone and, if not reached, a letter with the same content that would have been provided by telephone was sent. Two cycles of contact were attempted, one during the first 6-month period and then another during the last 6-month period. One dedicated round of contact was made for influenza vaccination during the fall of 2009 because of the time-sensitive nature of this task. On reaching the patient, the panel manager verified that the patient had not already completed the item due. If completed, he updated the information in the electronic medical record and made a note that the action had already been completed before the intervention; the panel manager then asked the patient to send or bring the relevant record to their review. The panel manager described the care due and stated explicitly that their doctor recommended the care. The panel manager facilitated completion by mailing health care proxy information and forms to the patient, placing an order for immunization and scheduling it. If the patient declined action, a letter summarising the recommended action was sent to the patient and forwarded electronically to the doctor to inform him or her of contact and to suggest that items due be addressed at the next visit.
Comparator	The control arm continued to use the existing electronic medical records without the new reminders.
Relevant outcome measures	Vaccine uptake Pneumonia
Number of participants	3227
Duration of follow-up	12 months
Loss to follow-up	None
Additional comments	Data on influenza vaccination was not included because this is out of scope for this work. Data for both reminder arms was combined to avoid double-counting the control arm in the summary meta-analysis.

Study arms

Reminder (N = 1926)
No reminder (N = 1301)

Characteristics

Arm-level characteristics

	Reminder (N = 1926)	**No reminder (N = 1301)**
Age *(years)* SD is given if provided by the study		
Mean/SD	75 (*empty data*)	74 (7)
Sex: Female *(%)*		
Nominal	59	55

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	High *(Physicians were assigned to the intention or control arm based on their office (big versus small shared office) and then the intervention arm physicians in the big office were randomised by an unknown method into 2 groups. There was no information about the allocation concealment. However, because of the nature of the intervention – a reminder – this was unlikely to affect the outcomes measured by the trial.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(The physicians were aware that they were taking part in a clinical trial and this could have affected their decisions to offer vaccination to their patients.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(There was a lack of information about assessor blinding. However, the data was extracted from a single vaccination registry. Therefore, lack of blinding was not expected to have affected the data.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Due to issues with the randomisation process.)*
	Overall Directness	Directly applicable

1

MacIntyre, 2003

2

Bibliographic Reference	MacIntyre, C R; Kainer, M A; Brown, G V; A randomised, clinical trial comparing the effectiveness of hospital and community-based reminder systems for increasing uptake of influenza and pneumococcal vaccine in hospitalised patients aged 65 years and over.; Gerontology; 2003; vol. 49 (no. 1); 33-40

3 **Study details**

Study type	Randomised controlled trial (RCT)
Study location	Australia
Study setting	Hospital and general practice
Study dates	1998
Sources of funding	Department of Human Services, Victoria
Inclusion criteria	People aged 65 years and older Patients admitted to hospital
Exclusion criteria	People who had already received the vaccine

Intervention(s)	**Hospital reminder**: the hospital reminder was to hospital staff in the form of a memo left in the patient's medical notes and a verbal (face-to-face) reminder to ward staff (nursing and medical). The decision to vaccinate was left to the treating physician. The reminder said that the patient had been identified as eligible for influenza and/or pneumonia vaccine, but was unvaccinated, and that vaccination was recommended.
Comparator	**General practitioner reminde**r: a reminder to the patient's usual family doctor. This was posted to the family doctor on the day of discharge from hospital. The reminder said that the patient had been identified as eligible for influenza and/or pneumonia vaccine, but was unvaccinated, and that vaccination was recommended.
Relevant outcome measures	Vaccine uptake Pneumonia
Number of participants	131
Duration of follow-up	3 months
Loss to follow-up	None
Additional comments	Influenza vaccine data has been excluded from this review because it did not match the protocol and is covered by another guideline

Study arms

Reminder for hospital staff (N = 70)
Reminder for general practice staff (N = 61)

Characteristics

Arm-level characteristics

	Reminder for hospital staff (N = 70)	**Reminder for general practice staff (N = 61)**
Mean age *(years)* Variance was not provided		
Nominal	74	73
Sex: Female *(%)*		
Nominal	56	56

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(There was no information about the allocation concealment. However, because of the nature of the intervention – a reminder – this was unlikely to affect the outcomes measured by the trial.)*
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

Section	Question	Answer
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Collecting the data involved effort because there was no central computer system. Data was collected from paper records and by way of telephone calls. Therefore, data collection could introduce bias because the investigators were not blinded.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Due to a lack of assessor blinding.)*
	Overall Directness	Directly applicable

Menzies, 2020

Bibliographic Reference	Menzies R; Heron L; Lampard J; McMillan M; Joseph T; Chan J; Storken A; Marshall H; A randomised controlled trial of SMS messaging and calendar reminders to improve vaccination timeliness in infants.; Vaccine; vol. 38 (no. 15)

Study details

Study type	Randomised controlled trial (RCT)
Trial registration number and/ or trial name	Australia and New Zealand Clinical Trial Registration No. ACTRN12614000970640
Study location	Australia
Study setting	16 general practices, 8 council immunisation clinics, 3 Aboriginal Medical Services and a Community Health Centre.
Study dates	2015
Sources of funding	National Health and Medical Research Council (NHMRC) Australia.
Inclusion criteria	Parents of young children Who possessed a mobile phone and sufficient English language skills. Children of a specific age Aged less than 16 months
Exclusion criteria	None reported
Intervention(s)	3 interventions: 1. SMS text message reminders only. 2. Personalised calendar reminder only. 3. SMS text message and personalised calendar (both interventions). Data from the VaxSMS app was exported to Microsoft Excel, including names (parent/carer and infant), mobile telephone numbers, date of enrolment, state and immunisation provider service where enrolment occurred, infant date of birth, allocated intervention group, due dates for future immunisations and dates of SMS messages scheduled and sent, dates of calendars printed or

	emailed where applicable. Dates and types of vaccines administered were obtained from Australian Childhood Immunisation Register and immunisation provider records in November 2017.
Comparator	No intervention. No further information was provided about the no intervention group or the other study arms.
Relevant outcome measures	Vaccine uptake
Number of participants	1594 eligible infant/carer pairs were recruited into the study. The majority were enrolled at council immunisation clinics and a Community Health Centre (78%), followed by general practices (18%) and Aboriginal Medical Services (AMSs) (4%). Participants were equally distributed between South Australia and New South Wales.
Duration of follow-up	30 days
Loss to follow-up	None
Additional comments	Reminder arms have been combined for two of the meta-analyses. This is to prevent double counting of the control group. The data was not used in the meta-analysis that is sub-grouped according to who sent the reminders. This is because this study does not provide that information. The data used for the analysis was the 18 month on-time compliance. This is because this was the latest date used in the study. Therefore, this data is more summative compared to the earlier data collection time points.

1

2 **Study arms**

Text message reminders (N = 398)	
Personalised calendar reminders (N = 398)	
Text message reminders and calendar reminders (N = 404)	
No reminders (N = 394)	
Inclusion criteria	Parents of young children Who possessed a mobile phone and sufficient English language skills.
Comparator	No intervention.

Arm-level characteristics

	Text message reminders (N = 398)	Personalised calendar reminders (N = 398)	Text message reminders and calendar reminders (N = 404)	No reminders (N = 394)
Age *(days)* Days of age at enrolment				
MedianIQR	126 (50 to 218)	127 (50 to 210)	129 (51 to 218)	124 (50 to 202)

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 *(This RCT had no blinding. Participants appeared to be unaware that they were part of a clinical trial and therefore knowing their allocation was not expected to affect the participant's decisions to vaccinate their children. There was no personnel blinding, but this was also not expected to bias the results as the same processes were carried out for all arms of the trial.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	High *(This study had no randomisation or blinding. The method of data collection was not described. It is possible that the lack of blinding could have influenced data collection.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(No blinding and method of data collection is not provided.)*
	Overall Directness	Directly applicable

Morgan, 1998

Bibliographic Reference	Morgan, M Z; Evans, M R; Initiatives to improve childhood immunisation uptake: a randomised controlled trial.; BMJ (Clinical research ed.); 1998; vol. 316 (no. 7144); 1569-70

Study details

Study type	Randomised controlled trial (RCT)
Study location	UK

Study setting	The former county of South Glamorgan
Study dates	1998
Sources of funding	None reported
Inclusion criteria	Children of a specific age Children aged 3 to 15 months scheduled to complete the primary course of diphtheria, pertussis, tetanus, polio, and Haemophilus influenzae type b immunisation. Children aged 15 to 27 months for MMR. Children were included in the trial if they had not completed their primary course by 9 months of age or their measles, mumps, and rubella immunisation by 21 months of age. Live in a specific area Children resident in the former county of South Glamorgan
Exclusion criteria	None reported
Intervention(s)	Intervention A comprised a nondirective telephone call to the child's health visitor to confirm the child's personal details and immunisation status. The health visitor was not informed of the trial and, although follow up of the child was anticipated, it was not specifically requested. Intervention B comprised a single mailed reminder to the child's parents together with a questionnaire about details of immunisation status and reasons for non--immunisation, and a reply paid envelope. Parents were not informed of the trial.
Comparator	No reminder
Relevant outcome measures	Vaccine uptake For children aged 3 to 15 months- the primary course of diphtheria, pertussis, tetanus, polio, and Haemophilus influenzae type b immunisation. For children aged 15 to 27 months - MMR.
Number of participants	451
Duration of follow-up	Not provided
Loss to follow-up	None

Study arms

Reminder letter and questionnaire to parents (N = 159)
Reminder call to health visitor (N = 153)
No reminders (N = 139)

Characteristics

Arm-level characteristics

	Reminder letter and questionnaire to parents (N = 159)	**Reminder call to health visitor (N = 153)**	**No reminders (N = 139)**
Sex: Female *(%)*			
Nominal	50	54	49

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(There was no information about the allocation concealment. However, because of the nature of the intervention (reminders) this was unlikely to affect the outcomes measured by the trial.)*
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	High *(The follow-up period was not provided. Blinding was not mentioned and neither was the method of data collection. Lack of blinding could have affected the rigour of data collection in an unequal way for different arms.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High
	Overall Directness	Directly applicable

O'Leary, 2015

Bibliographic Reference	O'Leary, S.T.; Lee, M.; Lockhart, S.; Eisert, S.; Furniss, A.; Barnard, J.; Shmueli, D.; Stokley, S.; Miriam Dickinson, L.; Kempe, A.; Effectiveness and cost of bidirectional text messaging for adolescent vaccines and well care; Pediatrics; 2015; vol. 136 (no. 5); e1220-e1227

Study details

Evidence table available in an included systematic review	The evidence table for this study can be found in the Jacobson Vann 2018 Cochrane review.
Additional comments	Only the MCV and HPV vaccination data were included. The Tdap and MCV booster vaccines were not included because they are not on the UK routine vaccination schedule for this age group. We presented the data as intention to treat. Therefore, we presented the data as the total number of participants having had each vaccine by the end of the study, regardless of whether they had had the vaccine before the study. This was our routine way of presenting data.

Otsuka, 2013

1

Bibliographic Reference	Otsuka SH; Tayal NH; Porter K; Embi PJ; Beatty SJ; Improving herpes zoster vaccination rates through use of a clinical pharmacist and a personal health record.; The American journal of medicine; 2013; vol. 126 (no. 9)

2 **Study details**

Study type	Randomised controlled trial (RCT)
Study location	Ohio, USA
Study setting	Primary care at The Ohio State University Martha Morehouse General Internal Medicine Clinic in Columbus, Ohio.
Study dates	April 1, 2011 to May 15, 2011.
Sources of funding	Grants from the National Centre for Advancing Translational Sciences and the Ohio State University Medical Centre Institutional Review Board.
Inclusion criteria	Eligible to be vaccinated Did not have herpes zoster vaccine recorded in the electronic medical record Live in a specific area Patients included in the study received primary care from physicians at The Ohio State University Martha Morehouse General Internal Medicine Clinic in Columbus, Ohio People of a given age Aged 60 years and over Other Received primary care from physicians at The Ohio State University Martha Morehouse General Internal Medicine Clinic in Columbus, Ohio
Exclusion criteria	None reported
Intervention(s)	**People were stratified into 2 patient populations (+/- active personal health record) and randomisation was performed separately within each population.** **Intervention 1 (an electronic vaccination alert) was compared to intervention 2 (standard care) for patients with an active personal health record.** **1. Electronic vaccination alert for patients with an active personal health record** The study defined a personal health record (PHR) as follows: a PHR is one of the many tools of an electronic medical record that allows patients and providers to communicate securely over the internet and patients to view key components of their medical record, including laboratory results, medications, and immunization status. Patients with an activated personal health record in the intervention group received an informational packet regarding shingles and the herpes zoster vaccine through the electronic medical record. Patients were instructed to contact the clinic if they were interested in receiving the herpes zoster vaccine. If they had already received the herpes zoster vaccine, they were asked to contact the clinic to have their medical record updated. A pharmacist was contacted once interest from a patient was expressed. The pharmacist performed a review of the patient's medical record to confirm the herpes zoster vaccine was indicated and no contraindications existed. Where indicated, herpes zoster prescriptions were mailed patients with instructions on how to obtain the vaccine, a list of community pharmacies known to stock the vaccine, and a letter to the pharmacist requesting fax confirmation once the vaccine was administered. Time spent by the pharmacist reviewing medical charts was tracked to estimate time savings. **2. Standard care for patients with an active personal health record**

	Intervention 3 (a postal vaccination alert) was compared to intervention 4 (standard care) for patients without an active personal health record. **3. Postal vaccination alert for patients without an active personal health record** The study does not define people without an active PHR other than to say they were non-personal health record users. It is assumed that this means their medical records were held by their providers and could not be accessed remotely by the individual. Patients without an activated personal health record in the intervention group received an informational packet regarding shingles and the herpes zoster vaccine via US postal service. Patients were instructed to contact the clinic if they were interested in receiving the herpes zoster vaccine. If they had already received the herpes zoster vaccine, they were asked to contact the clinic to have their medical record updated. A pharmacist was contacted once interest from a patient was expressed. The pharmacist performed a review of the patient's medical record to confirm the herpes zoster vaccine was indicated and no contraindications existed. Where indicated, herpes zoster prescriptions were mailed patients with instructions on how to obtain the vaccine, a list of community pharmacies known to stock the vaccine, and a letter to the pharmacist requesting fax confirmation once the vaccine was administered. Time spent by the pharmacist reviewing medical charts was tracked to estimate time savings. **4. Standard care for patients without an active personal health record**
Comparator	**Standard care for patients without an active personal health record**
Relevant outcome measures	Vaccine uptake Shingles
Number of participants	Personal health record users: 674 Non-personal health record users: 1916
Duration of follow-up	6 months
Loss to follow-up	None
Additional comments	Baseline characteristics were not provided for each of the 4 arms. However, they were provided for all participants who received the intervention and all participants who received the control: Mean age (SD): intervention 69.8 years (8.3); control 68.6 years (7.9) Sex: female: intervention 48%; control 57%

1

2 **Study arms**

Personal health record users: Reminder (N = 250)
Personal health record users: No reminder (N = 424)
Non-personal health record users: Reminder (N = 250)
Non-Personal health record users: No reminder (N = 1665)

3

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(There was no information about the allocation concealment. However, because of the nature of the intervention – a reminder – this was unlikely to affect the outcomes measured by the trial.)*
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 *(Participants appeared to be unaware that they were part of a clinical trial. Therefore, knowing their allocation by receiving a reminder or not was not expected to affect the participant's vaccination decision. There was no mention of personnel blinding. However, this was also not expected to bias the results as the same processes were carried out for both arms of the trial.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(There was a lack of information about assessor blinding. However, data collection did not seem to depend on willpower. Therefore, lack of blinding was not expected to have affected the data.)*
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

Rand, 2015

Bibliographic Reference	Rand, CM; Brill, H; Albertin, C; Humiston, SG; Schaffer, S; Shone, LP; Blumkin, AK; Szilagyi, PG; Effectiveness of centralized text message reminders on human papillomavirus immunization coverage for publicly insured adolescents; Journal of adolescent health; 2015; vol. 56 (no. 5); S17-S20

Study details

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

Rand, 2017

Bibliographic Reference	Rand, Cynthia M; Vincelli, Phyllis; Goldstein, Nicolas P N; Blumkin, Aaron; Szilagyi, Peter G; Effects of Phone and Text Message Reminders on Completion of the

Human Papillomavirus Vaccine Series.; The Journal of adolescent health : official publication of the Society for Adolescent Medicine; 2017; vol. 60 (no. 1); 113-119

Study details

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

Rodewald, 1996

Bibliographic Reference	Rodewald LE; Szilagyi PG; Humiston SG; Raubertas RF; Wassilak S; Roghmann KJ; Hall CB; Effect of emergency department immunizations on immunization rates and subsequent primary care visits.; Archives of pediatrics & adolescent medicine; 1996; vol. 150 (no. 12)

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	An emergency department and 54 primary care practices in Monroe county, New York.
Study dates	1990 to 1991
Sources of funding	Centers for Disease Control and Prevention
Inclusion criteria	Children of a specific age Aged 6 to 36 months. Participants attended an emergency department
Exclusion criteria	None reported
Intervention(s)	When children attended an emergency department, they were randomised into a primary care reminder arm, emergency department vaccination arm or control groups. The reminder arm: No intervention in the emergency department. Less than a week later, the child's GP was sent a letter. If there was a chance that they might not be up to date with vaccinations, this was flagged up. The emergency department vaccination arm: Parents of children who were not likely to be up to date with their vaccinations were offered vaccines that likely had not been previously administered and vaccination was not contraindicated.
Comparator	No intervention with regards to vaccines.
Relevant outcome measures	Vaccine uptake The outcome was percentage / number of children up to date with their vaccinations. The study mentions diphtheria, tetanus, pertussis, polio, and Hib.

Number of participants	1835
Duration of follow-up	12 months
Loss to follow-up	none
Additional comments	Only the data for primary care reminders and the control were included as the data for emergency department vaccinations was not relevant for this review. Data from the latest time point was used because this should be the most summative data.

1 **Study arms**

Primary care reminders (N = 610)
No reminders but offers of vaccinations in the emergency department (N = 611)
Control group: no reminders and no offers of vaccinations in the emergency department (N = 614)

2 **Characteristics**

3 **Arm-level characteristics**

	Primary care reminders (N = 610)	**No reminders but offers of vaccinations in the emergency department (N = 611)**	**Control group: no reminders and no offers of vaccinations in the emergency department (N = 614)**
Age *(Months)*			
Nominal	18.2	17.5	18
Sex: Female *(%)*			
Nominal	41	45	42

4

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Blinding was not mentioned. The investigators do not mention how the data for uptake was collected. Therefore, it is difficult to assess bias for data collection.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns

Section	Question	Answer
	Overall Directness	Directly applicable

Rodewald, 1999

Bibliographic Reference	Rodewald, L E; Szilagyi, P G; Humiston, S G; Barth, R; Kraus, R; Raubertas, R F; A randomized study of tracking with outreach and provider prompting to improve immunization coverage and primary care.; Pediatrics; 1999; vol. 103 (no. 1); 31-8

Study details

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

Shevlin, 2002

Bibliographic Reference	Shevlin, Jennifer D; Summers-Bean, Christopher; Thomas, Donna; Whitney, Cynthia G; Todd, Daryl; Ray, Susan M; A systematic approach for increasing pneumococcal vaccination rates at an inner-city public hospital.; American journal of preventive medicine; 2002; vol. 22 (no. 2); 92-7

Study details

Study location	Georgia, USA
Study setting	Grady Memorial Hospital
Study dates	May - June 1999
Sources of funding	Not stated
Inclusion criteria	Eligible to be vaccinated Those with indications and no contraindications to pneumococcal vaccination
Exclusion criteria	None reported
Intervention(s)	Provider-reminder system initiated by nurses on pneumococcal vaccination rates in the inpatient areas of the hospital. The reminder system used a pre-printed screening and order form. Vaccination rates were evaluated during two phases: a 1-month period in which four wards were randomized to the intervention or control (INT1) group, and a 5-month period in which the intervention was implemented hospital-wide (INT2). In INT1 Intervention area nurses, physicians, and administrators received both in-service education prior to commencing the pilot study, and then received continual feedback regarding the form's use and vaccination rates. The pre-printed forms were included in patients' admission packets and placed in the physician-order section of the chart. Nurses assessed patients for vaccine candidacy upon admission and flagged the form for physicians if the patient had indications. Physicians ordered the vaccine for eligible patients after obtaining the patient's verbal consent.

	INT2 was not randomised and is not relevant for this review so no details are provided.
Comparator	No education or organizational changes were provided for the control floors.
Relevant outcome measures	Vaccine uptake
Number of participants	Intervention: N= 296, Control: N=238
Duration of follow-up	1 month
Loss to follow-up	None
Additional comments	The randomised 1-month period was followed by a 5 month period (INT2) where the intervention was implemented across the hospital. The results from this were not used as this was not randomised or and lacked a comparison group. This study included all participants who were eligible for pneumococcal vaccination and these included the elderly and patients at high risk of pneumonia. In INT1 23% of participants were 65 years and older, while in the control arm this was 29%. Data was not provided separately for over 65 years olds.

1 **Study arm**

Provider reminders (N = 296)
Control (N = 238)

2 **Characteristics**

3 **Arm-level characteristics**

	Provider reminders (N = 296)	**Control (N = 238)**
Race, White %		
Custom value	8.4%	7.1%
Race, Black %		
Custom value	89.5%	88.2%
Gender		
Custom value	48%	47%
Previous vaccination		
Custom value	16.6%	16.4%

4

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information regarding randomisation procedure.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(No information about blinding, but likely to be hard to achieve for this type of intervention.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low

Section	Question	Answer
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(Possible assessment bias if assessors were aware of allocation. Data was collected by chart review on discharge.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Due to a lack of information regarding randomisation or blinding of outcome assessors or study personnel.)*
	Overall Directness	Partially applicable *(Data could not be extracted separately for over 65 year olds.)*

Stehr-Green, 1993

Bibliographic Reference	Stehr-Green, P A; Dini, E F; Lindegren, M L; Patriarca, P A; Evaluation of telephoned computer-generated reminders to improve immunization coverage at inner-city clinics.; Public health reports (Washington, D.C. : 1974); 1993; vol. 108 (no. 4); 426-30

Study details

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

Stolpe, 2019

Bibliographic Reference	Stolpe, Samuel; Choudhry, Niteesh K; Effect of Automated Immunization Registry-Based Telephonic Interventions on Adult Vaccination Rates in Community Pharmacies: A Randomized Controlled Trial.; Journal of managed care & specialty pharmacy; 2019; vol. 25 (no. 9); 989-994

Study details

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Reminders were from pharmacies
Study dates	2015 to 2016
Sources of funding	Pfizer and Merck
Inclusion criteria	Individuals who were missing a pneumococcal vaccination and were aged either at least 65 years or between 19 and 64 years with potentially high-risk conditions and individuals aged at least 60 years who were missing a herpes zoster vaccination. All patients were scheduled to receive an automated telephone call from their community pharmacies. The nature of these routinely scheduled calls varied by pharmacy chain. Potentially eligible patients were those receiving a medication

	synchronization pre-appointment call at 1 chain (100 stores), a refill reminder call at the second chain (88 stores), and a refill ready call at the third chain (58 stores).
Exclusion criteria	People who had already received the vaccine
Intervention(s)	For intervention patients, a set of automated scripts offering the vaccines was developed. The vaccination prompt was appended to the outbound communication that patients were scheduled to receive (regarding medical matters other than vaccination) and offered either pneumococcal vaccine, herpes zoster vaccine, or both. Two additional attempts were made if the patient did not answer the phone, if the call went to an answering machine, or if the patient ended the call before receiving the vaccination prompt. Patients who listened to the entire vaccination prompt were asked to give a vocal response indicating their intent to receive the vaccine during their next visit to the pharmacy. If the patient indicated acceptance, a notification appeared within the pharmacy's clinical platform with an alert generated for the pharmacist indicating the patient's response. No further outreach to the patient was defined in the study protocol.
Comparator	Patients in the control group received their scheduled outbound communication (regarding medical matters other than vaccination) but without the added vaccination prompt.
Relevant outcome measures	Vaccine uptake
Number of participants	22301
Duration of follow-up	Not provided
Loss to follow-up	None (we calculated the number of participants who were vaccinated from the percentages of the analysed participants, and then used this as the numerator and the intention to treat population as the denominator in the meta-analysis)
Additional comments	We calculated the number of participants who were vaccinated from the percentages of the analysed participants, and then used this as the numerator and the intention to treat population as the denominator in the meta-analysis.

1

2 **Study arms**

Reminder using an autodialer + a reminder unrelated to vaccination using an autodialer (N = 11148)
A reminder unrelated to vaccination using an autodialer (control) (N = 11153)

3 **Characteristics**

4 **Study-level characteristics**

	Reminder using an autodialer + a reminder unrelated to vaccination using an autodialer (N = 11148)	**A reminder unrelated to vaccination using an autodialer (control) (N = 11153)**
% Female (%) Nominal	56.9	57.7
Mean age (SD) (years)	63.2 (14)	63.3 (14.1)

	Reminder using an autodialer + a reminder unrelated to vaccination using an autodialer (N = 11148)	A reminder unrelated to vaccination using an autodialer (control) (N = 11153)
Mean (SD)		

1

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Low
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Some concerns *(There was no blinding and the method of data collection was not provided.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Some concerns with lack of blinding and data collection.)*
	Overall Directness	Partially applicable *(Some participants were included because they were at 'high risk'. In other words, not all participants were selected on the basis of being 65 years of age or older (or thereabouts).)*

2

Suh, 2012

3

Bibliographic Reference	Suh, CA; Saville, A; Daley, MF; Glazner, JE; Barrow, J; Stokley, S; Dong, F; Beaty, B; Dickinson, LM; Kempe, A; Effectiveness and net cost of reminder/recall for adolescent immunizations; Pediatrics; 2012; vol. 129 (no. 6); e1437-45

4 **Study details**

Evidence table available in an included systematic review	The evidence table for this study can be found in the Jacobson Vann 2018 Cochrane review.
Additional comments	Only the MCV4 and HPV 1st dose data were included because Tdap is not on the UK vaccination schedule for this age group.

5

Szilagyi, 2011

Bibliographic Reference	Szilagyi, P.G.; Humiston, S.G.; Gallivan, S.; Albertin, C.; Sandler, M.; Blumkin, A.; Effectiveness of a citywide patient immunization navigator program on improving adolescent immunizations and preventive care visit rates; Archives of Pediatrics and Adolescent Medicine; 2011; vol. 165 (no. 6); 547-553

Study details

Evidence table available in an included systematic review	The evidence table for this study can be found in the Jacobson Vann 2018 Cochrane review.
Additional comments	Only the MCV4 and HPV vaccines were included because Tdap is not on the UK vaccination schedule for this age group.

Szilagyi, 2015

Bibliographic Reference	Szilagyi, P.G.; Serwint, J.R.; Humiston, S.G.; Rand, C.M.; Schaffer, S.; Vincelli, P.; Dhepyasuwan, N.; Blumkin, A.; Albertin, C.; Curtis, C.R.; Effect of provider prompts on adolescent immunization rates: A randomized trial; Academic Pediatrics; 2015; vol. 15 (no. 2); 149-157

Study details

Study type	Cluster randomised controlled trial
Study location	New York, USA
Study setting	The Greater Rochester practice-based research networks (PBRN): consists of 85 primary care practices, including 44 pediatric and 14 family medicine practices serving >80% of all children in The Monroe County, New York, region, which has a population of 750,000. The national Continuity Clinic Research Network (CORNET) consists of 73 pediatric continuity clinics in 36 states serving over 683,000 children and adolescents; many are large hospital-based continuity clinics
Study dates	The 12-month randomized controlled trial spanned June 2011, to June 2012 (GR-PBRN), and September 2011, to January 2013 (CORNET).
Sources of funding	US Centers for Disease Control and Prevention
Inclusion criteria	Adolescents Aged 11 to 17 years old were the vaccination target People who have not been vaccinated with the vaccine of interest but are eligible for vaccination Tdap if no prior Tdap or Td vaccination within 2 years (most practices used this time frame between Tdap and Td vaccines); MCV4 if no prior vaccination; HPV vaccine for girls [first HPV vaccination (HPV1) if none prior, HPV2 if >60 days from HPV1, and HPV3 if >24 weeks from HPV1 and >12 weeks from HPV2], and influenza vaccine if none received that season. Primary care practices within the selected practice-based research networks The Greater Rochester practice-based research networks (GR-PBRN) and the national Continuity Clinic Research Network (CORNET).
Exclusion criteria	Catch-up vaccinations

Intervention(s)	**Provider prompts** A provider prompt (alert) was displayed on the initial screen that health care providers viewed upon opening each patient's electronic medical chart. all prompts used the same algorithm and displayed a list of vaccines due at that visit. Prompts did not generally show prior vaccinations and did not include standing orders. Electronic health records (EHRs) were programmed to display prompts at all visits, not just preventive visits. In 3 of 4 EHR intervention practices from the GR-PBRN, the EHR prompt was only used for adolescent (not child) immunizations; in the remaining EHR practice, immunization prompts were activated for all ages, but results were analysed only for adolescent immunizations. In CORNET's EHR intervention practices, immunization prompts were turned on for all ages. Two CORNET intervention practices transitioned to EHRs during the study and performed nurse/staff prompts for several months until EHR prompts were implemented; these practices were allocated to the EHR group. For each intervention practice, 1- or 2-hour educational sessions were provided inform providers about EHR-based prompts. On the basis of participating practitioners' preferences and practice patterns, providers could elect to follow or ignore prompts. At 2 intervention practices (1 per PBRN), practitioners preferred nurse/staff prompts because they lacked EHRs that could be programmed to deliver prompts. For these practices, we delivered 1 or 2 educational sessions to physicians and nurses/staff. The study personnel described the importance of immunizations and provided a nurse/staff protocol to: 1) review immunization records for every adolescent at each visit; 2) list immunizations due at each visit onto a sheet; and 3) display vaccine information statement forms. The study personnel also conducted monthly telephone calls with intervention practices to assess progress, address concerns, and engage practitioners in group discussions and problem solving (eg, strategies during busy periods). They encouraged practices to select a small number of charts to review for missed opportunities as a process metric; of note, few practices complied as a result of limited time and staff toperform chart reviews.
Comparator	Adolescents in control practices received standard of care, which did not include prompts.
Relevant outcome measures	Vaccine uptake
Number of participants	GBRN prompts: 5 practices (4 suburban, 1 rural), N=800 GBRN control: 5 practices (4 suburban, 1 rural), N=800 CORNET prompts: 6 practices (6 urban), N=960 CORNET control: 6 practices (6 urban), N=960
Duration of follow-up	12 months for both GR-PBRN and CORNET
Loss to follow-up	Loss of 1 practice pair in GR-PBRN
Additional comments	Only the HPV and MCV4 data was included. The influenza vaccine data was excluded because it did not fit the protocol. Tdap data was excluded because it is not on the UK vaccination schedule for this age group.

1 **Study arms**

GR-PBRN prompts (N = 800)

GR-PBRN control (N = 800)
CORNET prompts (N = 960)
CORNET control (N = 960)

1 **Characteristics**

2 **Arm-level characteristics**

	GR-PBRN prompts (N = 800)	GR-PBRN control (N = 800)	CORNET prompts (N = 960)	CORNET control (N = 960)
Female				
Custom value	49%	50%	49%	49%
Race / Ethnicity				
White, non-Hispanic (%)				
Custom value	Missing	Missing	35%	20%
Black, non-Hispanic (%)				
Custom value	Missing	Missing	38%	36%
Hispanic				
Custom value	Missing	Missing	11%	19%

3

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(Lack of information regarding randomisation procedure. Unclear how clusters were 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	Risk of bias judgement for deviations from intended interventions	Low
3. Bias due to missing outcome data	Risk of bias judgement for missing outcome data	Low
4. Bias in measurement of the outcome	Risk of bias judgement for measurement of the outcome	Some concerns *(No information regarding blinding of assesors and data was collected by chart review.)*
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 *(Due to a lack of information regarding blinding and randomisation procedure.)*
	Overall Directness	Directly applicable

Szilagyi, 2013

Bibliographic Reference	Szilagyi, Peter G; Albertin, Christina; Humiston, Sharon G; Rand, Cynthia M; Schaffer, Stanley; Brill, Howard; Stankaitis, Joseph; Yoo, Byung-Kwang; Blumkin, Aaron; Stokley, Shannon; A randomized trial of the effect of centralized reminder/recall on immunizations and preventive care visits for adolescents.; Academic pediatrics; 2013; vol. 13 (no. 3); 204-13

Study details

Evidence table available in an included systematic review	The evidence table for this study can be found in the Jacobson Vann 2018 Cochrane review.
Additional comments	Data in Szilagyi 2013 was presented as 'per protocol analysis', in other words the numerator is the number of new vaccinations and the denominator is participants who had not had the vaccine before. To make this data comparable with other studies, we converted it to 'intention to treat', in other words, the numerator is the number of participants who were vaccinated at the end of the study and the denominator is the total number of participants who were included in the study to begin with and therefore experienced the intervention.

Szilagyi, 2020

Bibliographic Reference	Szilagyi, Peter; Albertin, Christina; Gurfinkel, Dennis; Beaty, Brenda; Zhou, Xinkai; Vangala, Sitaram; Rice, John; Campbell, Jonathan D; Whittington, Melanie D; Valderrama, Rebecca; Breck, Abigail; Roth, Heather; Meldrum, Megan; Tseng, Chi-Hong; Rand, Cynthia; Humiston, Sharon G; Schaffer, Stanley; Kempe, Allison; Effect of State Immunization Information System Centralized Reminder and Recall on HPV Vaccination Rates.; Pediatrics; 2020; vol. 145 (no. 5)

Study details

Trial registration number and/ or trial name	NCT03057379 and NCT0299396
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Random practices in Colorado and the New York State counties area, excluding New York City
Study dates	2017 to 2019
Sources of funding	National Cancer Institute of the National Institutes of Health
Inclusion criteria	Adolescents 11 to 17 years of age
Exclusion criteria	People who had already received the vaccine Death of a participant Participants who did not have a local address

	The participant had parents who had opted out Parents who had opted out of the Centralised Immunisation Information System (CIIS).
Intervention(s)	**intervention 1:** 1 autodialer reminder **Intervention 2:** 2 autodialer reminders **Intervention 3:** 3 autodialer reminders The investigators contracted a cloud-based telephony company to send autodialer calls to the family's primary phone number in the immunization information systems (IIS). Autodialer calls were sent in English and Spanish. The calls contained the practice's name and phone number, or the name and phone number of the county health department in Colorado when practices did not wish for practice names and phone numbers to be included. Messages were essentially identical in the 2 states (New York and Colorado). They consulted with parents and providers for feedback on the message content during the message development phase. Messages used the Health Belief Model framework with HPV vaccination framed as cancer prevention for all adolescents. They randomly assigned index adolescent subjects to either usual care (no calls) or up to 1, 2, or 3 autodial calls per needed dose of the HPV vaccine, depending on the study arm. Autodial calls reflected monthly IIS data pulls identifying eligible adolescents. Respondents could opt out of the study by calling a toll-free number included in the message or by pressing "9" during the autodial call.
Comparator	No reminders
Relevant outcome measures	Vaccine uptake HPV vaccine
Number of participants	62118
Duration of follow-up	Not provided
Loss to follow-up	None
Additional comments	For the summary meta-analysis, we used HPV vaccine initiation data. Baseline characteristics of participants in New York and Colorado were provided. However, baseline characteristics that corresponded to study arms were not provided.

1 **Study arms**

3 autodialer reminders (New York) (N = 7579)
2 autodialer reminders (New York) (N = 7631)
1 autodialer reminder (New York) (N = 7682)
No autodialer reminders (New York) (N = 7724)
3 autodialer reminders (Colorado) (N = 7890)
2 autodialer reminders (Colorado) (N = 7870)

1 autodialer reminder (Colorado) (N = 7864)
0 autodialer reminders (Colorado) (N = 7878)

Characteristics

Study-level characteristics

	Study (N = 45424)
% Female	
Custom value	64.3%

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(The method of randomisation was not provided. Baseline characteristics of participants allocated to separate arms was not provided. Therefore, it is not possible to check the randomisation process.)*
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 *(Participants appeared to be unaware that they were part of a clinical trial. Therefore, knowing their allocation by receiving a reminder or not was not expected to affect the participant's vaccination decision. There was no mention of personnel blinding. However, this was also not expected to bias the results as the same processes were carried out for both arms of the trial.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(There was a lack of information about assessor blinding. However, the data was extracted from a single vaccination registry. Therefore, lack of blinding was not expected to have affected the data.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Concern regarding randomisation and missing participant baseline characteristics.)*
	Overall Directness	Directly applicable

Szilagyi, 2006

Bibliographic Reference Szilagyi, PG; Schaffer, S; Barth, R; Shone, LP; Humiston, SG; Ambrose, S; Averhoff, F; Effect of telephone reminder/recall on adolescent immunization and preventive visits: results from a randomized clinical trial; Archives of pediatrics & adolescent medicine; 2006; vol. 160 (no. 2); 157-163

1 **Study details**

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

Szilagyi, 1996

3

Bibliographic Reference	Szilagyi, P G; Rodewald, L E; Humiston, S G; Pollard, L; Klossner, K; Jones, A M; Barth, R; Woodin, K A; Reducing missed opportunities for immunizations. Easier said than done.; Archives of pediatrics & adolescent medicine; 1996; vol. 150 (no. 11); 1193-200

4 **Study details**

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	1 Paediatric Continuity Clinic and 1 Neighbourhood Health Centre, Rochester, New York
Study dates	Paediatric Continuity Clinic: October 1991 - June 1992; Neighbourhood Health Centre: May 1992 - October 1993
Sources of funding	New York State Department of Health in Albany and Strong Children's Research Centre, Rochester
Inclusion criteria	Children eligible for vaccination No clear definition
Exclusion criteria	Patients who had transferred out of either practice. Patients who made no visits or phone calls to the Neighbourhood Health Centre during the study period or the following 2 years
Intervention(s)	No Missed Opportunities: Nurses were told to review patients records for immunisation status at all visit types (acute, follow-up and nurse-only visits). A brightly coloured reminder card was attached to a record if an immunisation was due, including a list of the contraindications to vaccination. Providers had to complete the card to say whether vaccination was given, and providing reasons if it was not.
Comparator	Standard of care: Providers were instructed to follow the usual standard of care for immunisations.
Relevant outcome measures	Vaccine uptake
Number of participants	1789
Duration of follow-up	18 months
Loss to follow-up	None
Additional comments	Study originally included 2 arms at the Paediatric Continuity Clinic but 4 arms at the Neighbourhood Health Centre (No Missed Opportunities vs Control and Vaccination without guardian's signature at each visit vs Control). There were no significant differences between the vaccination arms for any of the trial outcomes and so the authors combined the study and control groups. Results for both the clinic and the centre therefore reflect No Missed Opportunities vs Control.

1

2 **Study arms**

Medical records highlighted if an immunisation was due with a card to record whether or not vaccine was given (at a paediatric continuity clinic) (N = 430)
Medical records highlighted if an immunisation was due with a card to record whether or not vaccine was given (at a neighbourhood health centre) (N = 473)
Standard care for paediatric continuity clinic (N = 448)
Standard care for neighbourhood health centre (N = 438)

3 **Characteristics**

4 **Study-level characteristics**

	Medical records highlighted if an immunisation was due with a card to record whether or not vaccine was given (at a paediatric continuity clinic) (N = 430)	**Medical records highlighted if an immunisation was due with a card to record whether or not vaccine was given (at a neighbourhood health centre) (N = 473)**	**Standard care for paediatric continuity clinic (N = 448)**	**Standard care for neighbourhood health centre (N = 438)**
% Female	49	51	48	52

5

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

6

Terrell-Perica, 2001

7

Bibliographic Reference	Terrell-Perica, S M; Effler, P V; Houck, P M; Lee, L; Crosthwaite, G H; The effect of a combined influenza/pneumococcal immunization reminder letter.; American journal of preventive medicine; 2001; vol. 21 (no. 4); 256-60

1 **Study details**

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	Community
Study dates	1996
Sources of funding	Not provided
Inclusion criteria	Enrolled in a medical insurance scheme: People with Medicare who were newly enrolled for the period of 25 September 1995 through 31 August 1996.
Exclusion criteria	People who had already received the vaccine. Participants who were enrolled in a managed care plan prior to 1 January 1997 or they had a claims record indicating that they had received an influenza and/or pneumococcal immunization between 1 January 1996 to 25 September 1996 (i.e., before the reminder letter mail-out). Death of a participant. Participants who did not have a local address. Those not residing in Hawaii prior to 1 January 1997.
Intervention(s)	There were 2 interventions: 1. A flu reminder (not included in this review) 2. A combined flu and pneumococcal vaccination reminder The immunization reminder letters were written on State of Hawaii Department of Health letterhead and signed by the state epidemiologist. The one-page influenza immunization reminder letter was formatted in an easy-to-read, 14-point font with two prominent bullets: “Have you had your FLU shot this year?” and “Medicare covers FLU shots!” The reminder letter for pneumococcal and influenza immunizations was similar with three prominent bullets: “Have you had your FLU shot this year?”; “Be sure to get your PNEUMONIA shot too!”; and “Medicare covers FLU and PNEUMONIA shots!” Reminder letters for Group 2 and Group 3 were mailed on 26 September 1996.
Comparator	No reminder
Relevant outcome measures	Vaccine uptake
Number of participants	4315
Duration of follow-up	3 months
Loss to follow-up	None
Additional comments	The median age of the participants was 65 years.

	Only data for pneumonia vaccination was included in this review. Data for influenza vaccination was excluded because flu vaccination is covered by another guideline and is out of scope of the review. There were no baseline characteristics for each arm separately. However, the study population had an estimated median age of 65 years. The combined letter mail-out to Group 3 was scheduled to coincide with the start of the annual influenza campaign and emphasized that patients could receive both vaccines at the same visit.

1 **Study arms**

Reminder letter (N = 2171)
No reminder (N = 2144)

2

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No details of randomisation were provided. Baseline characteristics of each arm were not provided. Therefore, the integrity of the randomisation process cannot be verified.)*
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 *(Participants appeared to be unaware that they were part of a clinical trial. Therefore, knowing their allocation by receiving a reminder or not was not expected to affect the participant's vaccination decision. There was no mention of personnel blinding. However, this was also not expected to bias the results as the same processes were carried out for both arms of the trial.))*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low *(There was a lack of information about assessor blinding. However, the data was extracted from a single vaccination registry. Therefore, lack of blinding was not expected to have affected the data collection.)*
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	Some concerns *(Due to a lack of information about randomisation.)*
	Overall Directness	Directly applicable

3

Tollestrup, 1991

4

Bibliographic Reference	Tollestrup, K; Hubbard, B B; Evaluation of a follow-up system in a county health department's immunization clinic.; American journal of preventive medicine; 1991; vol. 7 (no. 1); 24-8

1
2

3 **Study details**

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

Tull, 2019

5

Bibliographic Reference	Tull, F.; Borg, K.; Knott, C.; Beasley, M.; Halliday, J.; Faulkner, N.; Sutton, K.; Bragge, P.; Short Message Service Reminders to Parents for Increasing Adolescent Human Papillomavirus Vaccination Rates in a Secondary School Vaccine Program: A Randomized Control Trial; Journal of Adolescent Health; 2019; vol. 65 (no. 1); 116-123

6
7

8 **Study details**

Study type	Randomised controlled trial (RCT)
Study location	Australia
Study setting	Schools
Study dates	2015 to 2016
Sources of funding	Victorian Public Sector Innovation Fund
Inclusion criteria	Adolescents Age 10.5 to 12 years (attending school, Year 7 in Australia)
Intervention(s)	**The interventions were 2 types of text message: motivational SMS versus self-regulatory SMS.** The motivational SMS message: "Reminder from [name of provider]: [name of child] has a vaccine appointment at school this [day of week]. Vaccine preventable diseases are still a problem in the community and children most at risk are those that have not been immunised. Please contact xxxx xxxx if your child cannot attend." The self-regulatory SMS message: "Reminder from [name of provider]: [name of child] has a vaccine appointment at school this [day of week]. Make a plan now for how [name of child] will get to school on-time on immunisation day. Please contact xxxx xxxx if your child cannot attend. Thank you." Providers then prepared the SMS data files and used their SMS service provider to distribute the reminders to parents/ guardians of students in the intervention conditions two working days before the third school visit (one working day if the visit fell on a Monday or Tuesday). Only one reminder was sent per student, and the providers did not assess if the SMS was successfully delivered to the recipient.
Comparator	No reminder

Relevant outcome measures	Vaccine uptake HPV
Number of participants	4386
Duration of follow-up	5 months for the extended follow-up period.
Loss to follow-up	None
Additional comments	For the summary meta-analysis, we combined both reminder arms. This was to exclude double-counting of the control group. There were 2 different follow-up points in this study: Between when reminders were sent and the 3rd school visit by the investigators, or to the extended follow-up point - the end of the calendar year. For the analyses, the end of the calendar year was chosen. This is because the first follow-up period was only 2 days. The extended follow-up period was 5 months. This is a more common follow-up period for similar studies.

1 **Study arms**

Reminder (N = 2860)
No reminder (N = 1526)

2 **Characteristics**

3 **Arm-level characteristics**

	Reminder (N = 2860)	**No reminder (N = 1526)**
Age *(years)* Variance for each of the study arms was not provided		
Nominal	13	13
Sex: Female *(%)*		
Nominal	51	49
Mobile number available *(%)*		
Nominal	93	91

4

Section	**Question**	**Answer**
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Low *(There was no information about the allocation concealment. However, because of the nature of the intervention – a reminder – this was unlikely to affect the outcomes measured by the trial.)*
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 *(Personnel were not blinded. However, this was not expected to bias the results as the same processes were carried out for both arms of the trial.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low

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

Vivier, 2000

Bibliographic Reference	Vivier, P M; Alario, A J; O'Haire, C; Dansereau, L M; Jakum, E B; Peter, G; The impact of outreach efforts in reaching underimmunized children in a Medicaid managed care practice.; Archives of pediatrics & adolescent medicine; 2000; vol. 154 (no. 12); 1243-7

Study details

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

Wilkinson, 2019

Bibliographic Reference	Wilkinson, T.A.; Dixon, B.E.; Xiao, S.; Tu, W.; Lindsay, B.; Sheley, M.; Dugan, T.; Church, A.; Downs, S.M.; Zimet, G.; Physician clinical decision support system prompts and administration of subsequent doses of HPV vaccine: A randomized clinical trial; Vaccine; 2019; vol. 37 (no. 31); 4414-4418

Study details

Study type	Randomised controlled trial (RCT)
Study location	Indiana, USA
Study setting	5 primary care clinical sites within Eskenazi Health, a large safety net health system serving Marion County, Indiana. All five clinics in the study employ the electronic health records-based decision support system (CHICA)
Study dates	July 2015 - May 2016.
Sources of funding	Merck-Regenstrief Program in Personalized Health Care Research and Innovation.
Inclusion criteria	Adolescents patient aged 11–17 years who had previously received a dose of the HPV vaccine and was presenting for a well-child. Previous visits within a specific period Patients seen more than once in the study period could have been eligible at each encounter. Paediatric clinicians serving the five CHICA clinics were included.
Exclusion criteria	None reported

Intervention(s)	Automated clinical decision support system reminders via The Child Health Improvement through Computer Automation (CHICA) to recommend the 2nd and 3rd doses of HPV vaccine for eligible male and female adolescents who had already initiated the vaccine series. Any scheduled patient within the target age range was identified by CHICA and their eligibility for inclusion was verified by the automated checking of immunization records in the state-wide immunization information system (IIS), called the Children and Hoosier Immunization Registry Program (CHIRP). If a patient had received a prior HPV vaccine and the appropriate interval had passed for the 2nd or 3rd dose to be delivered, clinicians in the intervention arm received a CHICA prompt to order the vaccine within the CHICA physician worksheet which set the agenda for a clinical encounter. The physician is able to document whether a vaccine was given or declined within the physician worksheet. Weekly technical meetings were held by the research team throughout the study period for the clinical decision support system (system
Comparator	Usual practice, where vaccination recommendations from the state-wide IIS were manually obtained by nurses who looked them up in CHIRP.
Relevant outcome measures	Vaccine uptake
Number of participants	Prompt: Health-care providers: 15 Vaccine provision: 634 Contrl: Health-care providers: 14 Vaccine provision: 651
Duration of follow-up	13 months
Loss to follow-up	None
Additional comments	Twenty-nine paediatric clinicians were randomized across two arms. Data was adjusted to allow for clustering by provider.

1 **Study arms**

Prompt (N = 634)
Control (N = 651)

2 **Characteristics**

3 **Arm-level characteristics**

	Prompt (N = 634)	**Control (N = 651)**
% Female		
Custom value	48.9%	41%
Race / Ethnicity		

	Prompt (N = 634)	Control (N = 651)
Black		
Custom value	47.3%	71.1%
White		
Custom value	4.9%	9.2%
Hispanic		
Custom value	34.7%	9.8%
Other/unknown		
Custom value	12.6	8.4
MIssing		
Custom value	0.5%	1.4%

1

Section	Question	Answer
Domain 1: Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	High *(Large differences in baseline race/ethinicity characteristics, unclear if this was due to poor randomisation or differences in demographics per different clinics.)*
Domain 2a: Risk of bias due to deviations from the intended interventions (effect of assignment to intervention)	Risk of bias for deviations from the intended interventions (effect of assignment to intervention)	Some concerns *(Participant blinding was not possible.)*
Domain 3. Bias due to missing outcome data	Risk-of-bias judgement for missing outcome data	Low
Domain 4. Bias in measurement of the outcome	Risk-of-bias judgement for measurement of the outcome	Low
Domain 5. Bias in selection of the reported result	Risk-of-bias judgement for selection of the reported result	Low
Overall bias and Directness	Risk of bias judgement	High *(Due to concerns regarding randomisation.)*
	Overall Directness	Directly applicable

2

Winston, 2007

3

Bibliographic Reference	Winston, Carla A; Mims, Adrienne D; Leatherwood, Kecia A; Increasing pneumococcal vaccination in managed care through telephone outreach.; The American journal of managed care; 2007; vol. 13 (no. 10); 581-8

4 **Study details**

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

5

Zimet, 2018

1

Bibliographic Reference	Zimet, G.; Dixon, B.E.; Xiao, S.; Tu, W.; Kulkarni, A.; Dugan, T.; Sheley, M.; Downs, S.M.; Simple and Elaborated Clinician Reminder Prompts for Human Papillomavirus Vaccination: A Randomized Clinical Trial; Academic Pediatrics; 2018; vol. 18 (no. 2supplement); 66-s71

2 **Study details**

Study type	Cluster randomised controlled trial
Study location	Indiana, USA
Study setting	29 paediatric health care providers (HCPs) serving 5 pediatric clinics
Study dates	2014 - 2015
Sources of funding	Merck and Roche
Inclusion criteria	People who have not been vaccinated with the vaccine of interest but are eligible for vaccination Male and female children 11 to 13 years of age who had not previously received HPV vaccines were eligible for study participation. Children also had to be eligible for Men- ACWY and/or Tdap vaccine. Pediatric healthcare providers and clinics
Exclusion criteria	None reported
Intervention(s)	The interventions were aimed at the providers but targeted vaccination of eligible children. There were 2 intervention arms: 1) computer-generated reminders with a suggested script for recommending the 3 adolescent platform vaccines (elaborated prompt). 2) computer-generated messages reminding providers of MenACWY, HPV, and Tdap vaccination eligibility (simple prompt) During the study period, the HPV prompts (simple as well as elaborate) were given the same relatively high priority. For example, it was given a higher priority than evaluating attention deficit–hyperactivity disorder in a child with nonspecific symptoms of inattention, but a lower priority than a patient experiencing food insecurity.
Comparator	Usual practice control, where vaccination recommendations were made by care providers on the basis of their existing methods for determining eligibility.
Relevant outcome measures	Vaccine uptake
Duration of follow-up	1 year
Loss to follow-up	None

3 **Study arms**

Elaborated Prompt (N = 223) 11 health care providers
Prompt (N = 124)

8 health care providers
Control (N = 301) 10 health care providers

1 **Characteristics**

2 **Arm-level characteristics**

	Elaborated Prompt (N = 223)	Prompt (N = 124)	Control (N = 301)
% Female			
Custom value	47%	45%	43%
Race / Ethnicity			
Non-hispanic black			
Custom value	38.1%	70.2%	49.8%
Non-hispanic white			
Custom value	13.5%	7.3%	12%
Hispanic			
Custom value	30%	5.6%	17.3%
Other/unknown			
Custom value	18.4%	16.9%	20.9%

3

Section	Question	Answer
1a. Bias arising from the randomisation process	Risk of bias judgement for the randomisation process	Some concerns *(No information regarding randomisation method or allocation.)*
1b. Bias arising from the timing of identification and recruitment of individual participants in relation to timing of randomisation	Risk of bias judgement for the timing of identification and recruitment of individual participants in relation to timing of randomisation	Low
2. Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Some concerns *(Concerns regarding analysis method.)*
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 *(Concern regarding allocation concealment and analysis.)*
	Overall Directness	Directly applicable

4

Summary risk of bias judgements for the Cochrane review

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

Table 12 Overall risk of bias and directness for studies included in the Jacobson Vann 2018 Cochrane review

Author	Risk of bias*	Reason	Directness
Alto 1994	Some concerns	All risks were low except for the following which were unclear: allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data.	Directly applicable
Campbell 1994	Some concerns	All risks were low except for the following which were unclear: random sequence generation, allocation concealment and blinding of outcome assessment.	Directly applicable
CDC 2012	Some concerns	All risks were low except for the following which was unclear: other bias (individual practices may have delivered reminder-recall interventions in the background; 21% of respondents to survey of Montana Medicaid health services providers indicated use of immunization reminder or recall strategies).	Directly applicable
Chao 2015	High	All risks were low except for the following which were unclear: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, other bias (methods were not fully described).	Directly applicable[1]
Daley 2002	Some concerns	All risks were low except for the following which was unclear: incomplete outcome data.	Directly applicable
Daley 2004	Some concerns	All risks were low except for the following which were unclear: allocation concealment, incomplete outcome data, other bias (immunisation registry had 8% error rate).	Directly applicable
Dini 2000	High	All risks were low except for the following which were unclear: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data.	Directly applicable
Dombkowski 2014	Some concerns	All risks were low except for the following which were unclear: blinding of participants and personnel, blinding of outcome assessment, other bias (it was unknown whether paediatric offices or other local providers independently sent reminder/recall notifications concurrently with this study).	Directly applicable

Ferson 1995	High	All risks were unclear except for the following which were low or high: selective reporting (low); other biases and issues with baseline measurement (high)	Directly applicable
Hambidge 2009	Low	All risks were low except for the following which were unclear: blinding of participants and personnel which was judged to be unlikely to bias the results in practice.	Directly applicable
Irigoyen 2000	Some concerns	All risks were low except for the following which were unclear: blinding of participants and personnel, blinding of outcome assessment, and other bias (29 children were recorded as not having received the vaccine because of a vaccine shortage; for these children, investigators simulated the vaccine as being given on date ordered. Misclassification rate for DTaP dose was 30%).	Directly applicable
Kempe 2001	Some concerns	All risks were low except for the following which were unclear: random sequence generation, allocation concealment, incomplete outcome data.	Directly applicable
LeBaron 2004	High	All risks were low except for the following which was high: blinding of outcome assessment.	Directly applicable
Lieu 1997	Some concerns	All risks were low except for the following which were unclear: blinding of participants and personnel, blinding of outcome assessment.	Directly applicable
Lieu 1998	High	There was a high risk of bias for random sequence generation. Other risks were low except for the following which were unclear: allocation concealment, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data.	Directly applicable
Linkins 1994	Some concerns	All risks were low except for the following which were unclear: random sequence generation, blinding of participants and personnel, incomplete outcome data.	Directly applicable
O'Leary 2015	Low	All risks were low.	Directly applicable
Rand 2015	Some concerns	All risks were low except for the following which were unclear: blinding of participants and personnel, blinding of outcome assessment.	Directly applicable
Rand 2017	High	All risks were low except for the following which were unclear: random sequence generation, blinding of participants and personnel, blinding of outcome assessment, incomplete outcome data, other bias.	Directly applicable

Rodewald 1999	Low	All risks were low except for the following was unclear: blinding of participants and personnel which was judged to be unlikely to bias the results in practice.	Directly applicable
Stehr-Green 1993	Some concerns	All risks were low except for the following which were unclear: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment.	Directly applicable
Suh 2012	Low	All risks were low.	Directly applicable
Szilagyi 2006	Low	All risks were low.	Directly applicable
Szilagyi 2011	Some concerns	All risks were low except for the following which was unclear: blinding of outcome assessment.	Directly applicable
Szilagyi 2013	Some concerns	All risks were low except for the following which was unclear: other bias (Survey of participating practices revealed 12 of 24 respondents used telephone or mailed reminders for adolescents with scheduled preventive care visits; 6 of 24 used telephone or mailed reminders for patients behind on vaccines; randomized within practices to minimize so the effect of these interventions would be similar across study groups.).	Directly applicable
Tollestrup 1997	High	There was high risk for the following domains: random sequence generation, allocation concealment. Blinding of participants and personnel, blinding of outcome assessment were at unclear risk and all other domains were low risk.	Directly applicable
Vivier 2000	Some concerns	All risks were low except for the following which were unclear: blinding of participants and personnel, blinding of outcome assessment.	Directly applicable
Winston 2007	Some concerns	All risks were low except for the following which were unclear: other bias (At baseline, "large proportion" of intervention participants reported receipt of pneumococcal vaccination previously, but not documented in their records; these patients were included in study; similar data not available for controls).	Directly applicable

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

1. Study recruited 9-26 year olds, but data was available for 9-17 year olds

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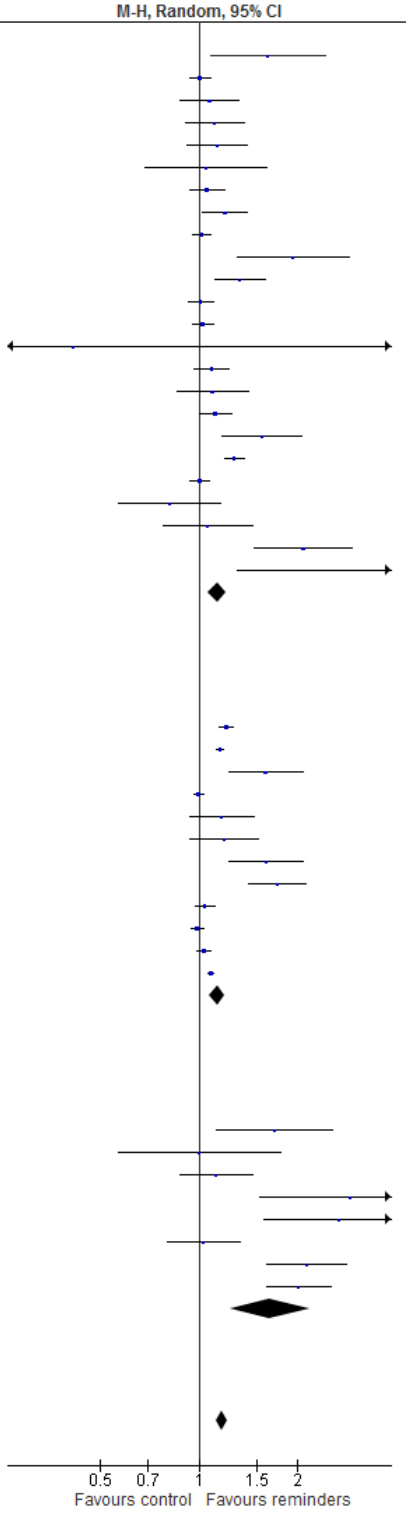
Appendix E – Forest plots

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

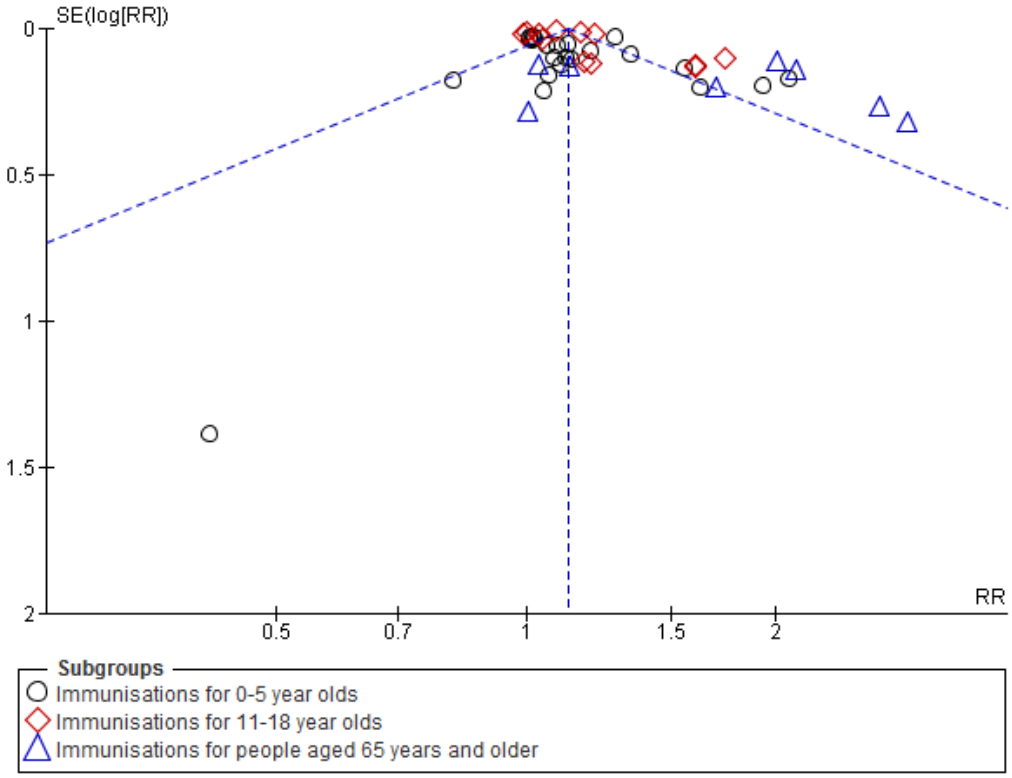
Patient reminders (summary) versus control

Study or Subgroup	Patient reminder sum Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
1.1.1 Immunisations for 0-5 year olds						
Alto 1994 (1)	49	213	33	233	0.8%	1.62 [1.09, 2.42]
Bjornson 1999 (2)	252	305	253	309	3.8%	1.01 [0.94, 1.09]
Campbell 1994	111	183	59	105	2.1%	1.08 [0.88, 1.33]
CDC 2012 (3)	139	438	125	440	2.1%	1.12 [0.91, 1.37]
Daley 2002 (4)	140	610	126	624	2.0%	1.14 [0.92, 1.41]
Daley 2004	35	205	35	215	0.7%	1.05 [0.68, 1.61]
Dombkowski 2014 (5)	370	1058	335	1014	3.2%	1.06 [0.94, 1.19]
Dombkowski 2014 (6)	628	3489	167	1112	2.7%	1.20 [1.02, 1.40]
Dombkowski 2014 (7)	871	1741	863	1761	3.9%	1.02 [0.95, 1.09]
Ferson 1995	35	49	20	54	0.9%	1.93 [1.31, 2.85]
Hambidge 2009	180	408	132	399	2.4%	1.33 [1.12, 1.59]
Hoekstra 1999 (8)	259	324	190	241	3.7%	1.01 [0.93, 1.10]
Hofstetter 2015 (9)	861	1372	417	682	3.9%	1.03 [0.95, 1.10]
Hogg 1998 (10)	1	41	1	17	0.0%	0.41 [0.03, 6.25]
Irigoyen 2006 (11)	275	549	257	561	3.1%	1.09 [0.97, 1.24]
Kempe 2001 (12)	89	294	85	309	1.6%	1.10 [0.86, 1.41]
LeBaron 2004 (13)	876	2287	260	763	3.3%	1.12 [1.01, 1.26]
Lieu 1997	82	153	47	136	1.5%	1.55 [1.18, 2.04]
Linkins 1994 (14)	1684	4636	955	3366	3.9%	1.28 [1.20, 1.37]
Menzies 2020	893	1200	291	394	3.9%	1.01 [0.94, 1.08]
Morgan 1998 (15)	42	159	45	139	1.0%	0.82 [0.57, 1.16]
Stehr-Green 1993 (16)	46	101	41	96	1.2%	1.07 [0.78, 1.46]
Tollestrup 1991	53	81	29	92	1.1%	2.08 [1.48, 2.92]
Vivier 2000 (17)	29	193	2	71	0.1%	5.33 [1.31, 21.78]
Subtotal (95% CI)		**20089**		**13133**	**53.0%**	**1.14 [1.07, 1.21]**
Total events	8000		4768			
Heterogeneity: Tau² = 0.01; Chi² = 96.09, df = 23 (P < 0.00001); I² = 76%						
Test for overall effect: Z = 4.09 (P < 0.0001)						
1.1.2 Immunisations for 11-18 year olds						
Chao 2015 (18)	5504	9760	1139	2445	4.2%	1.21 [1.16, 1.27]
Coley 2018 (19)	12905	81558	11031	80864	4.3%	1.16 [1.13, 1.19]
Kempe 2012 (20)	80	133	49	130	1.6%	1.60 [1.23, 2.07]
O'Leary 2015 (21)	1744	2228	1846	2359	4.3%	1.00 [0.97, 1.03]
Rand 2015 (22)	139	964	118	961	1.8%	1.17 [0.93, 1.48]
Rand 2017 (23)	85	178	72	180	1.8%	1.19 [0.94, 1.51]
Rand 2017 (24)	93	191	61	200	1.6%	1.60 [1.24, 2.06]
Suh 2012 (25)	212	799	122	797	2.1%	1.73 [1.42, 2.12]
Szilagyi 2006 (26)	778	1496	753	1510	3.9%	1.04 [0.97, 1.12]
Szilagyi 2020 (27)	2804	7579	2889	7724	4.2%	0.99 [0.95, 1.03]
Szilagyi 2020 (28)	2548	7890	2458	7878	4.2%	1.04 [0.99, 1.08]
Tull 2019 (29)	2756	2860	1353	1526	4.4%	1.09 [1.07, 1.11]
Subtotal (95% CI)		**115636**		**106574**	**38.3%**	**1.14 [1.07, 1.20]**
Total events	29648		21891			
Heterogeneity: Tau² = 0.01; Chi² = 156.19, df = 11 (P < 0.00001); I² = 93%						
Test for overall effect: Z = 4.49 (P < 0.00001)						
1.1.4 Immunisations for people aged 65 years and older						
Hurley 2018 (30)	58	2079	39	2370	0.8%	1.70 [1.13, 2.53]
Hurley 2019 (31)	22	307	22	309	0.5%	1.01 [0.57, 1.78]
Klassing 2018 (32)	34	41	22	30	1.6%	1.13 [0.87, 1.46]
Otsuka 2013 (33)	13	250	30	1666	0.4%	2.89 [1.53, 5.46]
Otsuka 2013 (34)	33	250	21	424	0.5%	2.67 [1.58, 4.50]
Stolpe 2019 (35)	123	11148	119	11153	1.6%	1.03 [0.80, 1.33]
Terrell-Percia 2001 (36)	146	2171	68	2144	1.4%	2.12 [1.60, 2.81]
Winston 2007 (37)	201	1198	100	1197	1.9%	2.01 [1.60, 2.52]
Subtotal (95% CI)		**17444**		**19293**	**8.7%**	**1.64 [1.25, 2.17]**
Total events	630		421			
Heterogeneity: Tau² = 0.12; Chi² = 36.46, df = 7 (P < 0.00001); I² = 81%						
Test for overall effect: Z = 3.53 (P = 0.0004)						
Total (95% CI)		**153169**		**139000**	**100.0%**	**1.17 [1.12, 1.22]**
Total events	38278		27080			
Heterogeneity: Tau² = 0.01; Chi² = 332.02, df = 43 (P < 0.00001); I² = 87%						
Test for overall effect: Z = 7.63 (P < 0.00001)						
Test for subgroup differences: Chi² = 6.70, df = 2 (P = 0.04), I² = 70.2%						

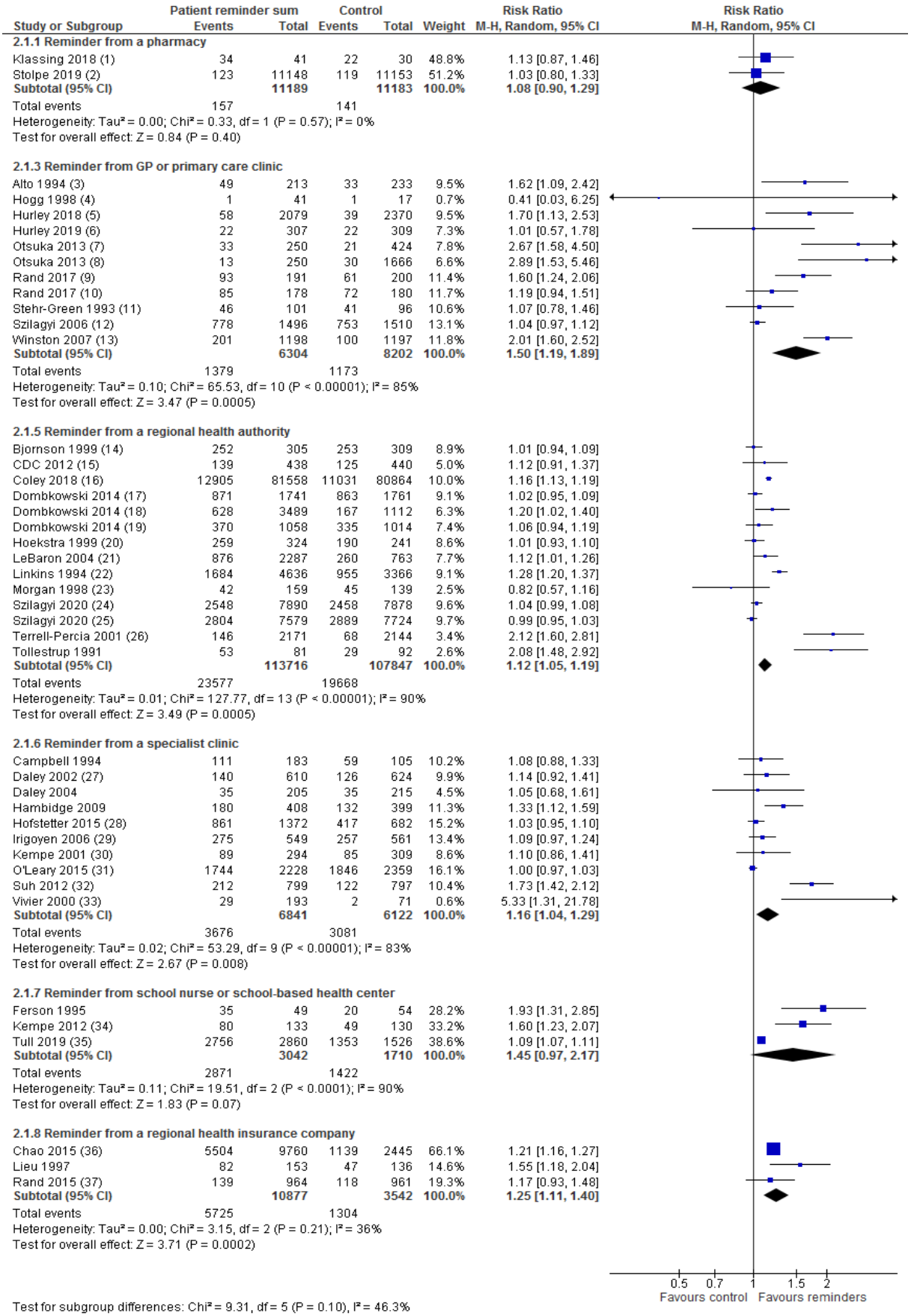


Footnotes
(1) Postcard then letter if needed
(2) Postcard
(3) Letter
(4) PCV (pneumonococcal conjugate vaccine) specific study
(5) 7 month recall
(6) 19 month recall
(7) 12 month reminder
(8) 9 telephone calls and then 2 biligual mailings if needed
(9) The 1 text message and 2-4 text message arms were merged
(10) Hib vaccine data. MMR data not included to avoid double-counting. 2 arms combined: customised and non-customised reminder letters.
(11) Continuous reminder arm at 6 months (from Cochrane review)
(12) Postcard and up to 4 telephone calls
(13) Data pooled for autodialer, outreach, and autodialer with outreach interventions
(14) Telephone
(15) Telephone
(16) Telephone
(17) Reminder interventions pooled by Cochrane review authors
(18) HPV specific study; data was extracted for 9-17 year olds only
(19) Postcard
(20) 1 or 2 reminders via written message or call to classroom or escort from class
(21) Text message. HPV 1st dose
(22) Hpv specific study; data obtained by Jacobson Vann 2018 Cochrane review authors from study authors
(23) HPV specific study; autodialer intervention; data added by GUT
(24) HPV specific study; text message intervention- data edited by GUT
(25) HPV 1st dose. Up to 2 letters separated by 2 autodialer telephone calls.
(26) Data for Td (Tetanus, Diphtheria) vaccination only
(27) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. Colorado data
(28) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. New York data
(29) Data for the arms for motivational text messages and self-regulatory text messages were merged
(30) 2x autodialer + postcard
(31) Up to 2 telephone call reminders and then a postcard
(32) Data is merged for phone call reminder arm and letter reminder arm
(33) Letter. This population and intervention is different to the other Otsuka 2013 data
(34) Electronic message to patient sent using patient's electronic medical record
(35) Autodialer reminder from pharmacy. Pneumococcal vaccine. Shingles data not included to prevent double counting.
(36) Letter reminder from regional health authority. Pneumococcal vaccine.
(37) Telephone reminder; pneumonococcal vaccination; data extracted for over 65 year olds only

Funnel plot for patient reminders (summary) versus control



Patient reminders versus control by who sent the reminder (same studies as previous meta-analysis)

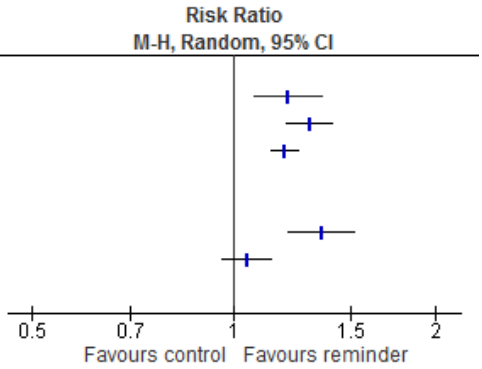


Test for subgroup differences: Chi² = 9.31, df = 5 (P = 0.10), I² = 46.3%

Footnotes
(1) Data is merged for phone call reminder arm and letter reminder arm
(2) Autodialer reminder from pharmacy. Pneumococcal vaccine. Shingles data not included to prevent double counting.
(3) Postcard then letter if needed
(4) Hib vaccine data. MMR data not included to avoid double-counting. 2 arms combined: customised and non-customised reminder letters.
(5) 2x autodialer + postcard
(6) Up to 2 telephone call reminders and then a postcard
(7) Electronic message to patient sent using patient's electronic medical record
(8) Letter. This population and intervention is different to the other Otsuka 2013 data
(9) HPV specific study; text message intervention- data edited by GUT
(10) HPV specific study; autodialer intervention; data added by GUT
(11) Telephone
(12) Data for Td (Tetanus, Diphtheria) vaccination only
(13) Telephone reminder; pneumonococcal vaccination; data extracted for over 65 year olds only
(14) Postcard
(15) Letter
(16) Postcard
(17) 12 month reminder
(18) 19 month recall
(19) 7 month recall
(20) 9 telephone calls and then 2 biligual mailings if needed
(21) Data pooled for autodialer, outreach, and autodialer with outreach interventions
(22) Telephone
(23) Telephone
(24) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. New York data
(25) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. Colorado data
(26) Letter reminder from regional health authority. Pneumococcal vaccine.
(27) PCV (pneumonococcal conjugate vaccine) specific study
(28) The 1 text message and 2-4 text message arms were merged
(29) Continuous reminder arm at 6 months (from Cochrane review)
(30) Postcard and up to 4 telephone calls
(31) Text message. HPV 1st dose
(32) HPV 1st dose. Up to 2 letters separated by 2 autodialer telephone calls.
(33) Reminder interventions pooled by Cochrane review authors
(34) 1 or 2 reminders via written message or call to classroom or escort from class
(35) Data for the arms for motivational text messages and self-regulatory text messages were merged
(36) HPV specific study; data was extracted for 9-17 year olds only
(37) Hpv specific study; data obtained by Jacobson Vann 2018 Cochrane review authors from study authors

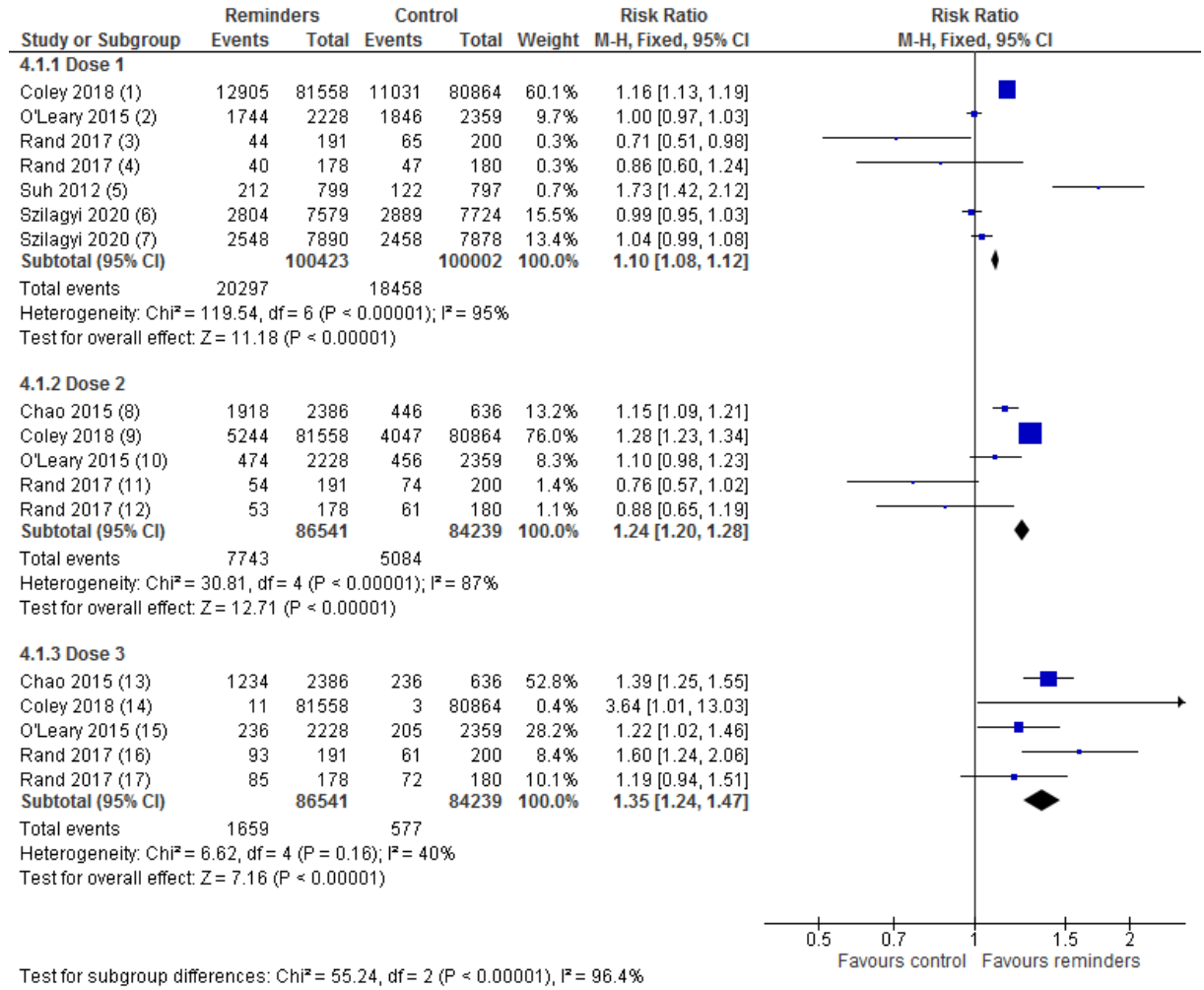
CLUSTER RCTs: Patient reminders: (summary) reminder versus control

Study or Subgroup	Reminder Events	Reminder Total	Control Events	Control Total	Risk Ratio M-H, Random, 95% CI
3.1.1 Immunisations for 0-5 year olds					
Dini 2000 (1)	648	1317	213	521	1.20 [1.07, 1.35]
Franzini 2000 (2)	585	709	273	429	1.30 [1.20, 1.40]
Rodewald 1999 (3)	1780	2022	532	719	1.19 [1.14, 1.25]
3.1.2 Immunisations for 11-18 year olds					
Szilagyi 2011 (4)	634	3839	453	3707	1.35 [1.21, 1.51]
Szilagyi 2013 (5)	1061	2819	467	1296	1.04 [0.96, 1.14]



Footnotes
1) cRCT data was not adjusted for clustering. Autodialer, letter and autodialer with letter data pooled.
2) cRCT data was not adjusted for clustering. Pooled data for postcard and autodialer arms.
3) cRCT data was not adjusted for clustering. Data pooled for tracking with outreach, provide prompts and the combined intervention.
4) cRCT data was not adjusted for clustering. HPV dose 1.
5) cRCT data was not adjusted for clustering. HPV dose 1. Data pooled for letter and autodialer interventions.

Patient reminders: (summary for HPV doses) reminder versus control

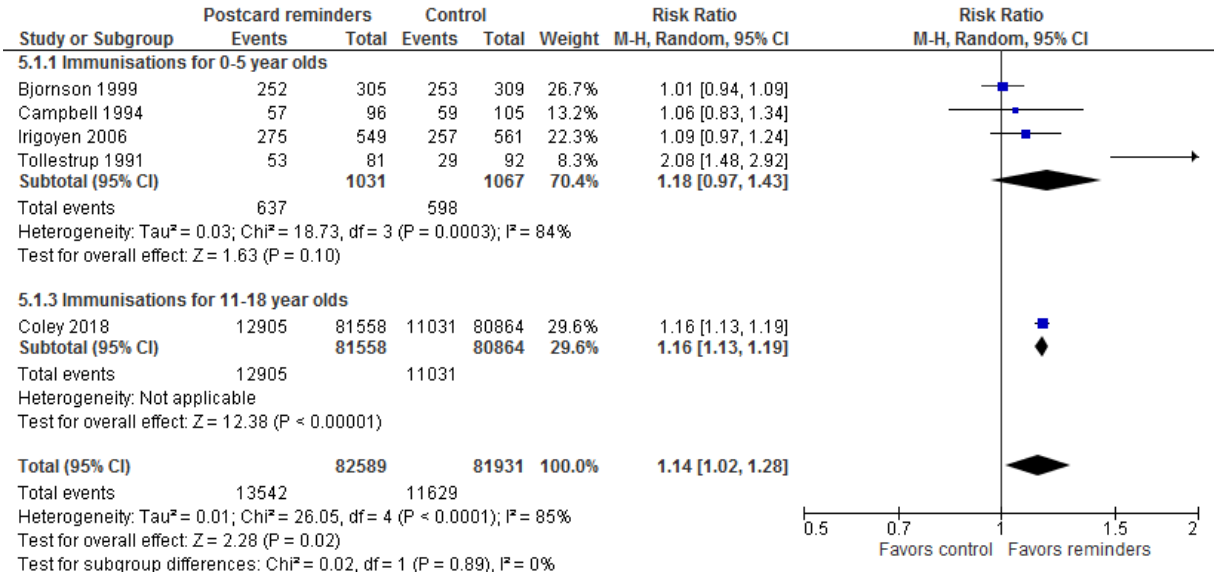


Test for subgroup differences: Chi² = 55.24, df = 2 (P < 0.00001), I² = 96.4%

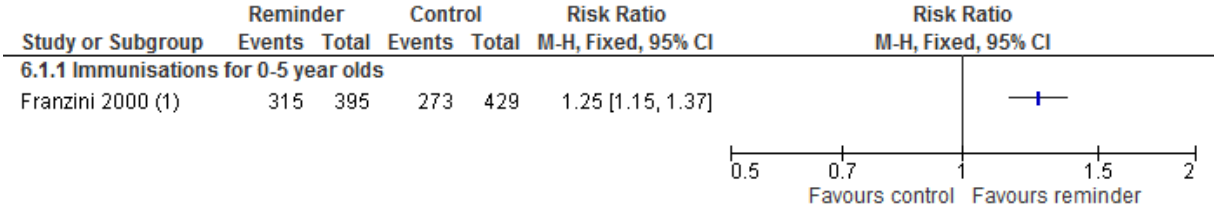
Footnotes

1) Postcard
2) Text message
3) Text
4) Autodialer
5) HPV 1st dose. Up to 2 letters separated by 2 autodialer telephone calls.
6) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. We could not use the 2nd/3rd dose data because they were merged. Colorado data.
7) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. We could not use the 2nd/3rd dose data because they were merged. New York data
8) Letter; data for 9-17 year olds; participants had one dose at baseline
9) Postcard
10) Text message
11) Text
12) Autodailer
13) Letter; data for 9-17 year olds; participants had one dose at baseline
14) Reminder letter
15) Text message
16) Text
17) Autodialer

Patient reminders: postcard versus control

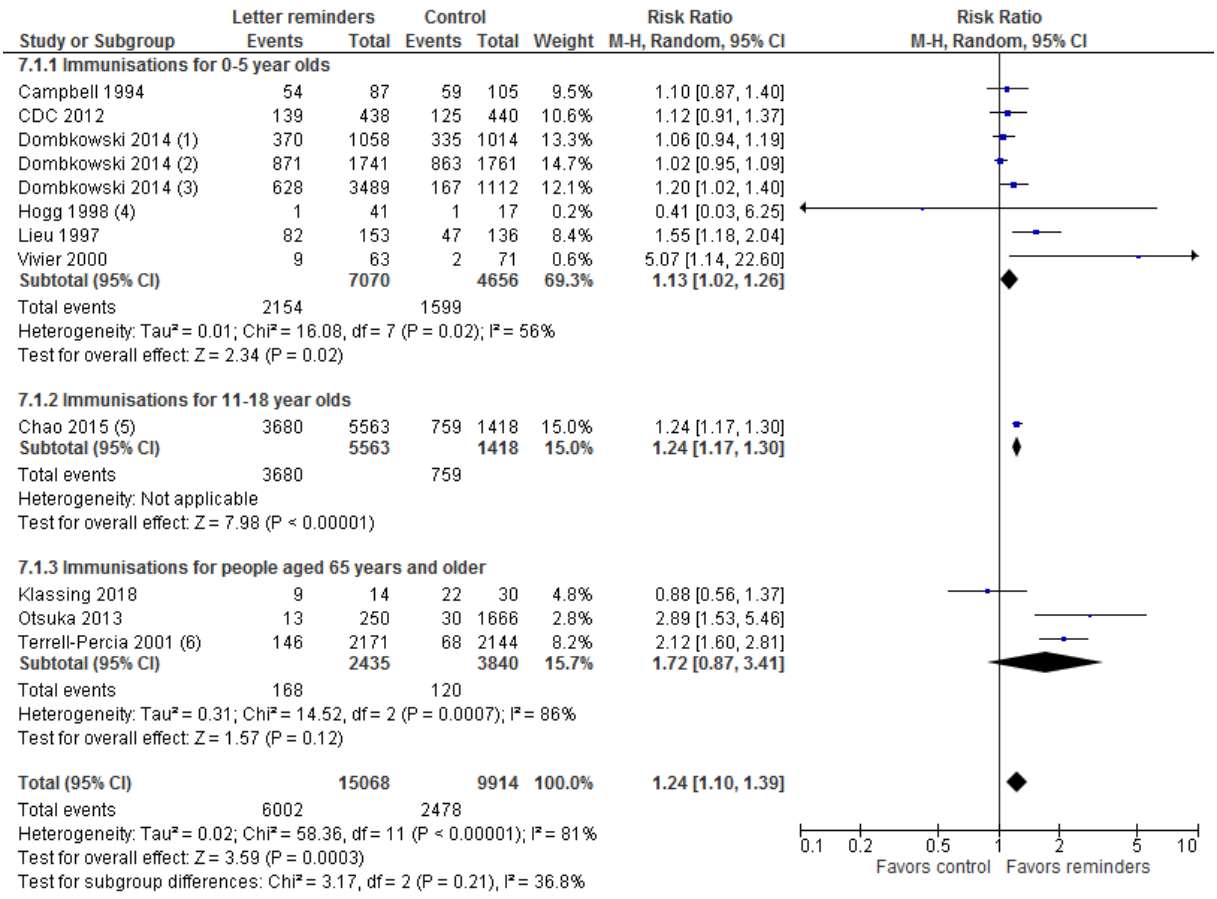


CLUSTER RCTs: Patient reminders: postcard versus control



Footnotes
(1) cRCT data was not adjusted for clustering.

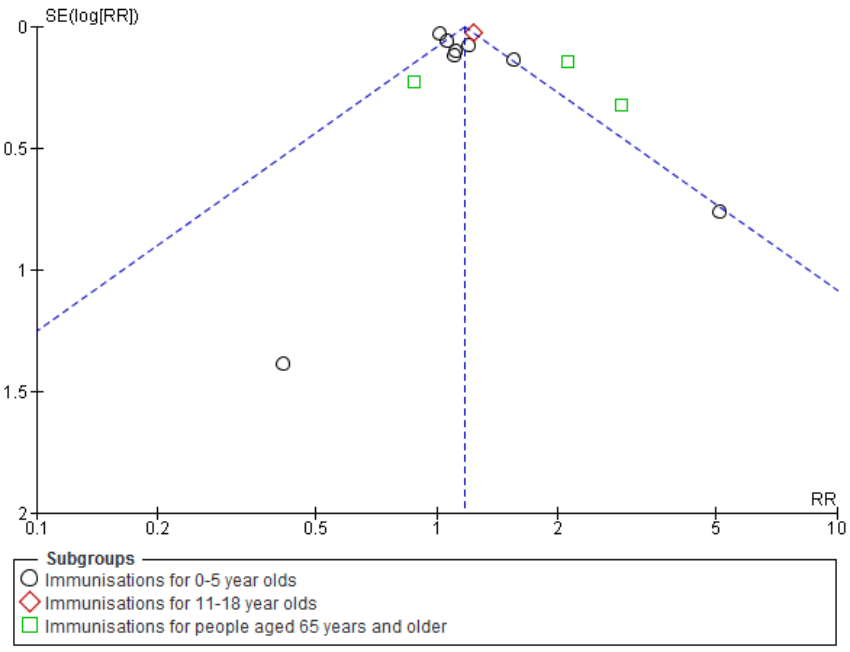
Patient reminders: letter versus control



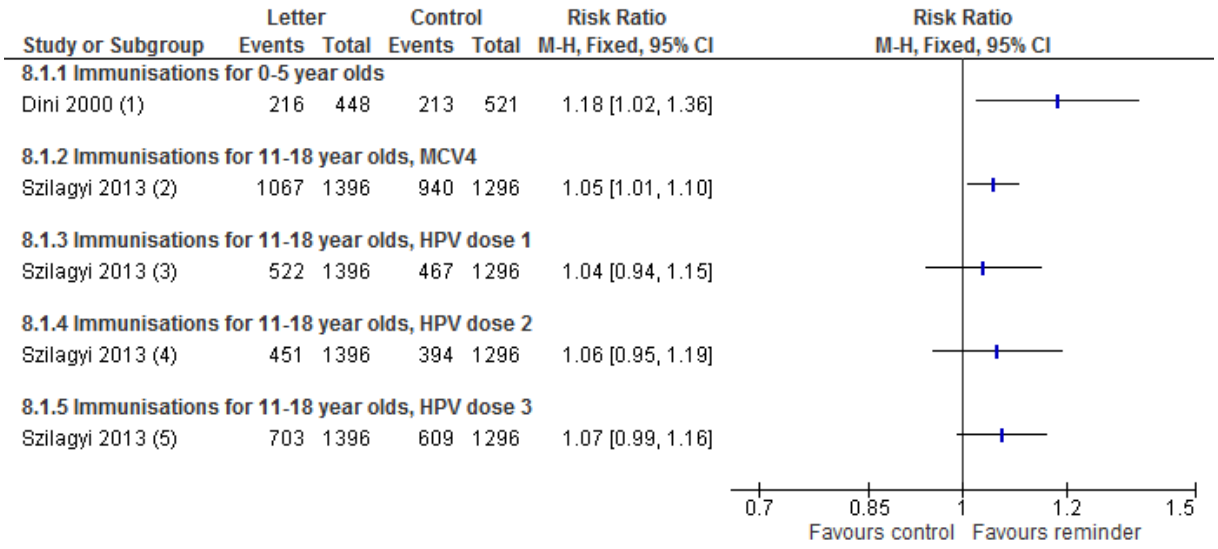
Footnotes

(1) 7 month recall
(2) 12 month reminder
(3) 19 month recall
(4) Hib vaccine data. MMR data not included to avoid double-counting. 2 arms combined: customised and non-customised reminder letters.
(5) Data was extracted for 9-17 year olds only
(6) Letter reminder from regional health authority. Pneumococcal vaccine.

Funnel plot for patient reminders: letter versus control



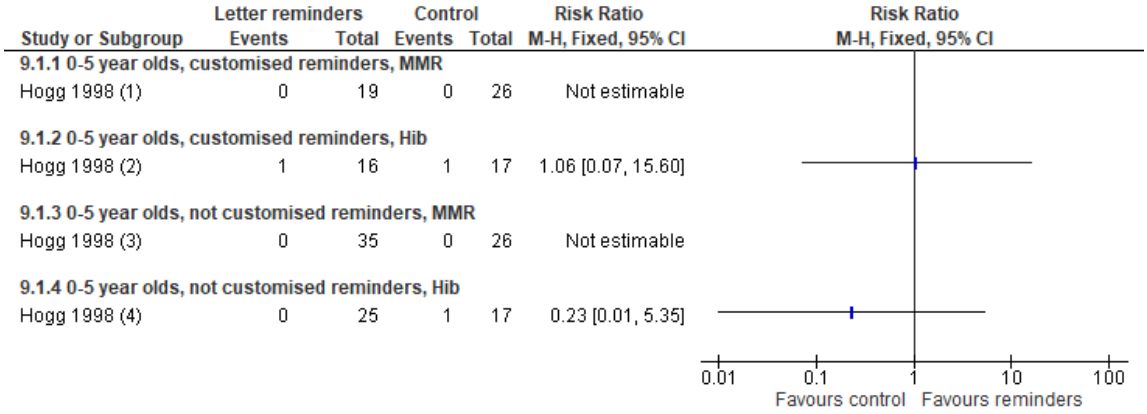
CLUSTER RCTs: Patient reminders: letter versus control



Footnotes

1 to 5: cRCT data was not adjusted for clustering

Patient reminders: customised or not customised letter reminders versus control

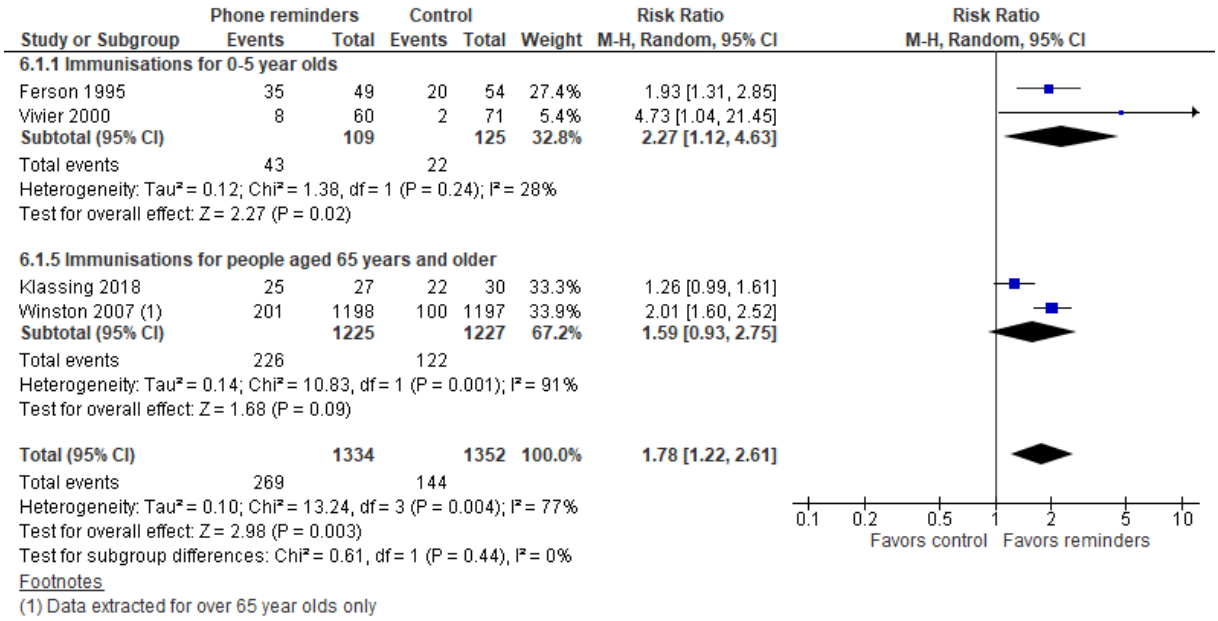


Footnotes

1 to 4: There are no totals to prevent double counting. This study has a small number of children because the study was about reminders for family members of all ages for different preventative measures.

1 and 3: Not estimable or not applicable because there were no events in either arm.

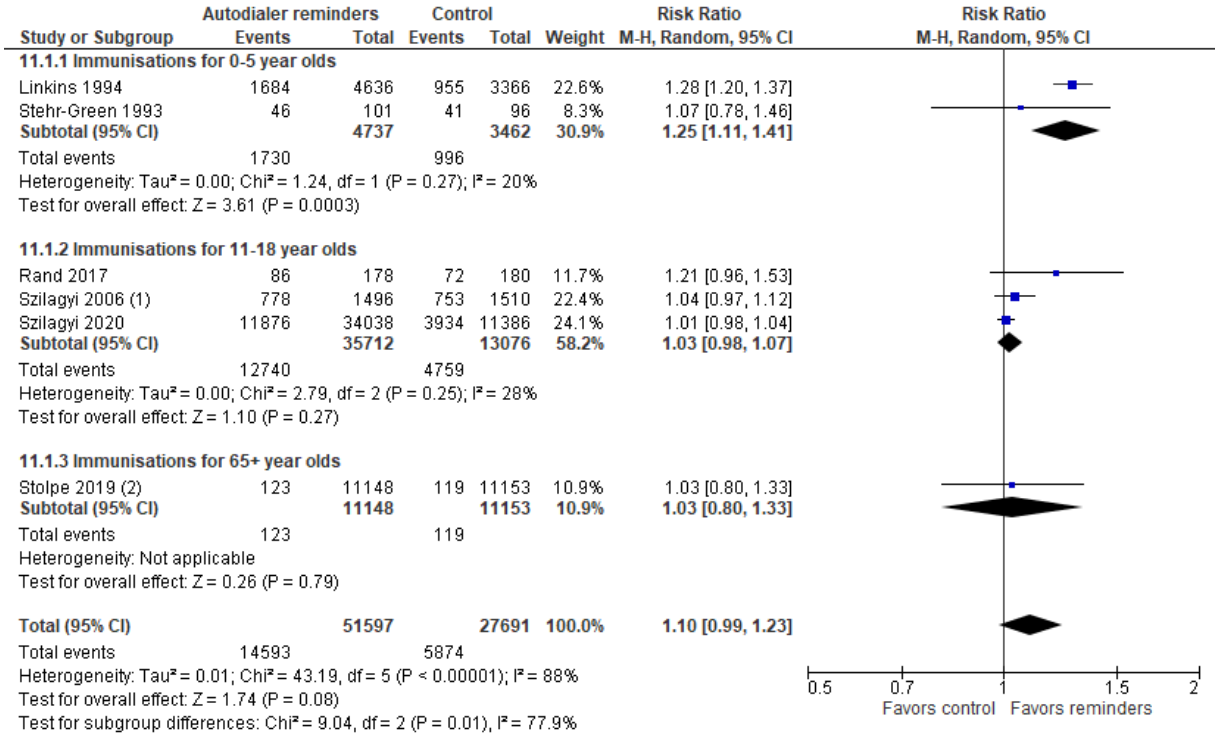
Patient reminders: telephone versus control



Footnotes

(1) Data extracted for over 65 year olds only

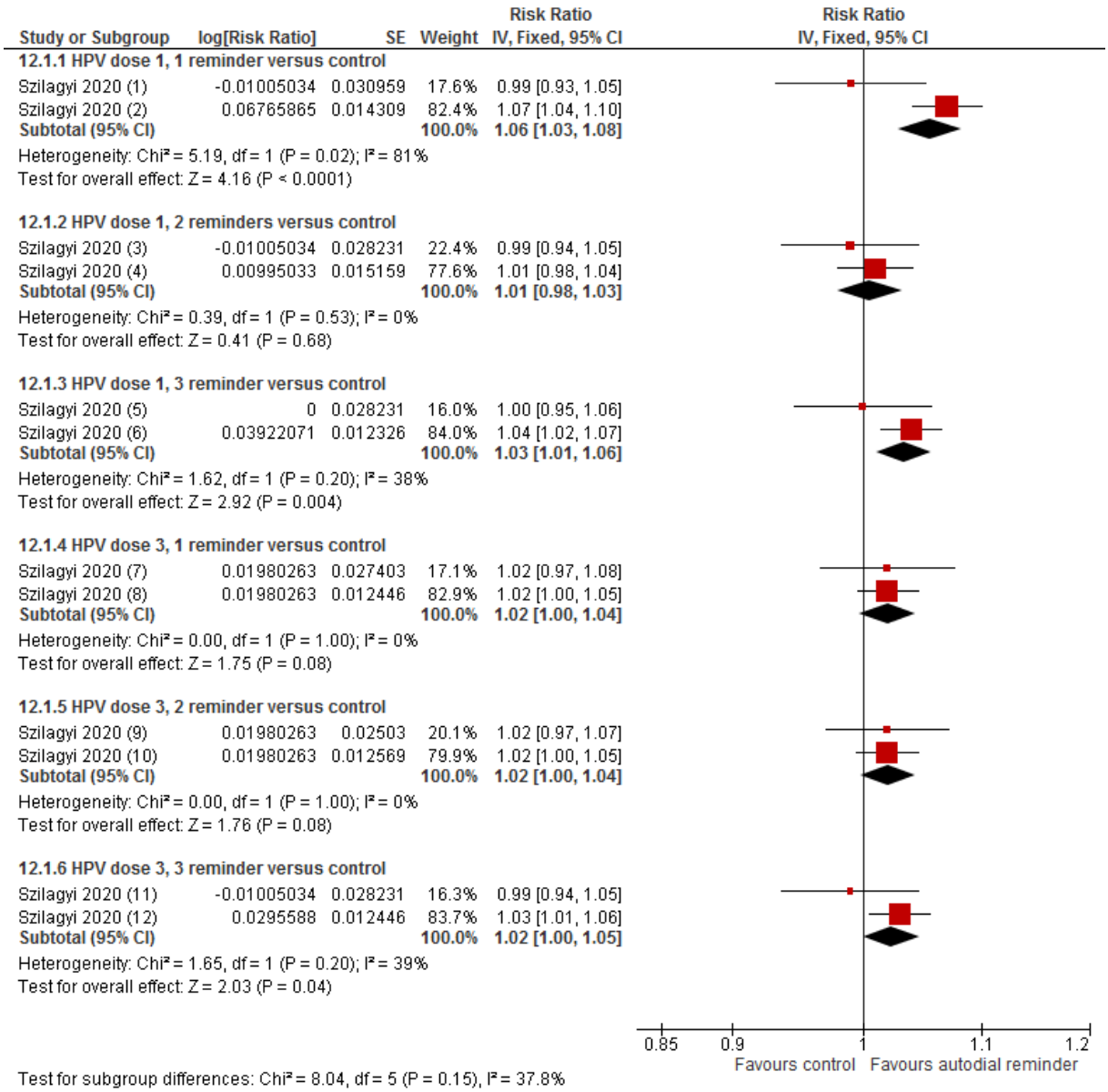
Patient reminders: autodialer versus control



Footnotes

1) Data for Td (Tetanus, Diphtheria) vaccination only.
2) Autodialer reminder from a pharmacy. Pneumococcal vaccine uptake. Data for shingles was not included on this meta-analysis to prevent double counting.

1 Patient reminders: 1 to 3 autodialer versus control



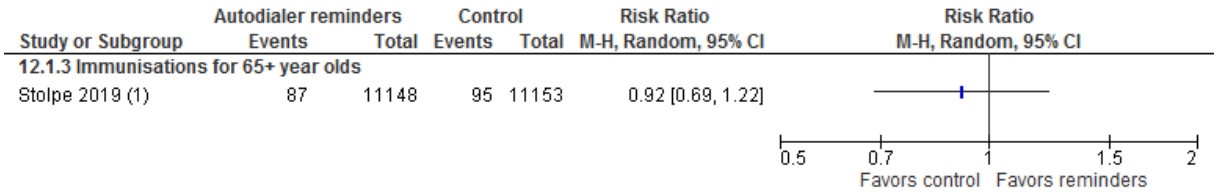
Test for subgroup differences: Chi² = 8.04, df = 5 (P = 0.15), I² = 37.8%

Footnotes

(1) Adjusted by the investigators for age, practice type, urban or rural status, and gender. New York data.
(2) Adjusted by the investigators for age, practice type, urban or rural status, and gender. Colorado data.
(3) Adjusted by the investigators for age, practice type, urban or rural status, and gender. New York data
(4) Adjusted by the investigators for age, practice type, urban or rural status, and gender. Colorado data
(5) Adjusted by the investigators for age, practice type, urban or rural status, and gender. New York data.
(6) Adjusted by the investigators for age, practice type, urban or rural status, and gender. Colorado data.
(7) Adjusted by the investigators for age, practice type, urban or rural status, and gender. New York data
(8) Adjusted by the investigators for age, practice type, urban or rural status, and gender. Colorado data.
(9) Adjusted by the investigators for age, practice type, urban or rural status, and gender. New York data.
(10) Adjusted by the investigators for age, practice type, urban or rural status, and gender. Colorado data.
(11) Adjusted by the investigators for age, practice type, urban or rural status, and gender. New York data.
(12) Adjusted by the investigators for age, practice type, urban or rural status, and gender. Colorado data.

2

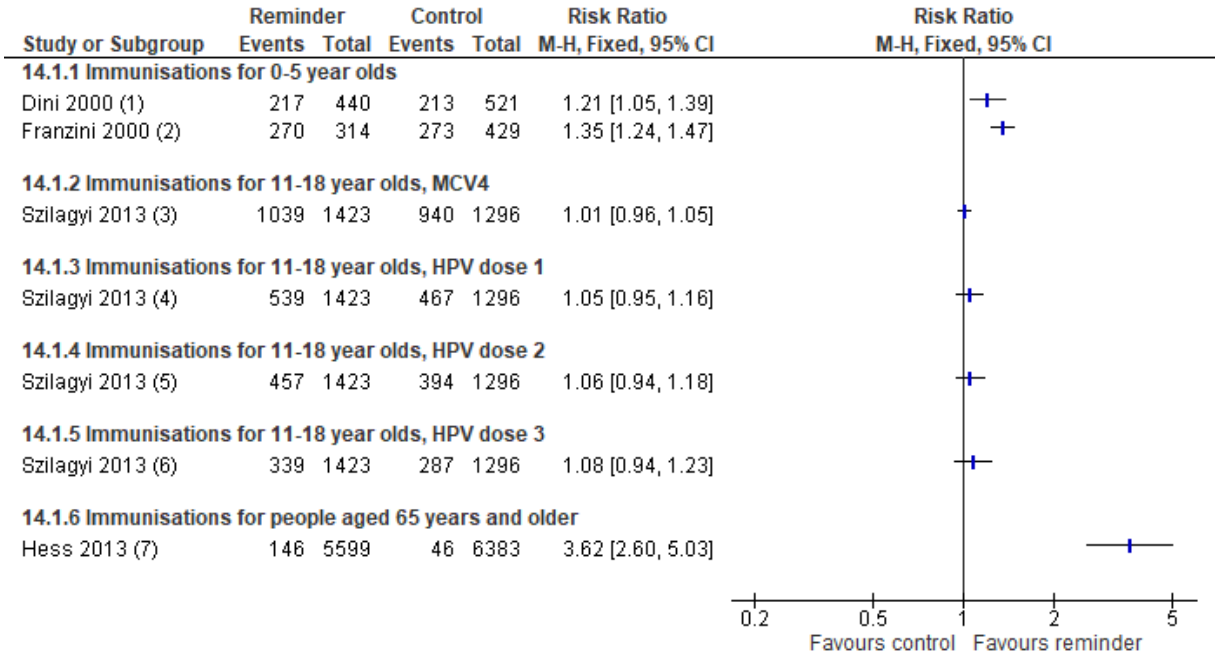
Patient reminders: autodialer versus control (shingles vaccine)



Footnotes

1) Autodialer reminder from a pharmacy. Shingles vaccine uptake. Data for pneumococcal vaccine is in the meta-analysis above. The shingles vaccine data is separate to avoid double counting.

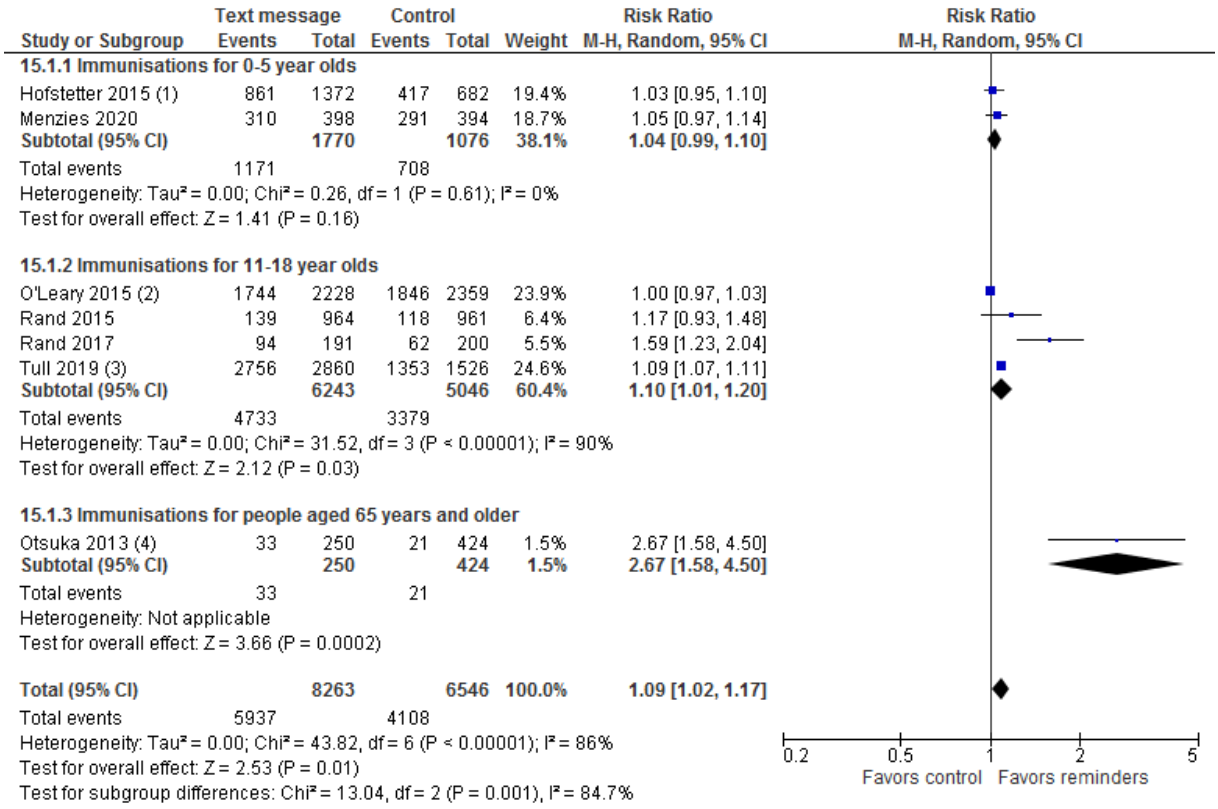
CLUSTER RCTs: Patient reminders: autodialer versus control



Footnotes

1 to 7: cRCT data was not adjusted for clustering.

Patient reminders: text or 'electronic' message versus control



Footnotes

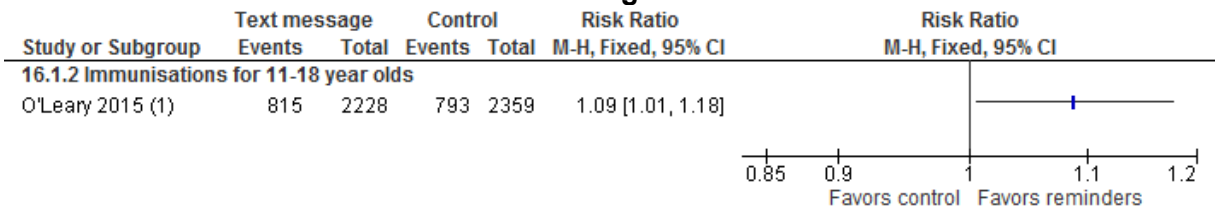
(1) The 1 text message and 2-4 text message arms were merged

(2) Text message. HPV 1st dose

(3) Data for the arms for motivational text messages and self-regulatory text messages were merged

(4) Electronic message to patient sent using patient's electronic medical record

Patient reminders: text or 'electronic' message versus control: MCV4 vaccine

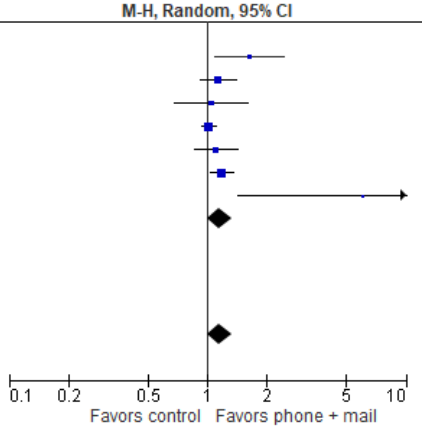


Footnotes

(1) Text message. MCV vaccine. This data has been presented seperately to avoid double-counting.

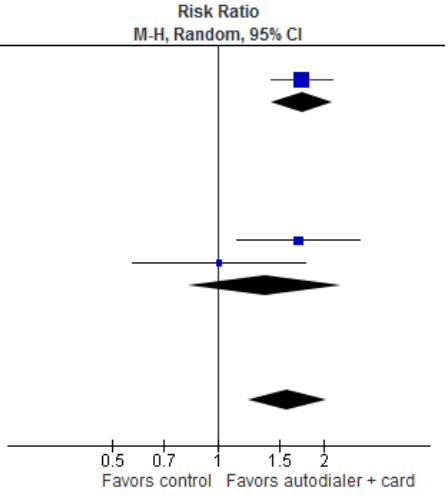
Patient reminders: telephone + mail versus control

Study or Subgroup	Phone + mail reminders Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
9.1.1 Immunisations for 0-5 year olds						
Alto 1994	49	213	33	233	8.6%	1.62 [1.09, 2.42]
Daley 2002	140	610	126	624	17.5%	1.14 [0.92, 1.41]
Daley 2004	35	205	35	215	7.8%	1.05 [0.68, 1.61]
Hoekstra 1999	259	324	190	241	26.7%	1.01 [0.93, 1.10]
Kempe 2001	89	294	85	309	15.1%	1.10 [0.86, 1.41]
LeBaron 2004	306	763	260	763	23.5%	1.18 [1.03, 1.34]
Vivier 2000	12	70	2	71	0.9%	6.09 [1.41, 26.21]
Subtotal (95% CI)		**2479**		**2456**	**100.0%**	**1.15 [1.00, 1.32]**
Total events	890		731			
Heterogeneity: Tau² = 0.02; Chi² = 15.82, df = 6 (P = 0.01); I² = 62%						
Test for overall effect: Z = 1.97 (P = 0.05)						
Total (95% CI)		**2479**		**2456**	**100.0%**	**1.15 [1.00, 1.32]**
Total events	890		731			
Heterogeneity: Tau² = 0.02; Chi² = 15.82, df = 6 (P = 0.01); I² = 62%						
Test for overall effect: Z = 1.97 (P = 0.05)						
Test for subgroup differences: Not applicable						



Patient reminders: autodialer + mail versus control

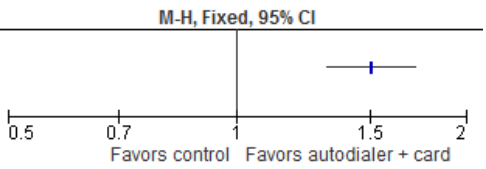
Study or Subgroup	Autodialer + postcard Events	Total	Control Events	Total	Weight	Risk Ratio M-H, Random, 95% CI
18.1.2 Immunisations for 11-18 year olds						
Suh 2012 (1)	212	799	122	797	56.0%	1.73 [1.42, 2.12]
Subtotal (95% CI)		**799**		**797**	**56.0%**	**1.73 [1.42, 2.12]**
Total events	212		122			
Heterogeneity: Not applicable						
Test for overall effect: Z = 5.39 (P < 0.00001)						
18.1.3 Immunisations for people aged 65 years and older						
Hurley 2018 (2)	58	2079	39	2370	27.6%	1.70 [1.13, 2.53]
Hurley 2019 (3)	22	307	22	309	16.4%	1.01 [0.57, 1.78]
Subtotal (95% CI)		**2386**		**2679**	**44.0%**	**1.36 [0.82, 2.25]**
Total events	80		61			
Heterogeneity: Tau² = 0.07; Chi² = 2.15, df = 1 (P = 0.14); I² = 54%						
Test for overall effect: Z = 1.19 (P = 0.23)						
Total (95% CI)		**3185**		**3476**	**100.0%**	**1.58 [1.22, 2.04]**
Total events	292		183			
Heterogeneity: Tau² = 0.02; Chi² = 3.15, df = 2 (P = 0.21); I² = 36%						
Test for overall effect: Z = 3.47 (P = 0.0005)						
Test for subgroup differences: Chi² = 0.76, df = 1 (P = 0.38), I² = 0%						



Footnotes
(1) HPV 1st dose. Up to 2 letters separated by 2 autodialer telephone calls.
(2) 2x autodialer + postcard
(3) Up to 2 telephone call reminders and then a postcard

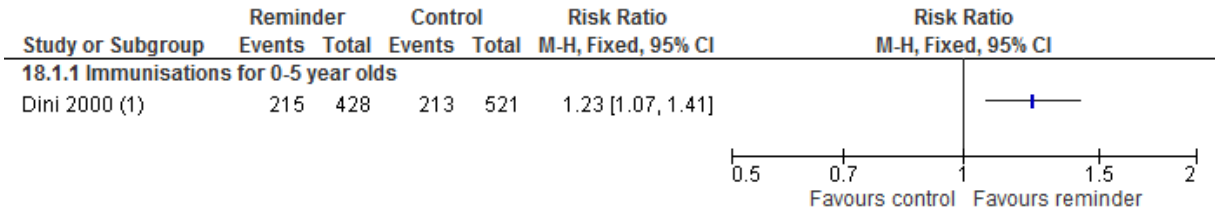
Patient reminders: autodialer + mail versus control: MCV vaccine

Study or Subgroup	Autodialer + postcard Events	Total	Control Events	Total	Risk Ratio M-H, Fixed, 95% CI
19.1.2 Immunisations for 11-18 year olds					
Suh 2012 (1)	354	799	235	797	1.50 [1.32, 1.72]



Footnotes
(1) MCV4 vaccine. Data presented seperately to avoid double-counting. Up to 2 letters separated by 2 autodialer telephone calls.

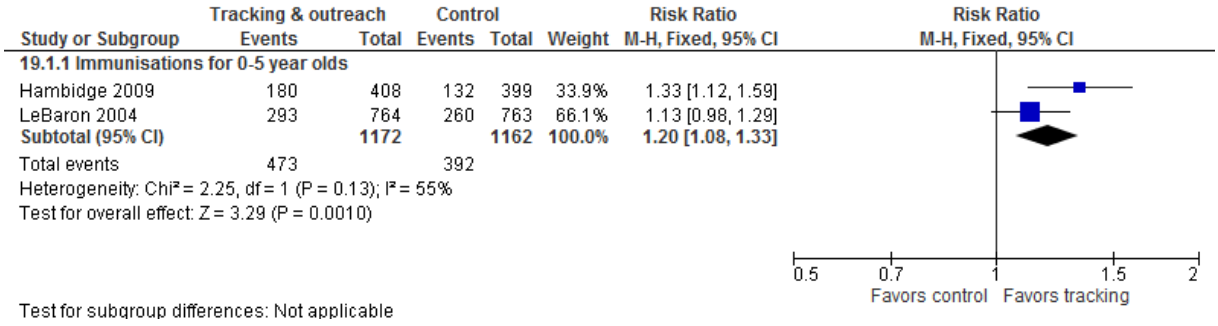
CLUSTER RCTs: Patient reminders: autodialer + letter (mail) versus control



Footnotes

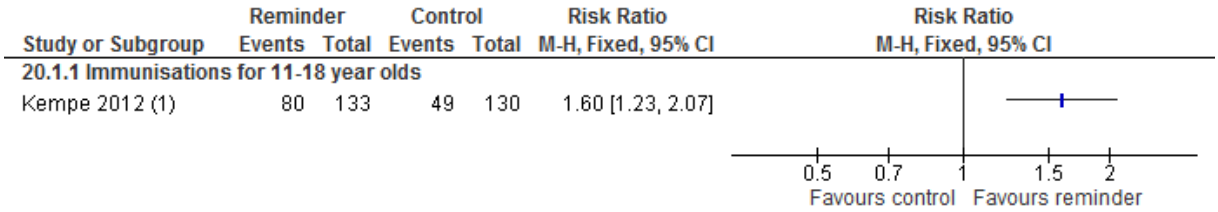
(1) cRCT data was not adjusted for clustering.

Patient reminders: outreach reminder versus control



Test for subgroup differences: Not applicable

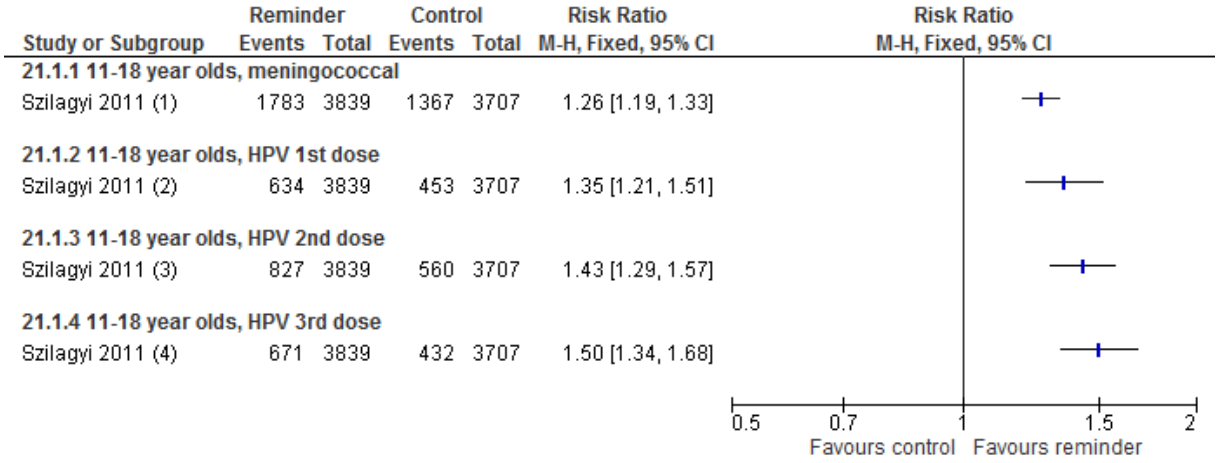
CLUSTER RCTs: Patient reminders: classroom recall (recalled 1 or 2 times via a note sent to classroom, a call to the classroom, or an escort from the classroom) versus control



Footnotes

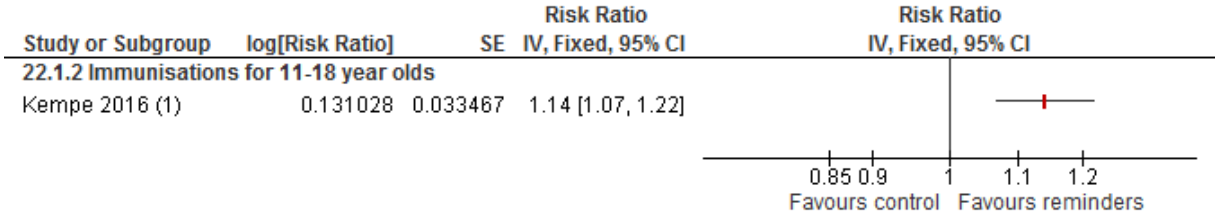
(1) 1 or 2 reminders via written message or call to classroom or escort from class

CLUSTER RCTs: Patient reminders: tracking, telephone or mail, home visits if needed versus control



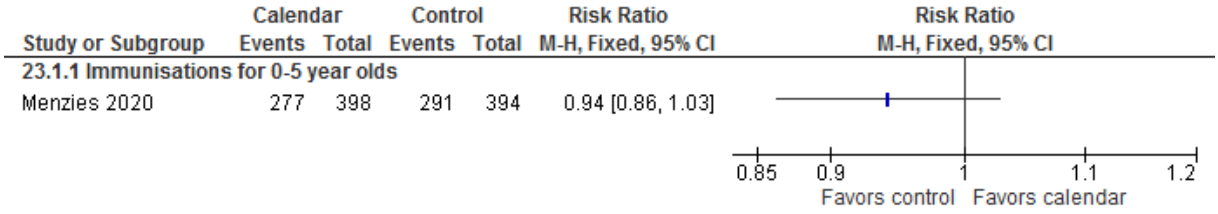
Footnotes
(1) cRCT data was not adjusted for clustering.
(2) cRCT data was not adjusted for clustering.
(3) cRCT data was not adjusted for clustering.
(4) cRCT data was not adjusted for clustering.

CLUSTER RCTs: Patient reminders: reminder of preference versus control

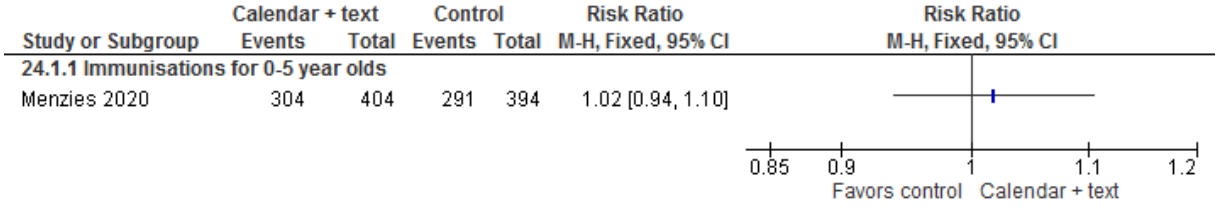


Footnotes
(1) cRCT data was adjusted for clustering by the investigators. HPV series completion rate.

Patient reminders: calendar reminder versus control

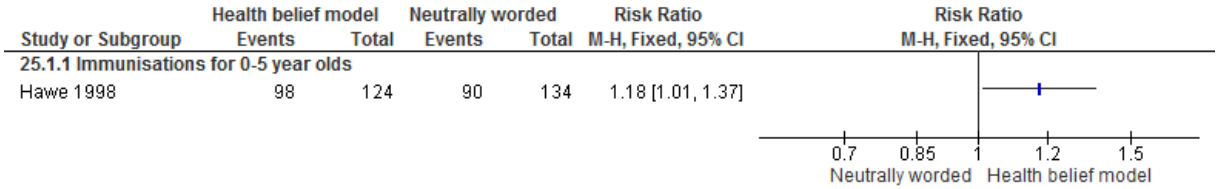


Patient reminders: calendar and text reminder versus control

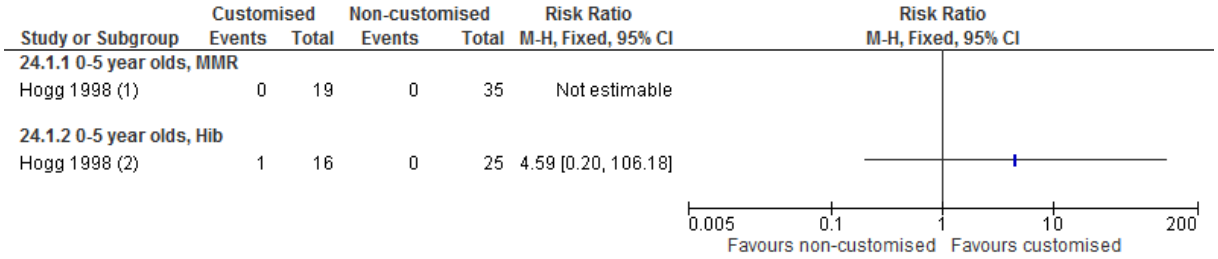


Reminders interventions aimed at individuals, parents/ carers compared to other reminder interventions

Patient reminders: health belief worded postcard versus neutrally worded postcard



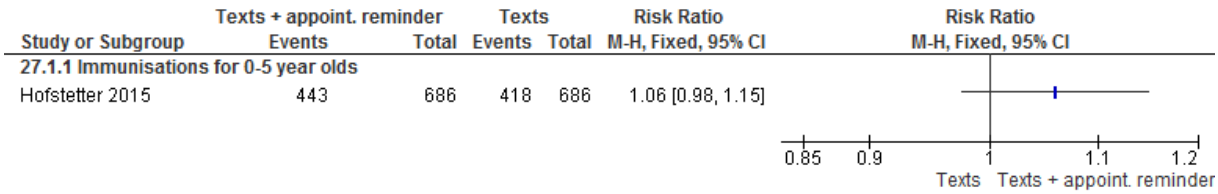
Patient reminders: customised reminders versus non-customised reminders



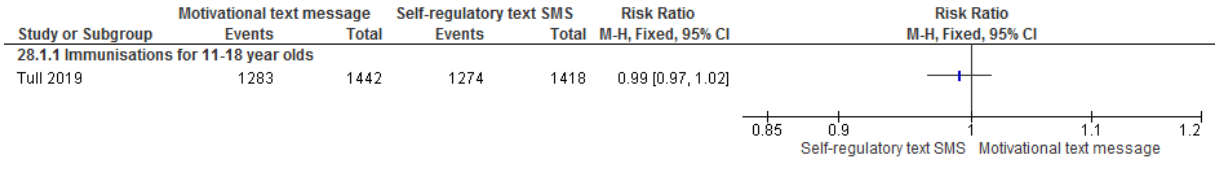
Footnotes

1 and 2: Reminders were by letter. There are no totals to prevent double counting. This study has a small number of children because the study was about reminders for family members of all ages for different preventative measures.

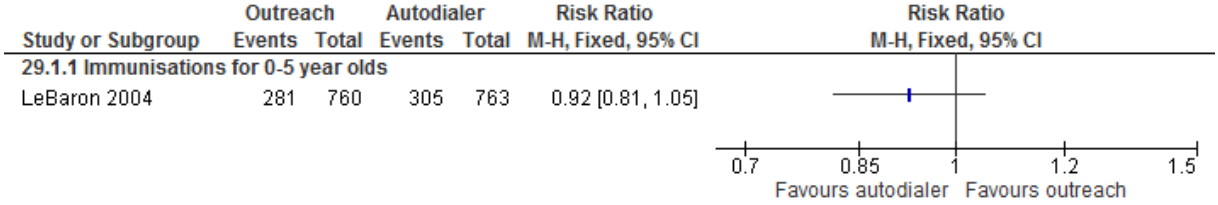
Patient reminders: texts + appointment scheduling reminder versus texts only



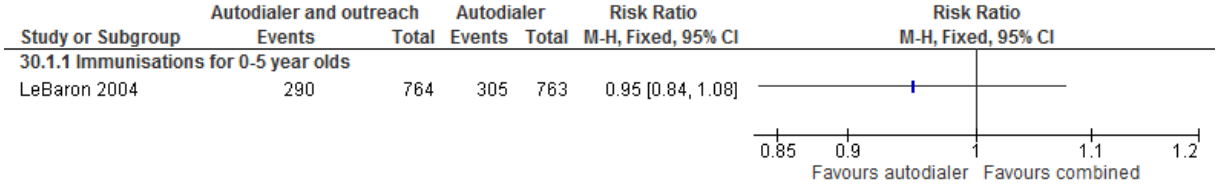
Patient reminders: motivational text message versus self-regulatory text message



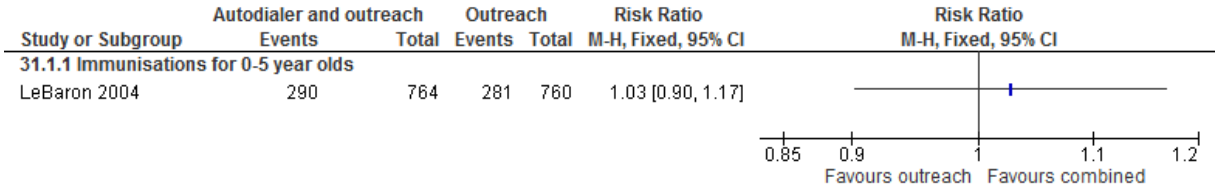
Patient reminders: outreach versus autodialer



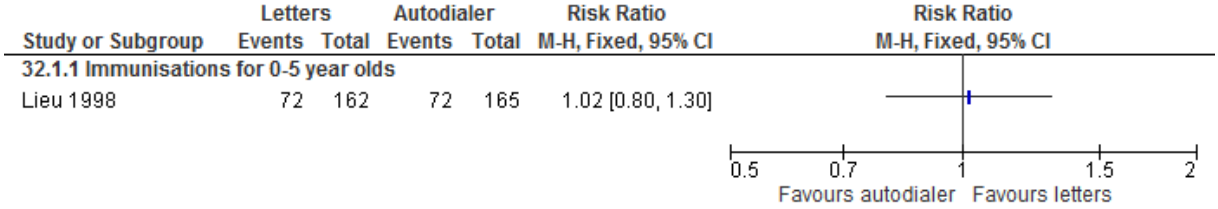
Patient reminders: autodialer + outreach versus autodialer



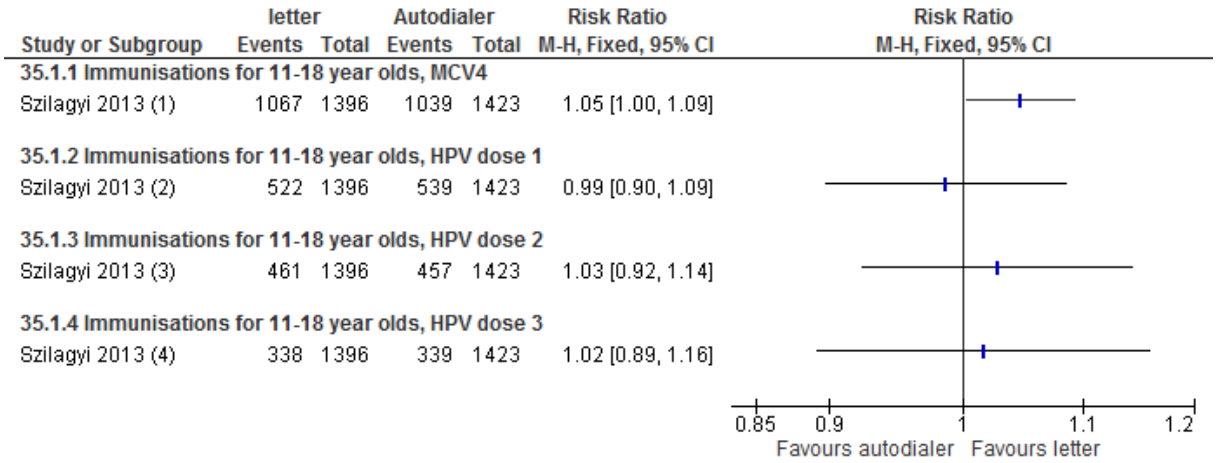
Patient reminders: autodialer + outreach versus outreach



Patient reminders: letters versus autodialer



CLUSTER RCTs: Patient reminders: letter versus autodialer

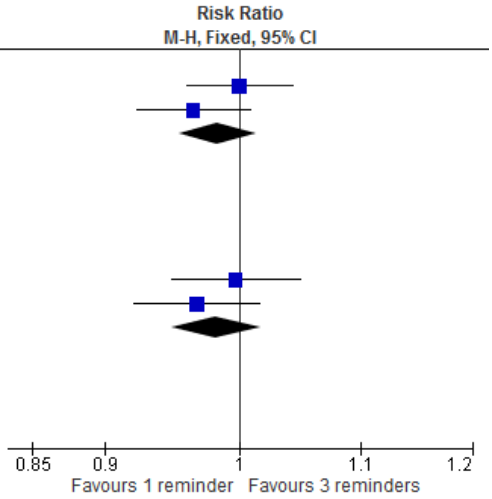


Footnotes

1 to 4: cRCT data was not adjusted for clustering.

CLUSTER RCTs: Patient reminders: 3 autodialer reminders versus 1 autodialer reminder

Study or Subgroup	3 reminders Events	Total	1 reminder Events	Total	Weight	Risk Ratio M-H, Fixed, 95% CI
34.1.1 HPV dose 1						
Szilagyi 2020 (1)	2804	7579	2842	7682	51.7%	1.00 [0.96, 1.04]
Szilagyi 2020 (2)	2548	7890	2634	7864	48.3%	0.96 [0.92, 1.01]
Subtotal (95% CI)		**15469**		**15546**	**100.0%**	**0.98 [0.95, 1.01]**
Total events	5352		5476			
Heterogeneity: Chi² = 1.39, df = 1 (P = 0.24); I² = 28%						
Test for overall effect: Z = 1.13 (P = 0.26)						
34.1.2 HPV series completion						
Szilagyi 2020 (3)	2186	7890	2186	7864	48.8%	1.00 [0.95, 1.05]
Szilagyi 2020 (4)	2205	7579	2315	7692	51.2%	0.97 [0.92, 1.02]
Subtotal (95% CI)		**15469**		**15556**	**100.0%**	**0.98 [0.95, 1.02]**
Total events	4391		4501			
Heterogeneity: Chi² = 0.73, df = 1 (P = 0.39); I² = 0%						
Test for overall effect: Z = 1.05 (P = 0.29)						

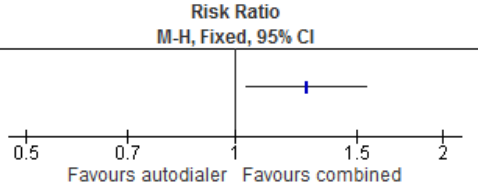


Test for subgroup differences: Chi² = 0.00, df = 1 (P = 0.95), I² = 0%

Footnotes
(1) Unadjusted data used because it is almost identical to the adjusted data. New York data
(2) Unadjusted data used because it is almost identical to the adjusted data. Colorado data
(3) HPV dose 2 or 3 depending on regimen. Unadjusted data used because it is almost identical to the adjusted data. Colorado data
(4) HPV dose 2 or 3 depending on regimen. Unadjusted data used because it is almost identical to the adjusted data. New York data

Patient reminders: autodialer + letters versus autodialer

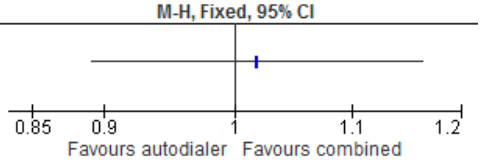
Study or Subgroup	Autodialer and letters Events	Total	Autodialer Events	Total	Risk Ratio M-H, Fixed, 95% CI
35.1.1 Immunisations for 0-5 year olds					
Lieu 1998 (1)	178	321	72	165	1.27 [1.04, 1.55]



Footnotes
(1) Autodialer and letters data from 2 similar arms combined

CLUSTER RCTs: Patient reminders: autodialer + letters versus autodialer

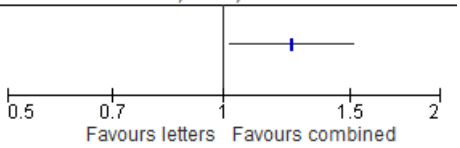
Study or Subgroup	Autodialer and letters Events	Total	Autodialer Events	Total	Risk Ratio M-H, Fixed, 95% CI
36.1.1 Immunisations for 0-5 year olds					
Dini 2000 (1)	215	428	217	440	1.02 [0.89, 1.16]



Footnotes
(1) cRCT. Data was not adjusted for clustering.

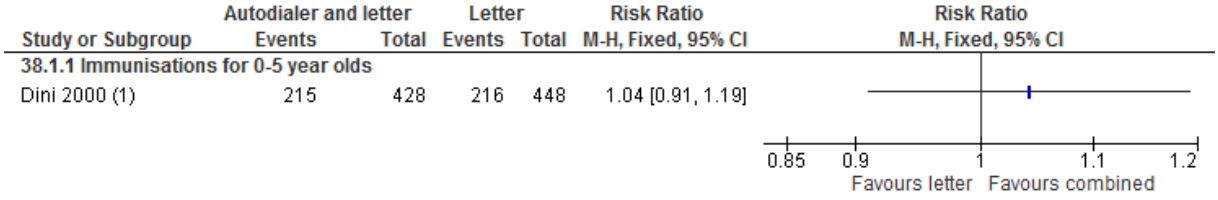
Patient reminders: autodialer + letters versus letters

Study or Subgroup	Autodialer and letters Events	Total	Letters Events	Total	Risk Ratio M-H, Fixed, 95% CI
37.1.1 Immunisations for 0-5 year olds					
Lieu 1998 (1)	178	321	72	162	1.25 [1.02, 1.52]



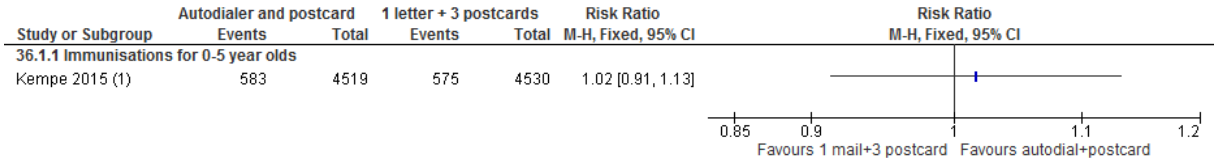
Footnotes
(1) Autodialer and letters data from 2 similar arms combined

CLUSTER RCTs: Patient reminders: autodialer + letter versus letter



Footnotes
(1) cRCT. Data was not adjusted for clustering.

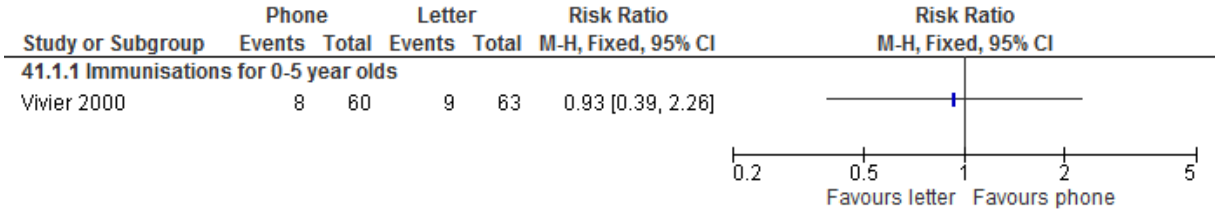
Patient reminders: reminders by autodialer and mail versus reminders by mail



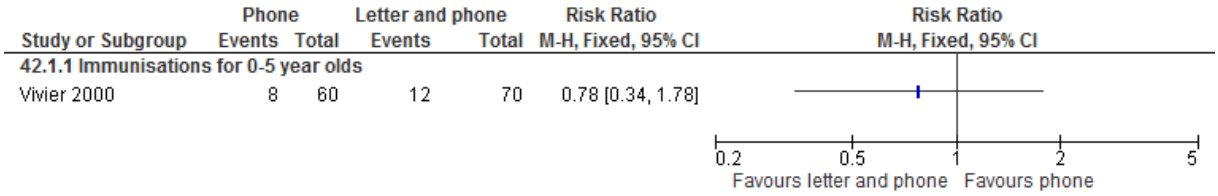
Footnotes

1) This part of Kemp 2015 was a normal RCT. Centrally organised reminders by autodialer and mail (2 telephone calls and 2 postcards) versus centrally organised reminders by mail (1 letter and 3 postcards).

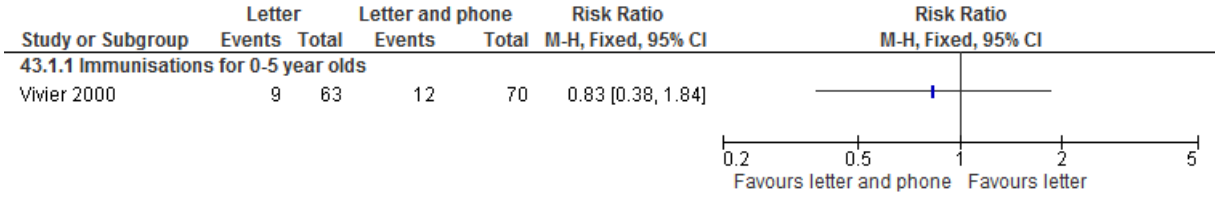
Patient reminders: phone versus letter



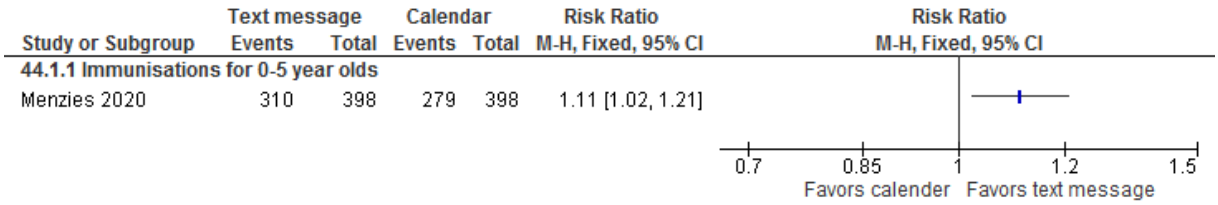
Patient reminders: phone versus letter and phone



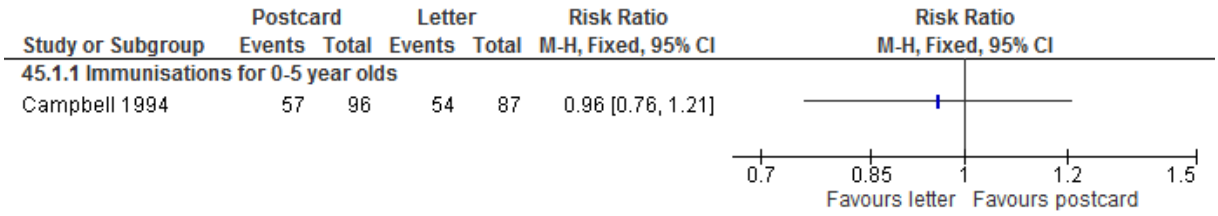
Patient reminders: letter versus letter and phone



Patient reminders: text message versus calendar reminder

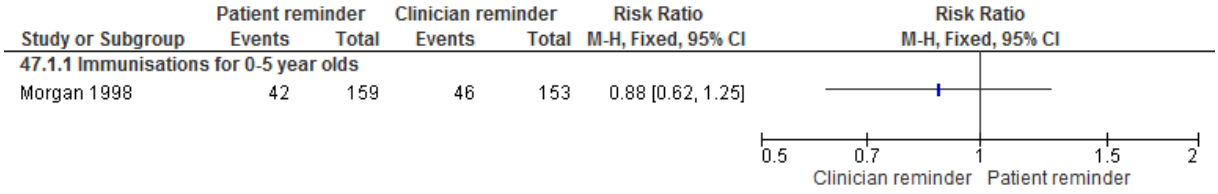


Patient reminders: postcard versus letter

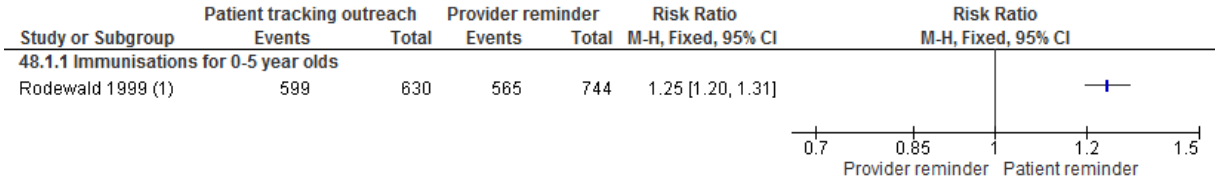


Reminders interventions aimed at individuals, parents/ carers compared to those aimed at providers to increase vaccine uptake

Patient reminder (letter) versus provider reminder (health visitor phone call)

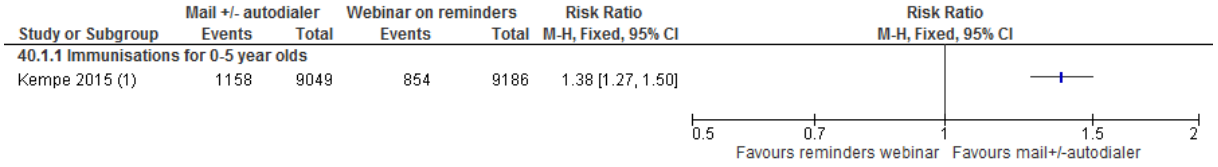


CLUSTER RCTs: Patient reminder (tracking and outreach) versus provider reminder



Footnotes
(1) cRCT. Data was not adjusted for clustering.

CLUSTER RCTs: Patient reminders: centrally organised reminders by mail or autodialer and mail versus primary care practice webinar training on vaccination reminders

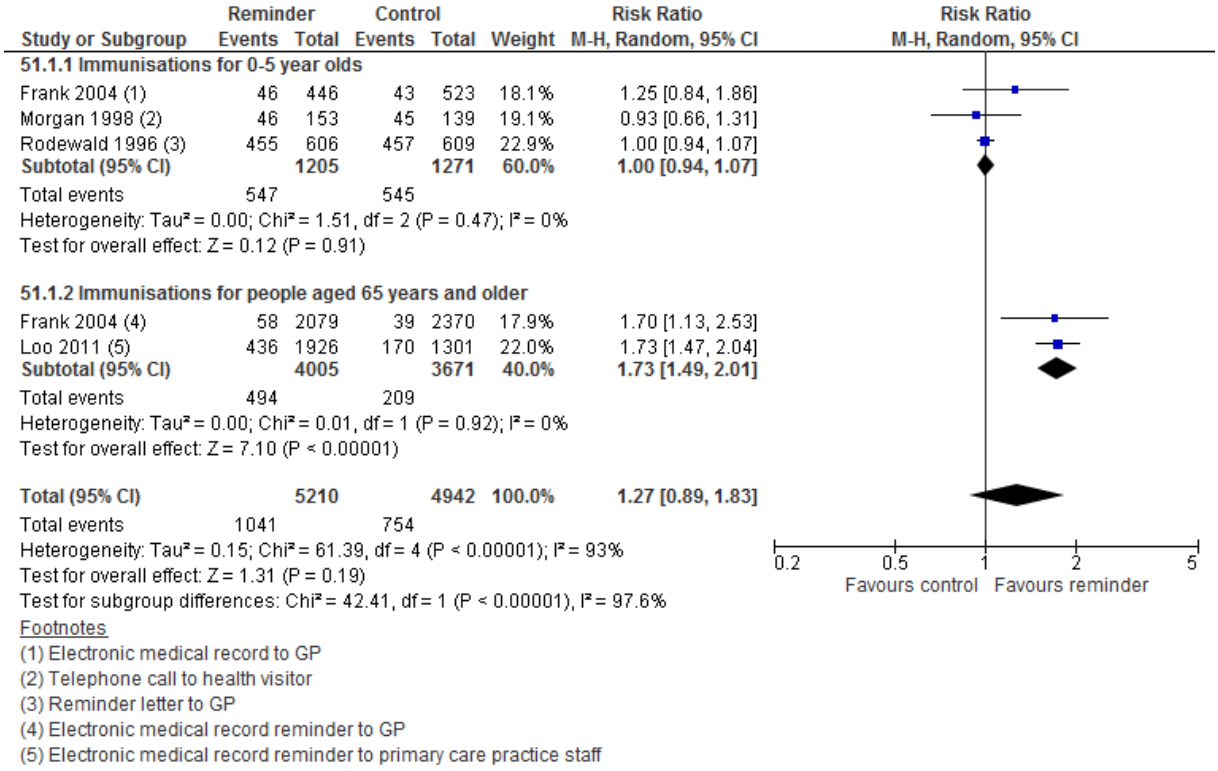


Footnotes

1) This part of Kemp 2015 was a cluster RCT. The data was not adjusted for clustering. Centrally organised reminders by mail or autodialer and mail (1 letter and 3 postcards or 2 telephone calls and 2 postcards) versus primary care practice webinar training on vaccination reminder.

Reminders interventions aimed at providers to increase vaccine uptake

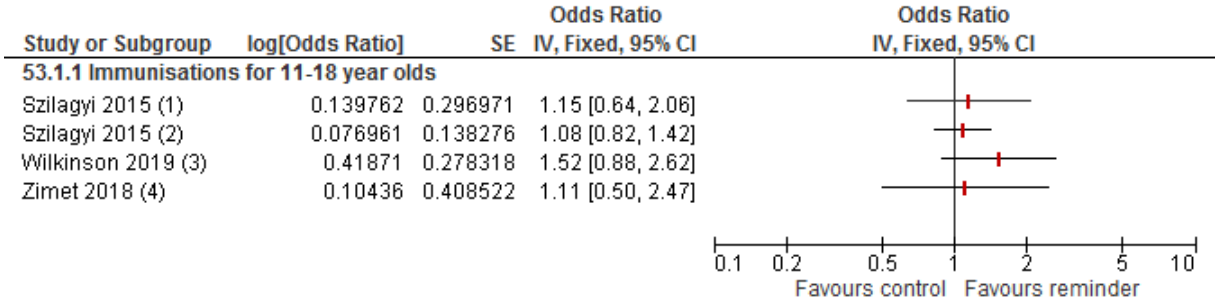
Provider reminders (summary) reminder versus control (all were reminders to primary care staff)



Footnotes

(1) Electronic medical record to GP
(2) Telephone call to health visitor
(3) Reminder letter to GP
(4) Electronic medical record reminder to GP
(5) Electronic medical record reminder to primary care practice staff

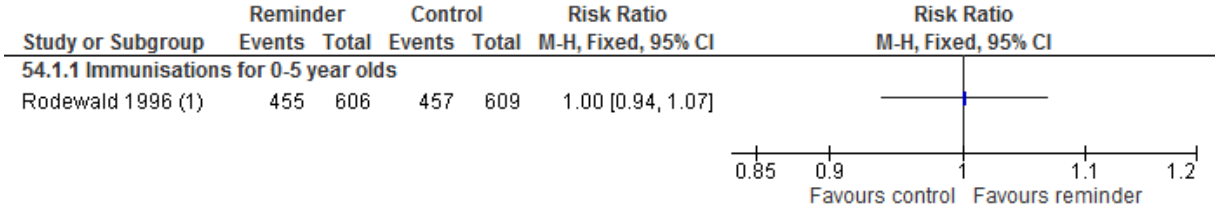
CLUSTER RCTs: Provider reminders: (summary) reminder versus control



Footnotes

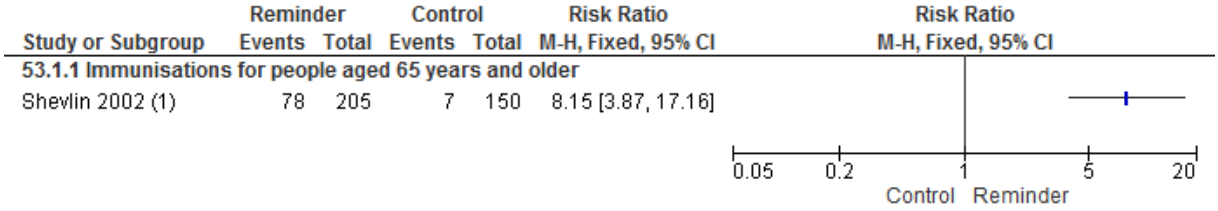
(1) cRCT. Data was adjusted by the investigators for clustering. GR-PBRN study. MCV4 data.
(2) cRCT. Data was adjusted by the investigators for clustering. CORNET study. MCV4 data.
(3) cRCT. Data was adjusted by the investigators for clustering.
(4) cRCT. Data was adjusted by the investigators for clustering. HPV dose 1.

Provider reminders: letter to GP versus control



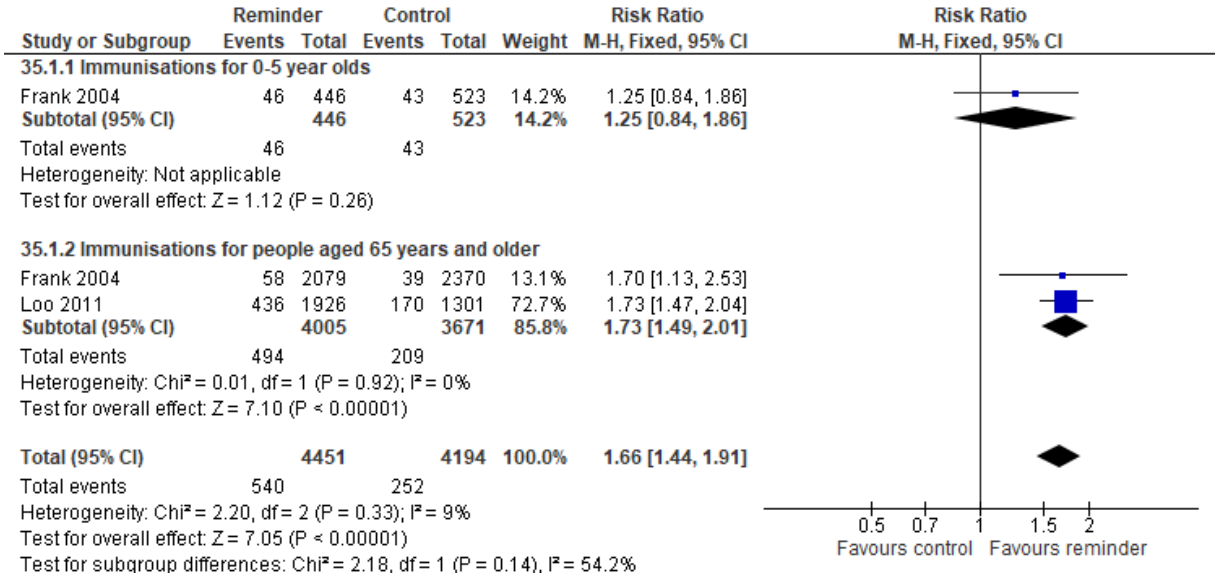
Footnotes
(1) Reminder letter to GP from emergency department

CLUSTER RCTs: Provider reminder: nurses assessing and reminding physicians versus control

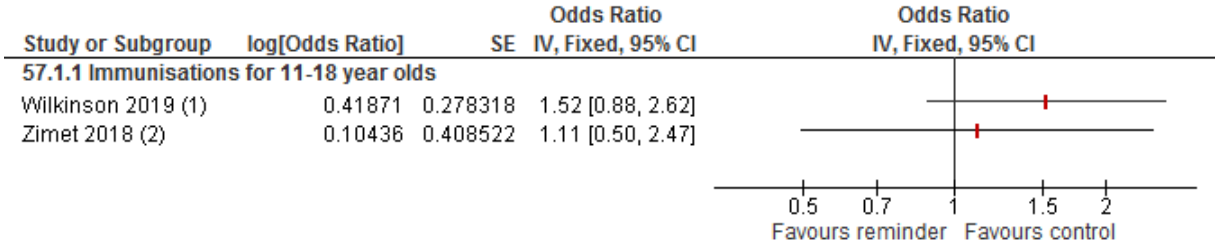


Footnotes
(1) cRCT. Data was not adjusted for clustering.

Provider reminders: electronic medical record versus control

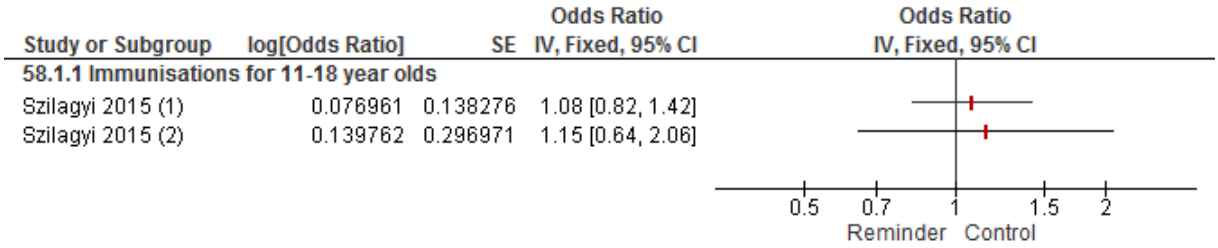


CLUSTER RCTs: Provider reminder: electronic reminder versus control



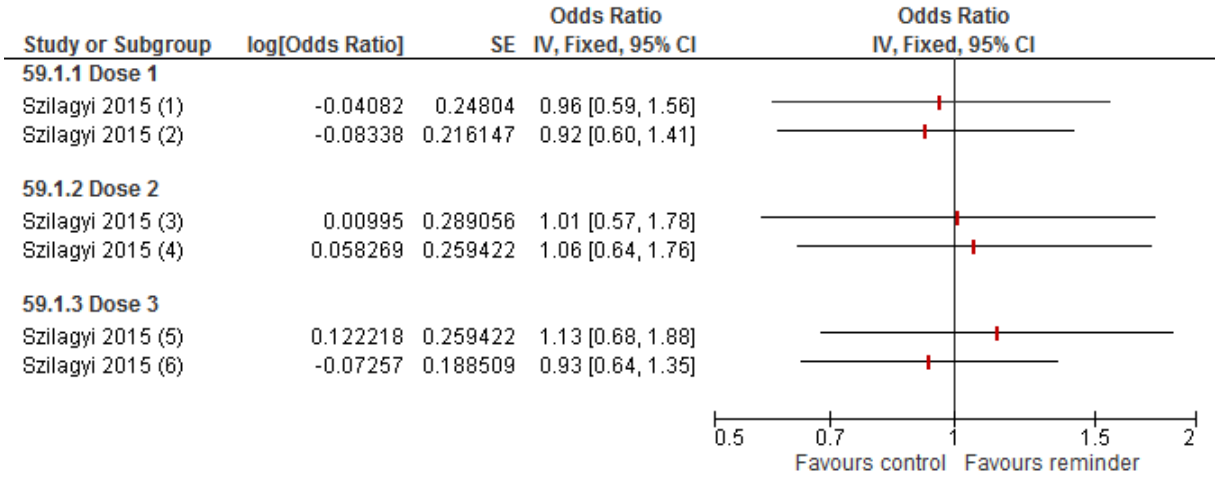
Footnotes
(1) cRCT. Data was adjusted by the investigators for clustering.
(2) cRCT. Data was adjusted by the investigators for clustering. HPV dose 1.

CLUSTER RCTs: Provider reminder: computer or paper reminder versus control, MCV4



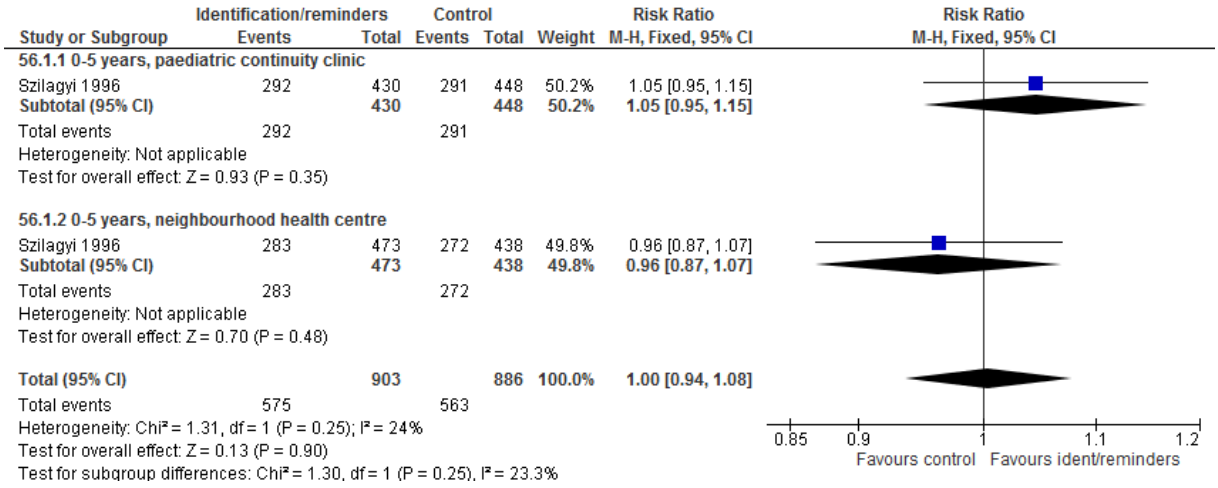
Footnotes
(1) cRCT. Data was adjusted by the investigators for clustering. CORNET study. MCV4 data.
(2) cRCT. Data was adjusted by the investigators for clustering. GR-PBRN study. MCV4 data

CLUSTER RCTs: Provider reminders: computer or paper reminder versus control, HPV doses



Footnotes
(1) cRCT. Data was adjusted by the investigators for clustering. CORNET study
(2) cRCT. Data was adjusted by the investigators for clustering. GR-PBRN study
(3) cRCT. Data was adjusted by the investigators for clustering. GR-PBRN study
(4) cRCT. Data was adjusted by the investigators for clustering. CORNET study
(5) cRCT. Data was adjusted by the investigators for clustering. CORNET study
(6) cRCT. Data was adjusted by the investigators for clustering. GR-PBRN study

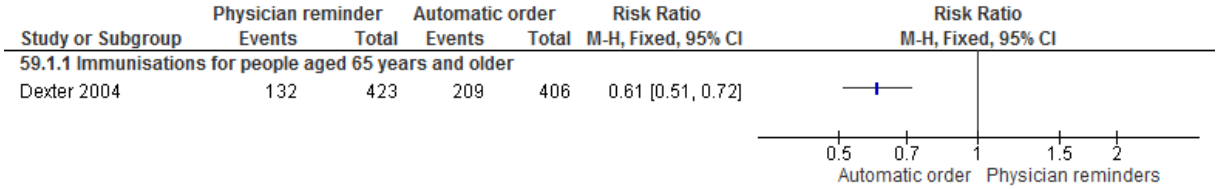
Provider identification and reminders versus control



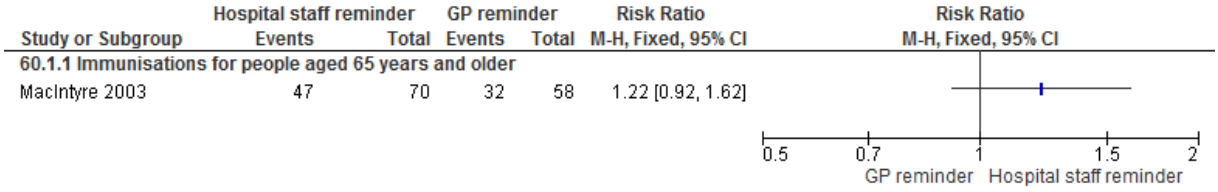
Footnote

This data can be pooled because each intervention arm had a separate control arm.

Provider reminders: physician reminders versus automatic vaccine order (by nurses)

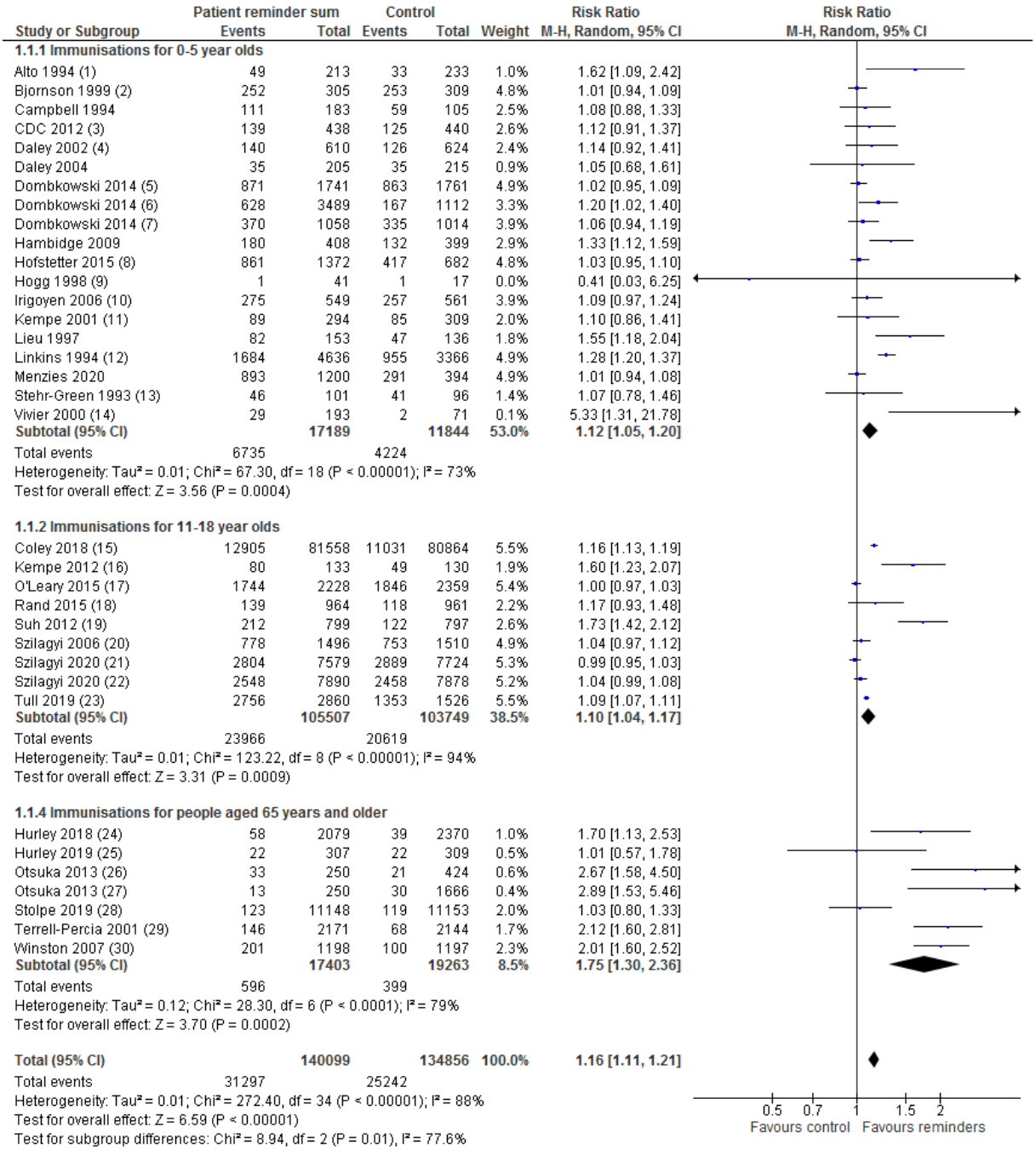


Provider reminders: hospital staff reminder versus GP reminder



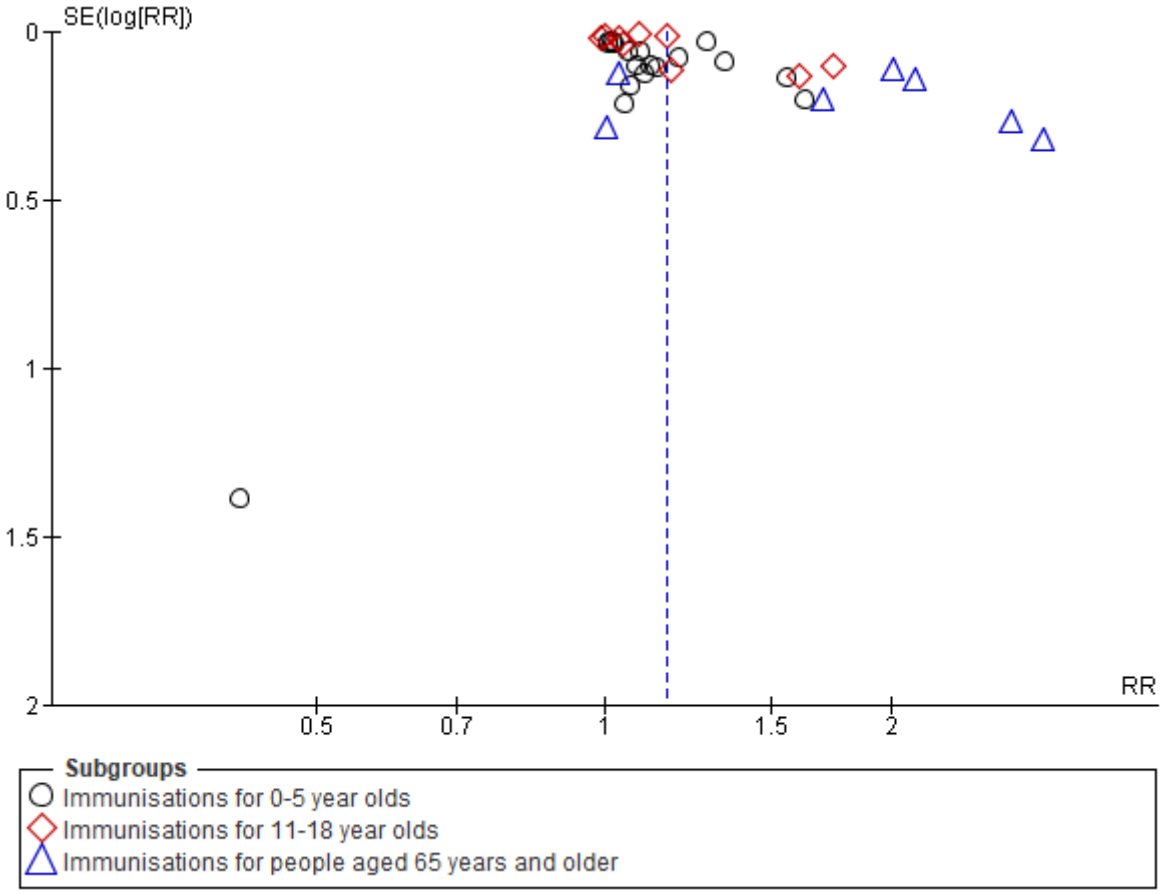
Sensitivity analyses

Patient reminders (summary) reminder versus control

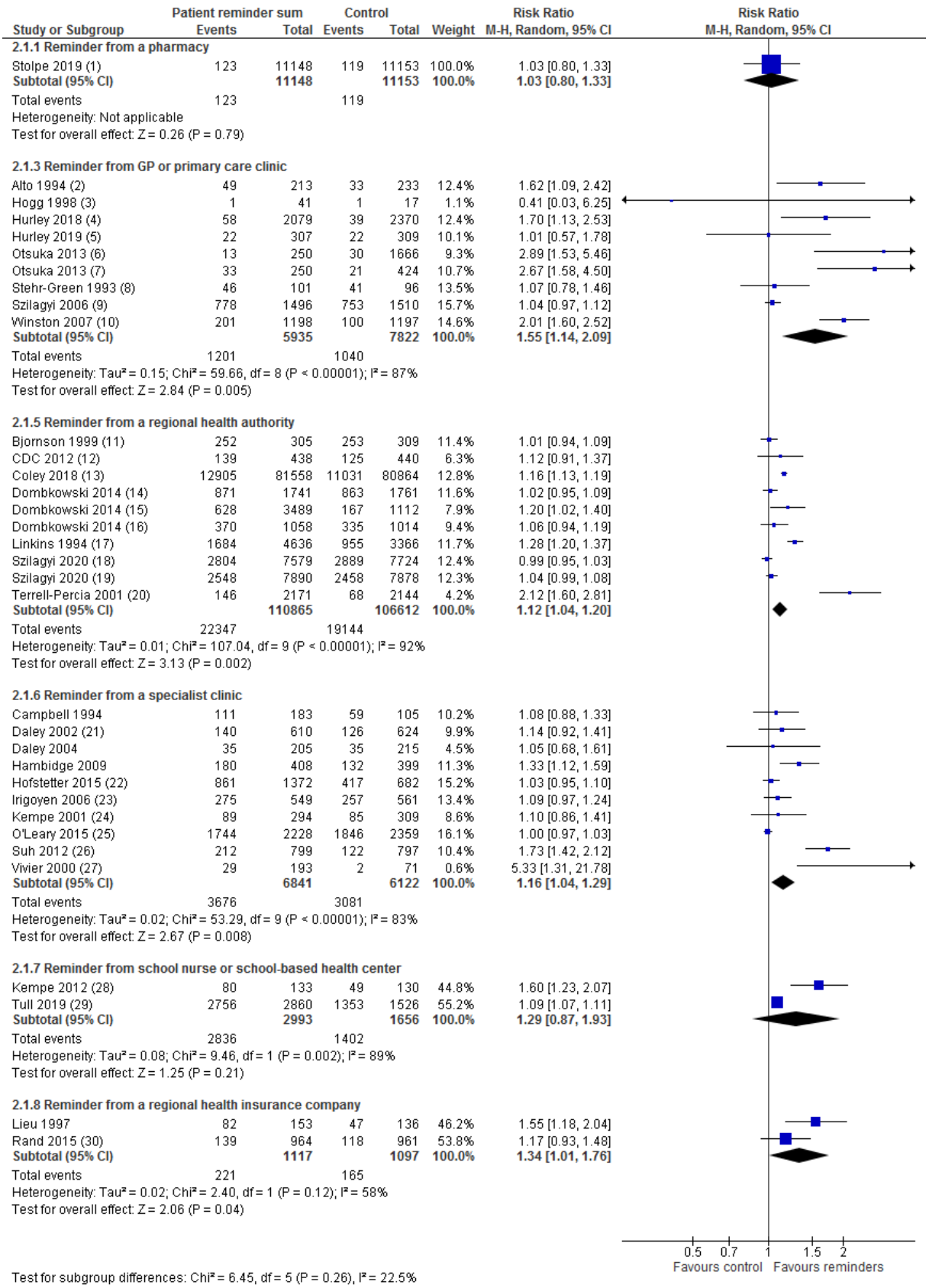


Footnotes
(1) Postcard then letter if needed
(2) Postcard
(3) Letter
(4) PCV (pneumonococcal conjugate vaccine) specific study
(5) 12 month reminder
(6) 19 month recall
(7) 7 month recall
(8) The 1 text message and 2-4 text message arms were merged
(9) Hib vaccine data. MMR data not included to avoid double-counting. 2 arms combined: customised and non-customised reminder letters.
(10) Continuous reminder arm at 6 months (from Cochrane review)
(11) Postcard and up to 4 telephone calls
(12) Telephone
(13) Telephone
(14) Reminder interventions pooled by Cochrane review authors
(15) Postcard
(16) 1 or 2 reminders via written message or call to classroom or escort from class
(17) Text message. HPV 1st dose
(18) Hpv specific study; data obtained by Jacobson Vann 2018 Cochrane review authors from study authors
(19) HPV 1st dose. Up to 2 letters separated by 2 autodialer telephone calls.
(20) Data for Td (Tetanus, Diphtheria) vaccination only
(21) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. Colorado data
(22) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. New York data
(23) Data for the arms for motivational text messages and self-regulatory text messages were merged
(24) 2x autodialer + postcard
(25) Up to 2 telephone call reminders and then a postcard
(26) Electronic message to patient sent using patient's electronic medical record
(27) Letter. This population and intervention is different to the other Otsuka 2013 data
(28) Autodialer reminder from pharmacy. Pneumococcal vaccine. Shingles data not included to prevent double counting.
(29) Letter reminder from regional health authority. Pneumococcal vaccine.
(30) Telephone reminder; pneumonococcal vaccination; data extracted for over 65 year olds only

Funnel plot for patient reminders (summary) reminder versus control



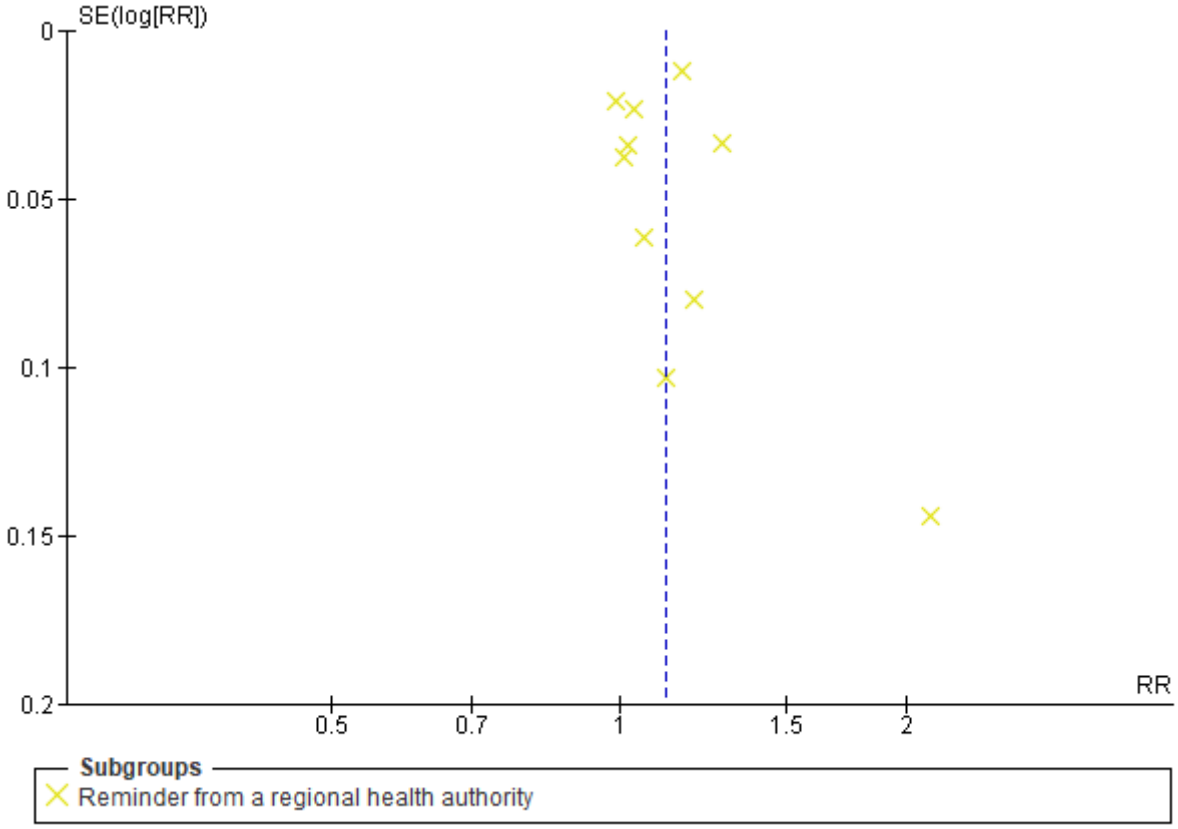
1 Patient reminders: who it was sent by: reminder versus control



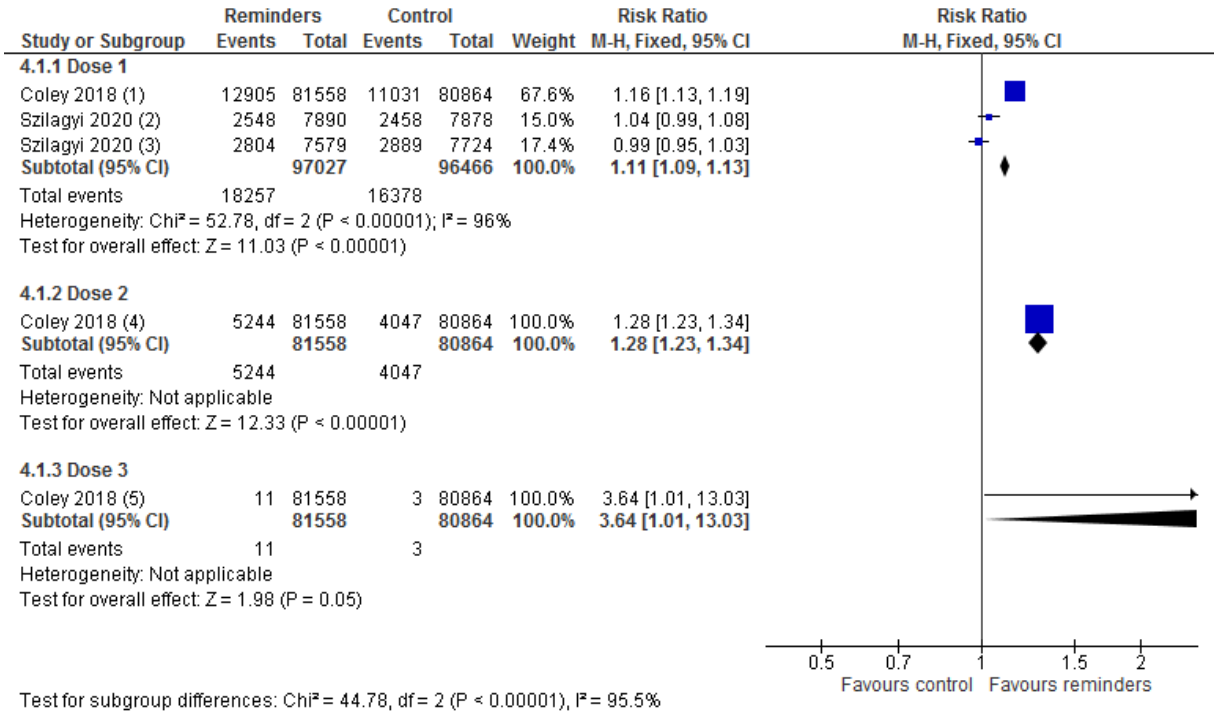
2 Test for subgroup differences: Chi² = 6.45, df = 5 (P = 0.26), I² = 22.5%

Footnotes
(1) Autodialer reminder from pharmacy. Pneumococcal vaccine. Shingles data not included to prevent double counting.
(2) Postcard then letter if needed
(3) Hib vaccine data. MMR data not included to avoid double-counting. 2 arms combined: customised and non-customised reminder letters.
(4) 2x autodialer + postcard
(5) Up to 2 telephone call reminders and then a postcard
(6) Letter. This population and intervention is different to the other Otsuka 2013 data
(7) Electronic message to patient sent using patient's electronic medical record
(8) Telephone
(9) Data for Td (Tetanus, Diphtheria) vaccination only
(10) Telephone reminder; pneumonococcal vaccination; data extracted for over 65 year olds only
(11) Postcard
(12) Letter
(13) Postcard
(14) 12 month reminder
(15) 19 month recall
(16) 7 month recall
(17) Telephone
(18) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. Colorado data
(19) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. New York data
(20) Letter reminder from regional health authority. Pneumococcal vaccine.
(21) PCV (pneumonococcal conjugate vaccine) specific study
(22) The 1 text message and 2-4 text message arms were merged
(23) Continuous reminder arm at 6 months (from Cochrane review)
(24) Postcard and up to 4 telephone calls
(25) Text message. HPV 1st dose
(26) HPV 1st dose. Up to 2 letters separated by 2 autodialer telephone calls.
(27) Reminder interventions pooled by Cochrane review authors
(28) 1 or 2 reminders via written message or call to classroom or escort from class
(29) Data for the arms for motivational text messages and self-regulatory text messages were merged
(30) Hpv specific study; data obtained by Jacobson Vann 2018 Cochrane review authors from study authors

Funnel plot for patient reminders: who it was sent by: reminder versus control (reminder from a regional health authority)



Patient reminders: (summary for HPV doses) reminder versus control

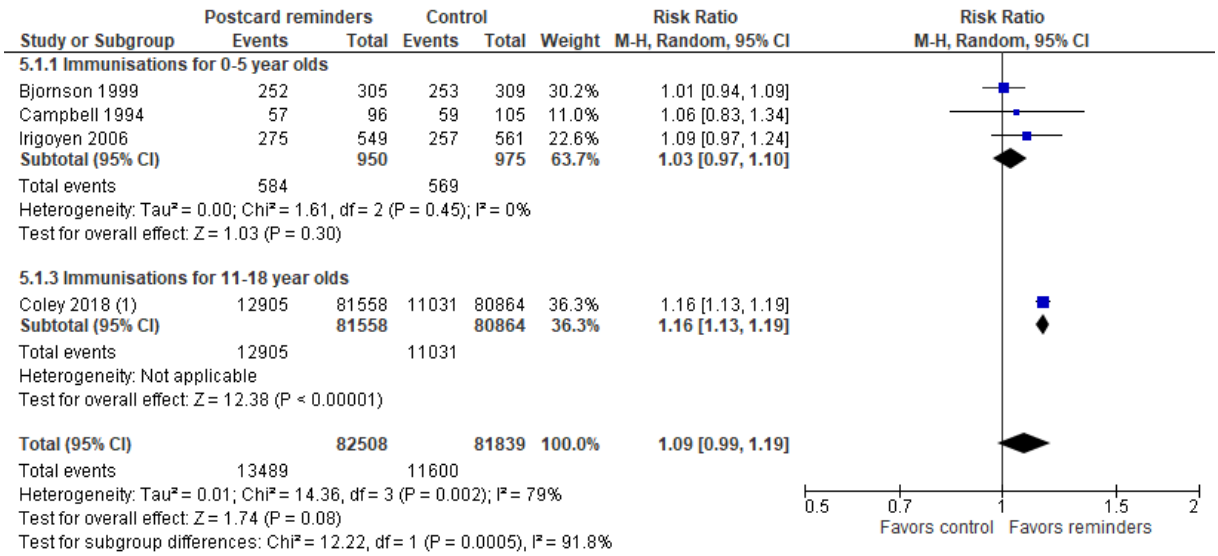


Test for subgroup differences: Chi² = 44.78, df = 2 (P < 0.00001), I² = 95.5%

Footnotes

1) Postcard
2) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. We could not use the 2nd/3rd dose data because they were merged. New York data.
3) HPV dose 1. 3 autodialer reminders. Unadjusted data used because it is almost identical to the adjusted data. We could not use the 2nd/3rd dose data because they were merged. Colorado data.
4) Postcard
5) Reminder letter

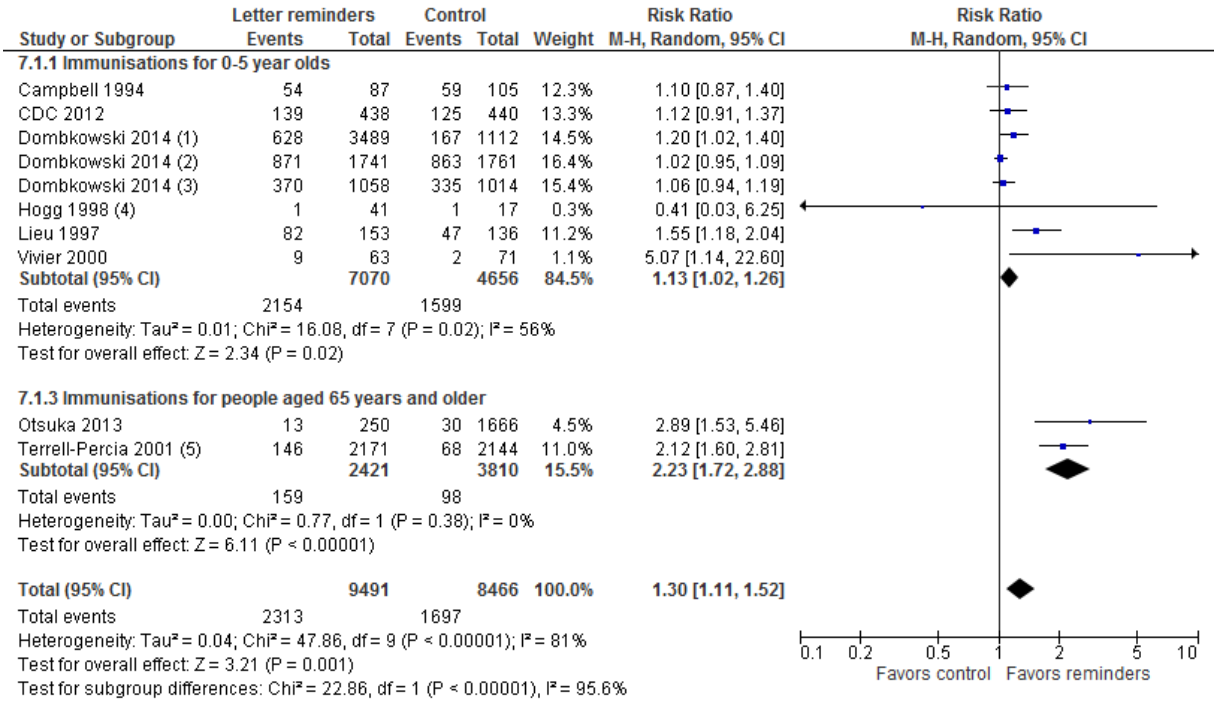
Patient reminders: postcard versus control



Footnotes

(1) Postcard

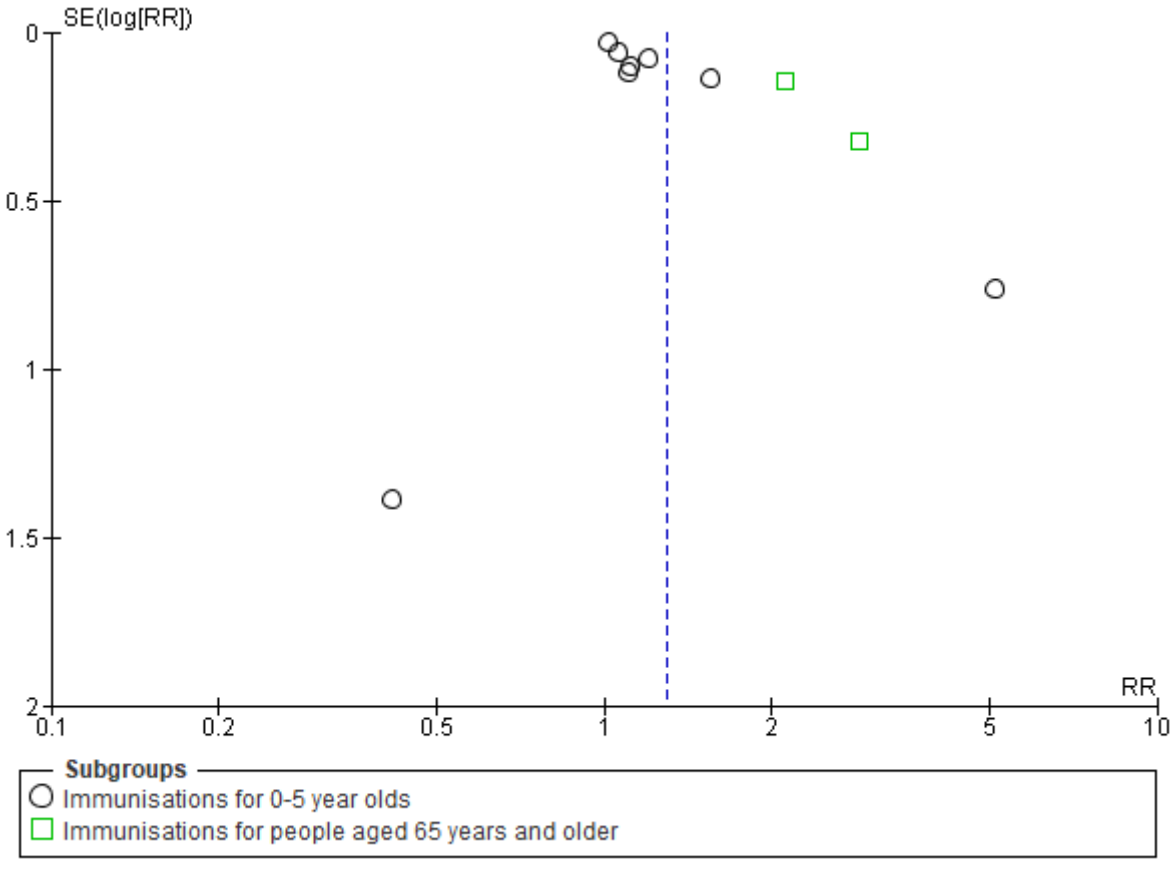
Patient reminders: letter versus control



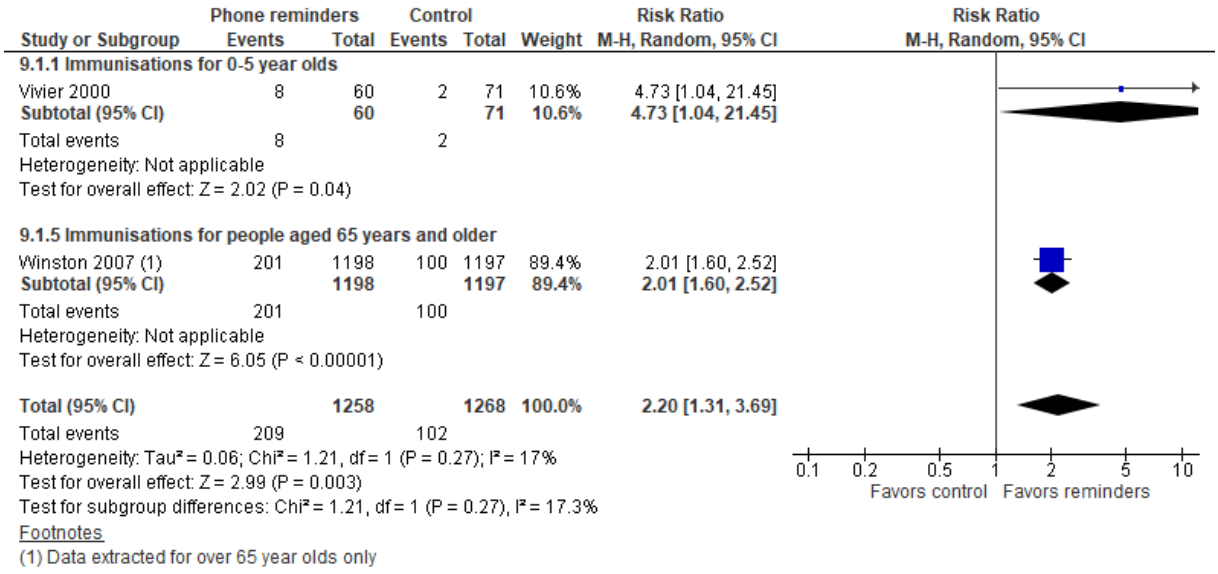
Footnotes

(1) 19 month recall
(2) 12 month reminder
(3) 7 month recall
(4) Hib vaccine data. MMR data not included to avoid double-counting. 2 arms combined: customised and non-customised reminder letters.
(5) Letter reminder from regional health authority. Pneumococcal vaccine.

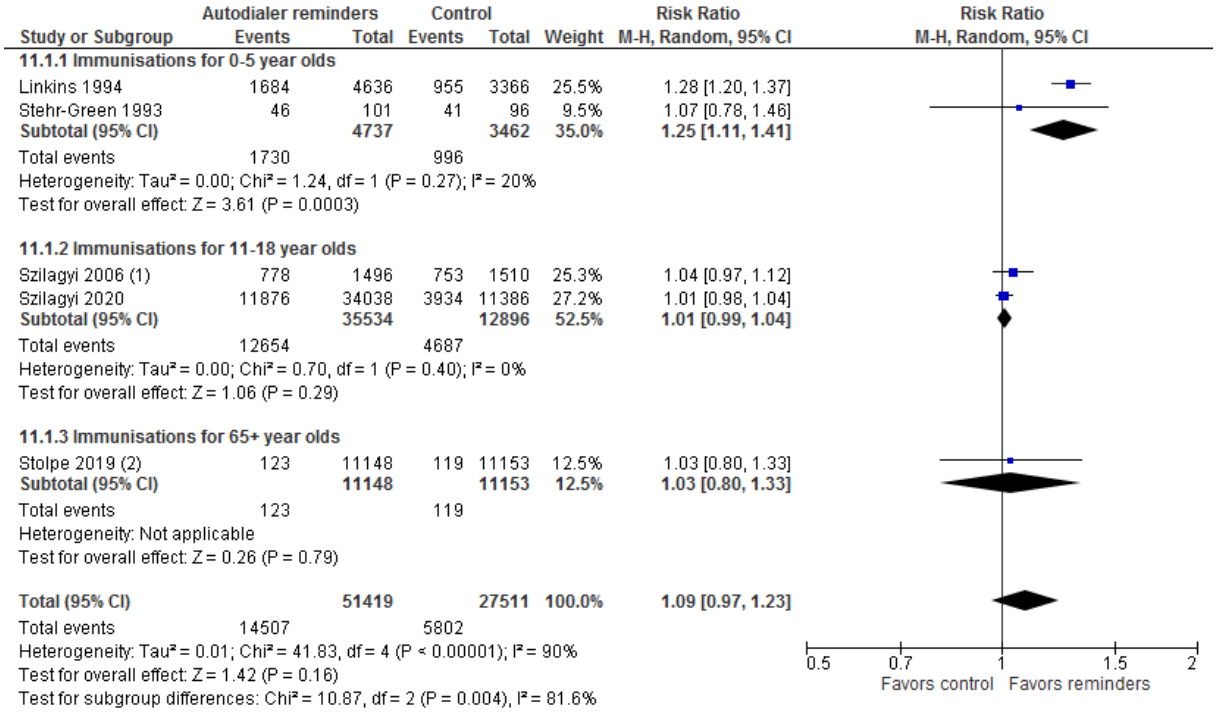
Funnel plot for patient reminders: letter versus control



Patient reminders: telephone versus control



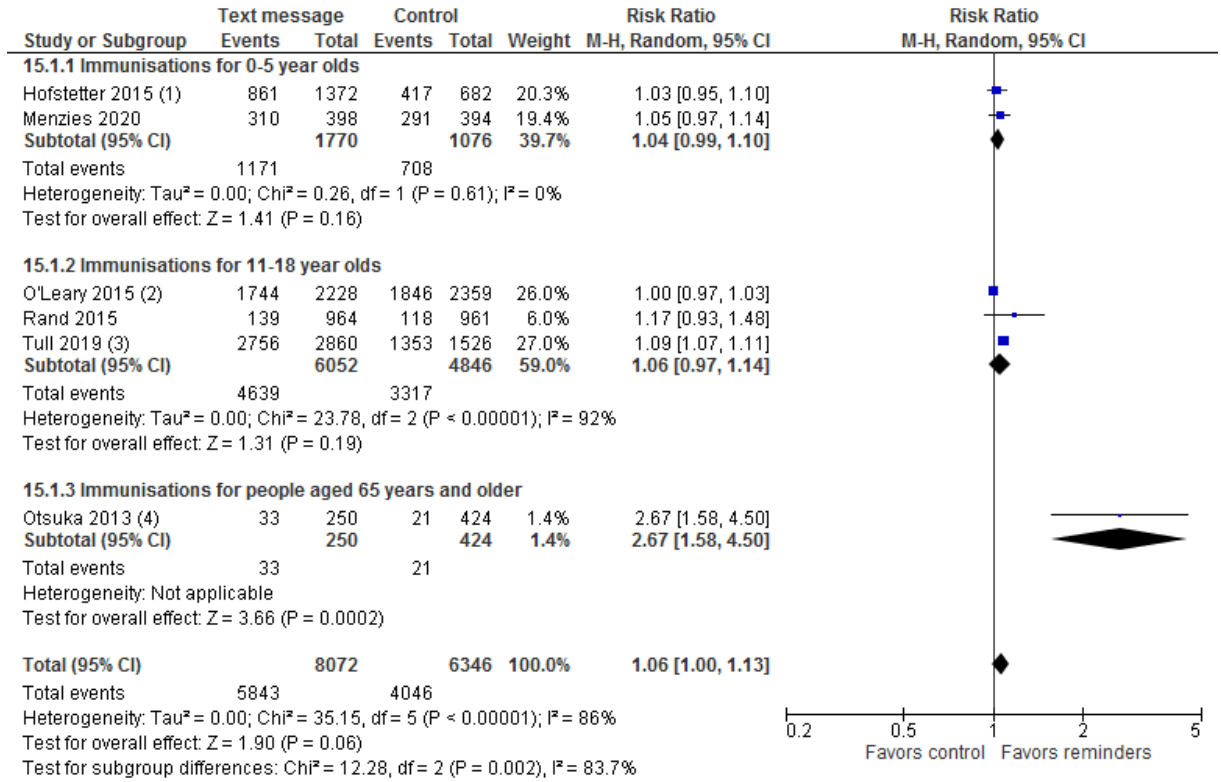
Patient reminders: autodialer versus control



Footnotes

1) Data for Td (Tetanus, Diphtheria) vaccination only.
2) Autodialer reminder from a pharmacy. Pneumococcal vaccine uptake. Data for shingles was not included on this meta-analysis to prevent double counting.

Patient reminders: text or 'electronic' message versus control



Footnotes

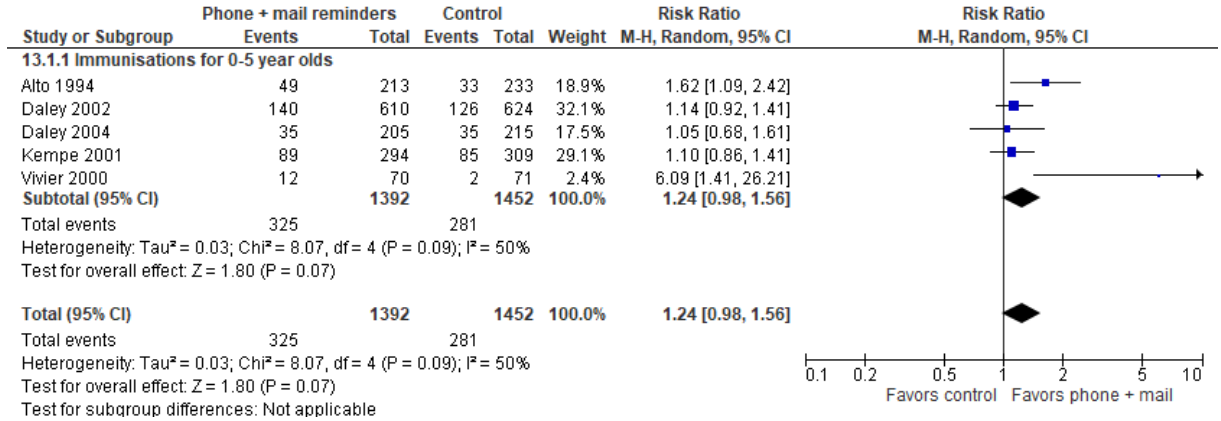
(1) The 1 text message and 2-4 text message arms were merged

(2) Text message. HPV 1st dose

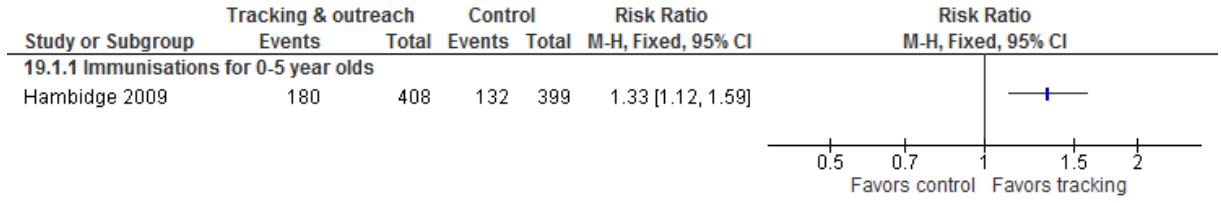
(3) Data for the arms for motivational text messages and self-regulatory text messages were merged

(4) Electronic message to patient sent using patient's electronic medical record

Patient reminders: telephone + mail versus control

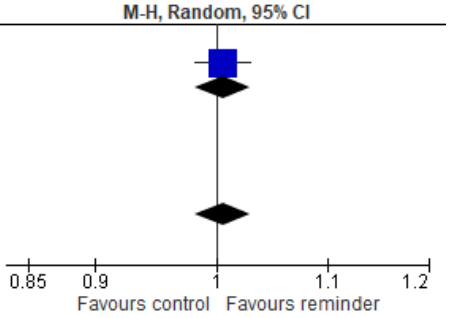


Patient reminders: outreach reminder versus control



Provider reminders (summary) reminder versus control

Study or Subgroup	Reminder Events	Reminder Total	Control Events	Control Total	Weight	Risk Ratio M-H, Random, 95% CI
39.1.1 Immunisations for 0-5 year olds						
Rodewald 1996 (1)	581	606	581	609	100.0%	1.00 [0.98, 1.03]
Subtotal (95% CI)		**606**		**609**	**100.0%**	**1.00 [0.98, 1.03]**
Total events	581		581			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.40 (P = 0.69)						
Total (95% CI)		**606**		**609**	**100.0%**	**1.00 [0.98, 1.03]**
Total events	581		581			
Heterogeneity: Not applicable						
Test for overall effect: Z = 0.40 (P = 0.69)						
Test for subgroup differences: Not applicable						



Footnotes

(1) Reminder letter to GP

Appendix F – GRADE tables

Reminders Interventions- uptake outcome

Reminders interventions aimed at individuals or parents/carers to increase vaccine uptake compared to control

Table 13 GRADE table for reminders interventions compared to control

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Patient reminders (summary) reminder versus control (RR >1 favours reminder) **Pooled result**										
44 (See the 3 subgroups below)	RCT	292169	RR 1.17 (1.12, 1.22)	19 per 100	23 per 100 (22, 24)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
0-5 year olds										
24[a]	RCT	33222	RR 1.14 (1.07, 1.21)	36 per 100	41 per 100 (39, 44)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
11-18 year olds										
12[b]	RCT	222210	RR 1.14 (1.07, 1.20)	21 per 100	23 per 100 (22, 25)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
65 and over										
8[c]	RCT	36737	RR 1.64 (1.25, 2.17)	2 per 100	4 per 100 (3, 5)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
Patient reminders: who it was sent by: reminder versus control (RR >1 favours reminder) (same studies as previous meta-analysis)										
Reminder from a pharmacy (RR >1 favours reminder)										
2 (Klassing 2018,	RCT	22372	RR 1.08 (0.90, 1.29)	1 per 100	1 per 100 (1, 2)	Very serious[2]	Serious[7]	Not serious	Serious[4]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Stolpe 2019)										
Reminder from GP or primary care clinic (RR >1 favours reminder)										
11[d]	RCT	14506	RR 1.50 (1.19, 1.89)	14 per 100	21 per 100 (17, 27)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
Reminder from a regional health authority (RR >1 favours reminder)										
14[e]	RCT	221563	RR 1.12 (1.05, 1.19)	18 per 100	20 per 100 (19, 22)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
Reminder from a specialist clinic (RR >1 favours reminder)										
10[f]	RCT	12963	RR 1.16 (1.04, 1.29)	50 per 100	58 per 100 (52, 65)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
Reminder from school nurse or school-based health centre (RR >1 favours reminder)										
3 (Ferson 1995, Kempe 2012, Tull 2019)	RCT	4752	RR 1.45 (0.97, 2.17)	83 per 100	121 per 100 (81, 180)	Not serious	Not serious	Very serious[3]	Serious[4]	Very low
Reminder from a regional health insurance company (RR >1 favours reminder)										
3 (Chao 2015, Lieu 1997, Rand 2015)	RCT	14419	RR 1.25 (1.11, 1.40)	37 per 100	46 per 100 (41, 52)	Very serious[2]	Not serious	Serious[4]	Not serious	Very low
CLUSTER RCTs: Patient reminders: (summary) reminder versus control (RR >1 favours reminder)										
0-5 year olds										
1 (Dini 2000)[h]	Cluster RCT	1838	RR 1.20 (1.07, 1.35)	41 per 100	49 per 100 (44, 55)	Very serious[13]	Not serious	N/A[16]	Not serious	Low
1 (Franzini 2000)[h]	Cluster RCT	1138	RR 1.30 (1.20, 1.40)	64 per 100	83 per 100 (76, 89)	Serious[14]	Not serious	N/A[16]	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
1 (Rodewald 1999)[h]	Cluster RCT	2741	RR 1.19 (1.14, 1.25)	74 per 100	88 per 100 (84, 92)	Not serious	Not serious	N/A[16]	Not serious	High
11-18 year olds										
1 (Szilagyi 2011)[h]	Cluster RCT	7546	RR 1.35 (1.21, 1.51)	12 per 100	16 per 100 (15, 18)	Serious[14]	Not serious	N/A[16]	NNot serious	Moderate
1 (Szilagyi 2013)[h]	Cluster RCT	4115	RR 1.04 (0.96, 1.14)	36 per 100	37 per 100 (35, 41)	Serious[14]	Not serious	N/A[16]	Serious[4]	Low
Patient reminders: (summary for HPV doses) reminder versus control (RR >1 favours reminder)										
Dose 1										
7 (Coley 2018, O'Leary 2015, Rand 2017 (2 comparisons), Suh 2012, Szilagyi 2020 (2 comparisons))	RCT	194242	RR 1.10 (1.08, 1.12)	18 per 100	20 per 100 (20, 21)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
Dose 2										
5 (Chao 2015, Coley 2018, O'Leary 2015, Rand 2017 (2	RCT	170780	RR 1.24 (1.2, 1.28)	6 per 100	7 per 100 (7, 8)	Very serious[2]	Not serious	Very serious[3]	Serious[5]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
comparisons))										
Dose 3										
5 (Chao 2015, Coley 2018, O'Leary 2015, Rand 2017 (2 comparisons))	RCT	170780	RR 1.35 (1.24, 1.47)	1 per 100	1 per 100 (1, 1)	Very serious[2]	Not serious	Serious[4]	Not serious	Very low
Patient reminders: postcard versus control (RR >1 favours reminder)										
Pooled result										
5 (See subgroups below)	RCT	164,520	RR 1.14 (1.02, 1.28)	14 per 100	16 per 100 (14, 18)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
0-5 year olds										
4 (Bjornson 1999, Campbell 1994, Irigoyen 2000, Tollestrup 1997))	RCT	2,098	RR 1.18 (0.97, 1.43)	56 per 100	66 per 100 (54, 80)	Serious[1]	Not serious	Very serious[3]	Serious[5]	Very low
11-18 year olds										
1 (Coley 2018)	RCT	162,422	RR 1.16 (1.13, 1.19)	14 per 100	16 per 100 (15, 16)	Not serious	Not serious	N/A[16]	Not serious	High
CLUSTER RCTs: Patient reminders: postcard versus control (RR >1 favours reminder)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
0-5 year olds										
1 (Franzini 2000)[h]	Cluster RCT	824	RR 1.25 (1.15, 1.37)	64 per 100	80 per 100 (73, 87)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
Patient reminders: letter versus control (RR >1 favours reminder)										
Pooled result										
12 (See subgroups below)	RCT	24982	RR 1.24 (1.10, 1.39)	25 per 100	31 per 100 (27, 35)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
0-5 year olds										
8 (Campbell 1994, CDC 2012, Dombkowski 2014 (3 comparisons), Lieu 1997, Vivier 2000)	RCT	11726	RR 1.13 (1.02, 1.26)	53 per 100	60 per 100 (54, 67)	Serious[1]	Not serious	Serious[4]	Not serious	Low
11-18 year olds										
1 (Chao 2015)	RCT	6981	RR 1.24 (1.17, 1.30)	54 per 100	66 per 100 (63, 70)	Very serious[13]	Not serious	N/A[16]	Not serious	Low
65 and over										
3 (Klassing 2018, Otsuka 2013,	RCT	6275	RR 1.72 (0.87, 3.41)	3 per 100	5 per 100 (3, 11)	Serious[1]	Not serious	Very serious[3]	Serious[5]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Terrell-Perica 2001)										
CLUSTER RCTs: Patient reminders: letter versus control (RR >1 favours reminder)										
0-5 year olds										
1 (Dini 2000)[h]	Cluster RCT	969	RR 1.18 (1.02, 1.36)	41 per 100	48 per 100 (42, 56)	Very serious[13]	Not serious	N/A[16]	Not serious	Low
11-18 year olds, MCV4										
1 (Szilagyi 2013)[h]	Cluster RCT	2692	RR 1.05 (1.01, 1.10)	73 per 100	76 per 100 (73, 80)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
11-18 year olds, HPV dose 1										
1 (Szilagyi 2013)[h]	Cluster RCT	2692	RR 1.04 (0.94, 1.15)	36 per 100	37 per 100 (34, 41)	Serious[14]	Not serious	N/A[16]	Serious[5]	Low
11-18 year olds, HPV dose 2										
1 (Szilagyi 2013)[h]	Cluster RCT	2692	RR 1.06 (0.95, 1.19)	30 per 100	32 per 100 (29, 36)	Serious[14]	Not serious	N/A[16]	Serious[5]	Low
11-18 year olds, HPV dose 3										
1 (Szilagyi 2013)[h]	Cluster RCT	2692	RR 1.07 (0.99, 1.16)	47 per 100	50 per 100 (47, 55)	Serious[14]	Not serious	N/A[16]	Serious[5]	Low
CLUSTER RCT: Patient reminders: customised or not customised letter reminders versus control (RR >1 favours reminder)										
0-5 year olds, customised reminders, MMR										
1 (Hogg 1998)	RCT	45	Not estimable[8]	N/A[8]	N/A[8]	Serious[14]	Not serious	N/A[16]	N/A[8]	Moderate
0-5 year olds, customised reminders, Hib										
1 (Hogg 1998)	RCT	33	RR 1.06 (0.07, 15.60)	6 per 100	6 per 100 (0, 92)	Serious[14]	Not serious	N/A[16]	Very serious[6]	Very low
0-5 year olds, not customised reminders, MMR										

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 (Hogg 1998)	RCT	61	Not estimable[8]	N/A[8]	N/A[8]	Serious[14]	Not serious	N/A[16]	N/A[8]	Moderate
0-5 year olds, not customised reminders, Hib										
1 (Hogg 1998)	RCT	42	RR 0.23 (0.01, 5.35)	6 per 100	1 per 100 (0, 31)	Serious[14]	Not serious	N/A[16]	Serious[5]	Low
Patient reminders: telephone versus control (RR >1 favours reminder) **Pooled result**										
4 (See subgroups below)	RCT	2686	RR 1.78 (1.22, 2.61)	11 per 100	19 per 100 (12, 28)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
0-5 year olds										
2 (Ferson 1995, Vivier 2000)	RCT	234	RR 2.27 (1.12, 4.63)	18 per 100	40 per 100 (20, 81)	Serious[1]	Not serious	Not serious	Not serious	Moderate
65 and over										
2 (Klassing 2018, Winston 2007)	RCT	2452	RR 1.59 (0.93, 2.75)	10 per 100	16 per 100 (9, 27)	Serious[1]	Not serious	Very serious[3]	Serious[5]	Very low
Patient reminders: autodialer versus control (RR >1 favours reminder) **Pooled result**										
6 (See subgroups below)	RCT	79288	RR 1.10 (0.99, 1.23)	21 per 100	23 per 100 (21, 26)	Serious[1]	Not serious	Very serious[3]	Serious[5]	Very low
0-5 year olds										
2 (Linkins 1994, Stehr-	RCT	8199	RR 1.25 (1.11, 1.41)	29 per 100	36 per 100 (32, 41)	Serious[1]	Not serious	Not serious	Not serious	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Green 1993)										
11-18 year olds										
3 (Rand 2017, Szilagyi 2006, Szilagyi 2020)	RCT	48788	RR 1.03 (0.98, 1.07)	36 per 100	37 per 100 (36, 39)	Serious[1]	Not serious	Not serious	Serious[5]	Low
65 and over										
1 (Stolpe 2019)	RCT	22301	RR 1.03 (0.80, 1.33)	1 per 100	1 per 100 (1, 1)	Serious[14]	Serious[15]	N/A[16]	Serious[5]	Very low
Patient reminders: 1 to 3 autodialer versus control (RR >1 favours reminder)										
HPV dose 1, 1 reminder versus control										
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.06 (1.03, 1.08)	Not calculable[9]	Not calculable[9]	Serious[1]	Not serious	Very serious[10]	Not serious	Very low
HPV dose 1, 2 reminders versus control										
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.01 (0.98, 1.03)	Not calculable[9]	Not calculable[9]	Serious[1]	Not serious	Not serious[12]	Serious[5]	Low
HPV dose 1, 3 reminders versus control										
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.03 (1.01, 1.06)	Not calculable[9]	Not calculable[9]	Serious[1]	Not serious	Serious[11]	Not serious	Low
HPV dose 3, 1 reminder versus 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
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.02 (1.00, 1.04)	Not calculable[9]	Not calculable[9]	Serious[1]	Not serious	Not serious[12]	Serious[5]	Low
HPV dose 3, 2 reminder versus control										
2 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.02, (1.00, 1.04)	Not calculable[9]	Not calculable[9]	Serious[1]	Not serious	Not serious[12]	Not serious	Moderate
HPV dose 3, 3 reminder versus control										
1 (Szilagyi 2020 (2 comparisons))	RCT	62118	RR 1.02 (1.00, 1.05)	Not calculable[9]	Not calculable[9]	Serious[1]	Not serious	Serious[11]	Not serious	Low
Patient reminders: autodialer versus control (shingles vaccine) (RR >1 favours reminder)										
65 and over										
1 (Stolpe 2019)	RCT	22301	RR 0.92 (0.69, 1.22)	1 per 100	1 per 100 (1, 1)	Serious[14]	Serious[15]	N/A[16]	Serious[5]	Very low
CLUSTER RCTs: Patient reminders: autodialer versus control (RR >1 favours reminder)										
0-5 year olds										
1 (Dini 2000)[h]	Cluster RCT	961	RR 1.21 (1.05, 1.39)	41 per 100	49 per 100 (43, 57)	Very serious[13]	Not serious	N/A[16]	Not serious	Low
1 (Franzini 2000)[h]	Cluster RCT	743	RR 1.35 (1.24, 1.47)	64 per 100	86 per 100 (79, 94)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
11-18 year olds, MCV4										
1 (Szilagyi 2013)[h]	Cluster RCT	2719	RR 1.01 (0.96, 1.05)	73 per 100	73 per 100 (70, 76)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
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 (Szilagyi 2013)[h]	Cluster RCT	2719	RR 1.05 (0.95, 1.16)	36 per 100	38 per 100 (34, 42)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
11-18 year olds, HPV dose 2										
1 (Szilagyi 2013)[h]	Cluster RCT	2719	RR 1.06 (0.94, 1.18)	30 per 100	32 per 100 (29, 36)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
11-18 year olds, HPV dose 3										
1 (Szilagyi 2013)[h]	Cluster RCT	2719	RR 1.08 (0.94, 1.23)	22 per 100	24 per 100 (21, 27)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
65 and over										
1 (Hess 2013)[h]	Cluster RCT	11982	RR 3.62 (2.60, 5.03)	1 per 100	3 per 100 (2, 4)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
Patient reminders: text or 'electronic' message versus control (RR >1 favours reminder)										
7 (See subgroups below)	RCT	14809	RR 1.09 (1.02, 1.17)	63 per 100	68 per 100 (64, 73)	Not serious	Not serious	Very serious[3]	Not serious	Low
0-5 year olds										
2 (Hofstetter 2015, Menzies 2020)	RCT	2846	RR 1.04 (0.99, 1.10)	66 per 100	68 per 100 (65, 72)	Not serious	Not serious	Not serious	Serious[5]	Moderate
11-18 year olds										
4 (O'Leary, Rand 2015, Rand 2017, Tull 2019)	RCT	11289	RR 1.10 (1.01, 1.20)	67 per 100	74 per 100 (68, 80)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
65 and over										

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 (Otsuka 2013)	RCT	674	RR 2.67 (1.58, 4.50)	5 per 100	13 per 100 (8, 22)	Not serious	Not serious	N/A[16]	Not serious	High
Patient reminders: text or 'electronic' message versus control: MCV4 vaccine (RR >1 favours reminder)										
11-18 year olds										
1 (O'Leary 2015	RCT	4587	RR 1.09 (1.01, 1.18)	34 per 100	37 per 100 (34, 40)	Not serious	Not serious	N/A[16]	Not serious	High
Patient reminders: telephone + mail versus control (RR >1 favours reminder)										
0-5 year olds										
7[d]	RCT	4935	RR 1.15 (1.00, 1.32)	30 per 100	34 per 100 (30, 39)	Serious[1]	Not serious	Serious[4]	Not serious	Low
Patient reminders: autodialer + mail versus control (RR >1 favours reminder) **Pooled result**										
3 (See subgroups below)	RCT	6661	RR 1.58 (1.22, 2.04)	5 per 100	8 per 100 (6, 11)	Not serious	Not serious	Not serious	Not serious	High
11-18 year olds										
1 (Suh 2012)	RCT	1596	RR 1.73 (1.42, 2.12)	15 per 100	26 per 100 (22, 32)	Not serious	Not serious	N/A[16]	Not serious	High
65 and over										
2 (Hurley 2018, Hurley 2019)	RCT	5065	RR 1.36 (0.82, 2.25)	2 per 100	3 per 100 (2, 5)	Not serious	Not serious	Serious[4]	Serious[5]	Low
Patient reminders: autodialer + mail versus control: MCV vaccine (RR >1 favours reminder)										
11-18 year olds										
1 (Suh 2012)	RCT	1596	RR 1.50 (1.32, 1.72)	29 per 100	44 per 100 (39, 51)	Not serious	Not serious	N/A[16]	Not serious	High
CLUSTER RCTs: Patient reminders: autodialer + letter (mail) versus control (RR >1 favours reminder)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
0-5 year olds										
1 (Dini 2000)[h]	Cluster RCT	949	RR 1.23 (1.07, 1.41)	41 per 100	50 per 100 (44, 58)	Very serious[13]	Not serious	N/A[16]	Not serious	Low
Patient reminders: outreach reminder versus control (RR >1 favours reminder)										
0-5 year olds										
2 (Hambidge 2009, LeBaron 2004)	RCT	2700	RR 1.20 (1.08, 1.33)	34 per 100	40 per 100 (36, 45)	Very serious[2]	Not serious	Not serious	Not serious	Low
CLUSTER RCTs: Patient reminders: class room recall (recalled 1 or 2 times via a note sent to classroom, a call to the classroom, or an escort from the classroom) versus control (RR >1 favours reminder)										
11-18 year olds										
1 (Kempe 2012)	Cluster RCT	263	RR 1.60 (1.23, 2.07)	38 per 100	60 per 100 (46, 78)	Not serious	Not serious	N/A[16]	Not serious	High
CLUSTER RCTs: Patient reminders: tracking, telephone or mail, home visits if needed versus control (RR >1 favours reminder)										
11-18 year olds, meningococcal										
1 (Szilagyi 2011)	Cluster RCT	7546	RR 1.26 (1.19, 1.33)	37 per 100	46 per 100 (44, 49)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
11-18 year olds, HPV 1st dose										
1 (Szilagyi 2011)	Cluster RCT	7546	RR 1.35 (1.21, 1.51)	12 per 100	16 per 100 (15, 18)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
11-18 year olds, HPV 2nd dose										
1 (Szilagyi 2011)	Cluster RCT	7546	RR 1.43 (1.29, 1.57)	15 per 100	22 per 100 (19, 24)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
11-18 year olds, HPV 3rd dose										
1 (Szilagyi 2011)	Cluster RCT	7546	RR 1.50 (1.34, 1.68)	12 per 100	17 per 100 (16, 20)	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
CLUSTER RCTs: Patient reminders: reminder of preference versus control (RR >1 favours reminder)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
11-18 year olds										
1 (Kempe 2016)[i]	Cluster RCT	929	RR 1.14 (1.07, 1.22)	Not calculable[9]	Not calculable[9]	Serious[14]	Not serious	N/A[16]	Not serious	Moderate
Patient reminders: calendar reminder versus control (RR >1 favours reminder)										
0-5 year olds										
1 (Menzies 2020)	RCT	792	RR 0.94 (0.86, 1.03)	74 per 100	69 per 100 (64, 76)	Serious[14]	Not serious	N/A[16]	Serious[5]	Low
Patient reminders: calendar reminder + text message versus control (RR >1 favours reminder)										
0-5 year olds										
1 (Menzies 2020)	RCT	798	RR 1.02 (0.94, 1.10)	74 per 100	75 per 100 (69, 81)	Serious[14]	Not serious	N/A[16]	Serious[5]	Low

a) Alto 1994, Bjornson 1999, Campbell 1994, CDC 2012, Daley 2002, Daley 2004, Dombkowski 2014 (3 comparisons), Ferson 1995, Hambidge 2009, Hoekstra 1999, Hofstetter 2015, Hogg 1998, Irigoyen 2000, Kempe 2001, LeBaron 2004, Lieu 1997, Linkins 1994, Menzies 2020, Morgan 1998, Stehr-Green 1993, Tollestrup 1997, Vivier 2000
b) Chao 2015, Coley 2018, Kempe 2012, O'Leary 2015, Rand 2015, Rand 2017 (2 comparisons), Suh 2012, Szilagyi 2006, Szilagyi 2020 (2 comparisons), Tull 2019.
c) Hurley 2018, Hurley 2019, Klassing 2018, Otsuka 2013 (2 comparisons), Stolpe 2019, Terrell-Perica 2001, Winston 2007.
d) Alto 1994, Hogg 1998, Hurley 2018, Hurley 2019, Otsuka 2013 (2 comparisons), Rand 2017 (2 comparisons), Stehr-Green 1993, Szilagyi 2006, Winston 2007
e) Bjornson 1999, CDC 2012, Coley 2018, Dombkowski 2014 (3 comparisons), Hoekstra 1999, LeBaron 2004, Linkins 1994, Morgan 1998, Szilagyi 2020 (2 comparisons), Terrell-Perica 2001, Tollestrup 1997
f) Campbell 1994, Daley 2002, Daley 2004, Hambidge 2009, Hofstetter 2015, Irigoyen 2000, Kempe 2001, O'Leary 2015, Suh 2012, Vivier 2000
g) Cluster RCT data is unadjusted.
h) Cluster RCT data has been adjusted by the investigators.
1. Downgraded once: greater than 33.3% of the weight of the meta-analysis came from studies at moderate or high risk of bias.
2. Downgraded twice: greater than 33.3% of the weight of the meta-analysis came from studies at high risk of bias.
3. Downgraded twice for inconsistency: the I^2 was greater than 66.7%.
4. Downgraded once for inconsistency: the I^2 was between 33.3% and 66.7%.
5. Downgraded once for imprecision: the 95% confidence interval for the effect size crossed the line of no effect.

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality

6. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and the sample size was sufficiently small (<200) that it is not plausible that any realistic effect size could have been detected.
7. Downgraded once for indirectness: greater than 33.3% of the weight of the meta-analysis came from studies that were partially direct or indirect.
8. Not estimable or not applicable because there were no events in either arm.
9. Not calculable because the investigators did not provide patient numbers for the adjusted RR.
10. Downgraded twice for inconsistency: the I2 was greater than 66.7%. We have treated the New York and Colorado data as two separate RCTs.
11. Downgraded once for inconsistency: the I^2 was between 33.3% and 66.7%. We have treated the New York and Colorado data as two separate RCTs.
12. We have treated the New York and Colorado data as two separate RCTs.
13. Downgraded twice: single study at high risk of bias.
14. Downgraded once: single study at moderate risk of bias.
15. Downgraded once for indirectness: single study that was partially direct.
16. Single study. Inconsistency not applicable.

1 Reminders interventions aimed at individuals, parents/ carers compared to other reminder interventions

2 Table 14 GRADE table for reminders interventions compared to other reminder 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
Patient reminders: health belief worded postcard versus neutrally worded postcard (RR >1 favours health belief model)										
0-5 year olds										
1 (Hawe 1998)	RCT	258	RR 1.18 (1.01, 1.37)	67 per 100	79 per 100 (68, 92)	Serious[1]	Not serious	N/A[10]	Not serious	Moderate
Patient reminders: customised reminders versus non-customised reminders (RR >1 favours customised reminders)										
0-5 years, MMR										
1 (Hogg 1998)	RCT	54	Not estimable[5]	N/A[5]	N/A[5]	Serious[1]	Not serious	N/A[10]	N/A[5]	Moderate
0-5 years, Hib										

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 (Hogg 1998)	RCT	41	RR 4.59 (0.20, 106.18)	N/A[6]	N/A[6]	Serious[1]	Not serious	N/A[10]	Very serious[4]	Very low
Patient reminders: texts + appointment scheduling reminder versus texts only (RR >1 favours texts + appointment scheduling reminder)										
0-5 year olds										
1 (Hofstter 2015)	RCT	1372	RR 1.06 (0.98, 1.15)	61 per 100	65 per 100 (60, 70)	Not serious	Not serious	N/A[10]	Serious[3]	Moderate
Patient reminders: motivational text message versus self-regulatory text message (RR >1 favours motivational text message)										
11-18 year olds										
1 (Tull 2019)	RCT	2860	RR 0.99 (0.97, 1.02)	90 per 100	89 per 100 (87, 92)	Not serious	Not serious	N/A[10]	Serious[3]	Moderate
Patient reminders: outreach versus autodialer (RR >1 favours outreach)										
0-5 year olds										
1 (LeBaron 2004)	RCT	1523	RR 0.92 (0.81, 1.05)	40 per 100	37 per 100 (32, 42)	Very serious[2]	Not serious	N/A[10]	Serious[3]	Very low
Patient reminders: autodialer + outreach versus autodialer (RR >1 favours autodialer + outreach)										
0-5 year olds										
1 (LeBaron 2004)	RCT	1527	RR 0.95 (0.84, 1.08)	40 per 100	38 per 100 (34, 43)	Very serious[2]	Not serious	N/A[10]	Serious[3]	Very low
Patient reminders: autodialer + outreach versus outreach (RR >1 favours autodialer + outreach)										
0-5 year olds										
1 (LeBaron 2004)	RCT	1524	RR 1.03 (0.90, 1.17)	37 per 100	38 per 100 (33, 43)	Very serious[2]	Not serious	N/A[10]	Serious[3]	Very low
Patient reminders: letters versus autodialer (RR >1 favours letters)										
0-5 year olds										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Lieu 1998)	RCT	327	RR 1.02 (0.80, 1.30)	44 per 100	45 per 100 (35, 57)	Very serious[2]	Not serious	N/A[10]	Serious[3]	Very low
CLUSTER RCTs: Patient reminders: letter versus autodialer (RR >1 favours letters)										
11-18 year olds, MCV4										
1 (Szilagyi 2013)	Cluster RCT	2819	RR 1.05 (1.00, 1.09)	73 per 100	77 per 100 (73, 80)	Serious[1]	Not serious	N/A[10]	Not serious	Moderate
11-18 year olds, HPV dose 1										
1 (Szilagyi 2013)	Cluster RCT	2819	RR 0.99 (0.90, 1.09)	38 per 100	37 per 100 (34, 41)	Serious[1]	Not serious	N/A[10]	Serious[3]	Low
11-18 year olds, HPV dose 2										
1 (Szilagyi 2013)	Cluster RCT	2819	RR 1.03 (0.92, 1.14)	32 per 100	33 per 100 (30, 37)	Serious[1]	Not serious	N/A[10]	Serious[3]	Low
11-18 year olds, HPV dose 3										
1 (Szilagyi 2013)	Cluster RCT	2819	RR 1.02 (0.89, 1.16)	24 per 100	24 per 100 (21, 28)	Serious[1]	Not serious	N/A[10]	Serious[3]	Low
CLUSTER RCTs: Patient reminders: 3 autodialer reminders versus 1 autodialer reminder (RR >1 favours										
HPV dose 1										
2 (Szilagyi 2020 (2 comparisons))[a]	Cluster RCT	31015	RR 0.98 (0.95, 1.01)	35 per 100	35 per 100 (33, 36)	Serious[9]	Not serious	Not serious[7]	Serious[3]	Low
HPV series completion										
2 (Szilagyi 2020 (2 comparisons))[a]	RCT	31015	RR 0.98 (0.95, 1.02)	29 per 100	28 per 100 (28, 30)	Serious[9]	Not serious	Not serious[7]	Serious[3]	Low
Patient reminders: autodialer + letters versus autodialer (RR >1 favours autodialer + letters)										
0-5 year olds										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Lieu 1998)	RCT	486	RR 1.27 (1.04, 1.55)	44 per 100	55 per 100 (45, 68)	Very serious[2]	Not serious	N/A[10]	Not serious	Low
CLUSTER RCTs: Patient reminders: autodialer + letters versus autodialer (RR >1 favours autodialer + letters)										
0-5 year olds										
1 (Dini 2000)[a]	Cluster RCT	868	RR 1.02 (0.89, 1.16)	49 per 100	50 per 100 (44, 57)	Very serious[2]	Not serious	N/A[10]	Serious[3]	Very low
Patient reminders: autodialer + letters versus letters (RR >1 favours autodialer + letters)										
0-5 year olds										
1 (Lieu 1998)	RCT	483	RR 1.25 (1.02, 1.52)	44 per 100	56 per 100 (45, 68)	Very serious[2]	Not serious	N/A[10]	Not serious	Low
CLUSTER RCTs: Patient reminders: autodialer + letter versus letter (RR >1 favours autodialer + letters)										
0-5 year olds										
1 (Dini 2000)[a]	Cluster RCT	876	RR 1.04 (0.91, 1.19)	48 per 100	50 per 100 (44, 57)	Very serious[2]	Not serious	N/A[10]	Serious[3]	Very low
Patient reminders: reminders by autodialer and mail versus reminders by mail (RR >1 favours autodialer and mail)										
0-5 year olds										
1 (Kempe 2015)	RCT	9049	RR 1.02 (0.91, 1.13)	13 per 100	13 per 100 (12, 14)	Serious[1]	Serious[4]	N/A[10]	Serious[3]	Very low
Patient reminders: phone versus letter (RR >1 favours phone)										
0-5 year olds										
1 (Vivier 2000)	RCT	123	RR 0.93 (0.39, 2.26)	14 per 100	13 per 100 (6, 32)	Serious[1]	Not serious	N/A[10]	Very serious[4]	Very low
Patient reminders: phone versus letter and phone (RR >1 favours phone)										
0-5 year olds										
1 (Vivier 2000)	RCT	130	RR 0.78 (0.34, 1.78)	17 per 100	13 per 100 (6, 31)	Serious[1]	Not serious	N/A[10]	Very serious[4]	Very low
Patient reminders: letter versus letter and phone (RR >1 favours letter)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
0-5 year olds										
1 (Vivier 2000)	RCT	133	RR 0.83 (0.38, 1.84)	17 per 100	14 per 100 (7, 32)	Serious[1]	Not serious	N/A[10]	Very serious[4]	Very low
Patient reminders: text message versus calendar reminder (RR >1 favours text message)										
0-5 year olds										
1 (Menzies 2020)	RCT	796	RR 1.11 (1.02, 1.21)	70 per 100	77 per 100 (72, 85)	Serious[1]	Not serious	N/A[10]	Not serious	Moderate
Patient reminders: postcard versus letter (RR >1 favours postcard)										
0-5 year olds										
1 (Campbell 1994)	RCT	183	RR 0.96 (0.76, 1.21)	62 per 100	60 per 100 (47, 75)	Serious[1]	Not serious	N/A[10]	Very serious[4]	Very low

a. Cluster RCT data was not adjusted for clustering.

1. Downgraded once: single study at moderate risk of bias.
2. Downgraded twice: single study at high risk of bias.
3. Downgraded once for imprecision: the 95% confidence interval for the effect size crossed the line of no effect.
4. Downgraded once for indirectness: single study that was partially direct.
5. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and number of participants was <200.
6. The effect size was not estimable because there was no vaccine uptake in either arm.
7. It was not possible to calculate absolute risks because there was no vaccine uptake in the non-customised events arm.
8. We treated the New York and Colarado data as 2 separate RCTs.
9. Downgraded once: greater than 33.3% of the weight of the meta-analysis came from studies at moderate or high risk of bias.
10. Single study. Inconsistency not applicable.

1

Reminders interventions aimed at individuals, parents/ carers compared to those aimed at providers to increase vaccine uptake

Table 15 GRADE table for reminders interventions aimed at individuals, parents/ carers compared to those aimed at providers to increase vaccine uptake

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
Patient reminder (mail) versus provider reminder (phone call to health visitor) (RR >1 favours patient reminder)										
0-5 year olds										
1 (Morgan 1998)	RCT	312	RR 0.88 (0.62, 1.25)	30 per 100	26 per 100 (19, 38)	Very serious[1]	Not serious	N/A[3]	Serious[2]	Very low
CLUSTER RCTs: Patient reminder (tracking and outreach) versus provider reminder (RR >1 favours patient reminder)										
0-5 year olds										
1 (Rodewald 1999)[a]	Cluster RCT	1374	RR 1.25 (1.20, 1.31)	76 per 100	95 per 100 (91, 99)	Not serious	Not serious	N/A[3]	Not serious	High
CLUSTER RCTs: Patient reminders: centrally organised reminders by mail or autodialer and mail versus primary care practice webinar training on vaccination reminders (RR >1 favours mail +/- autodialer)										
0-5 year olds										
1 (Kempe 2015)[a]	Cluster RCT	18235	RR 1.38 (1.27, 1.50)	9 per 100	13 per 100 (12, 14)	Serious[4]	Serious[5]	N/A[3]	Not serious	Low

a. Cluster RCT data was not adjusted for clustering.
1. Downgraded twice: single study at high risk of bias.
2. Downgraded once for imprecision: the 95% confidence interval for the effect size crossed the line of no effect.
3. Single study. Inconsistency not applicable.
4. Downgraded once: single study at moderate risk of bias.
5. Downgraded once: single study which is partially directly applicable.

1 Reminders interventions aimed at providers to increase vaccine uptake

2 Table 16 GRADE table for reminders interventions aimed at providers

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 reminders (summary) reminder versus control (RR >1 favours reminder) (all were reminders to primary care staff)										
5 (See subgroups below)	RCT	10152	RR 1.27 (0.89, 1.83)	15 per 100	19 per 100 (14, 28)	Very serious[1]	Not serious	Very serious[4]	Serious[5]	Very low
0-5 year olds										
3 (Frank 2004, Morgan 1998, Rodewald 1996)	RCT	2476	RR 1.00 (0.94, 1.07)	43 per 100	43 per 100 (40, 46)	Very serious[1]	Not serious	Not serious	Serious[5]	Very low
65 and over										
2 (Frank 2004, Loo 2011)	RCT	7676	RR 1.73 (1.49, 2.01)	6 per 100	10 per 100 (8, 11)	Very serious[1]	Serious[2]	Not serious	Not serious	Very low
CLUSTER RCTs: Provider reminders: (summary) reminder versus control (OR >1 favours reminder)										
CORNET study										
1 (Szilagyi 2015)[a]	Cluster RCT	1920	OR 1.08 (0.82, 1.42)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
GR-PBRN study										
1 (Szilagyi 2015)[a]	Cluster RCT	1600	OR 1.15 (0.64, 2.06)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
1 (Wilkinson 2019)[a]	Cluster RCT	1285	OR 1.52 (0.88, 2.62)	N/A[7]	N/A[7]	Very serious[8]	Not serious	N/A[10]	Serious[5]	Very low
1 (Zimet 2018)[a]	Cluster RCT	648	OR 1.11 (0.50, 2.47)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Provider reminders: letter to GP versus control (RR >1 favours reminder)										
0-5 year olds										
1 (Rodewald 1996)	RCT	1215	RR 1.00 (0.94, 1.07)	75 per 100	75 per 100 (71, 80)	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
CLUSTER RCTs: Provider reminder: nurses assessing and reminding physicians versus control (RR >1 favours reminder)										
65 and over										
1 (Shevlin 2002)[b]	Cluster RCT	355	RR 8.15 (3.87, 17.16)	5 per 100	38 per 100 (18, 80)	Very serious[8]	Serious[9]	N/A[10]	Not serious	Very low
Provider reminders: electronic medical record versus control (RR >1 favours reminder)										
3 (See subgroups below)	RCT	8645	RR 1.66 (1.44, 1.91)	6 per 100	10 per 100 (9, 11)	Very serious[1]	Not serious	Not serious	Not serious	Low
0-5 year olds										
1 (Frank 2004)	RCT	969	RR 1.25 (0.84, 1.86)	8 per 100	10 per 100 (7, 15)	Very serious[8]	Serious[9]	N/A[10]	Very serious[6]	Very low
65 and over										
2 (Frank 2004, Loo 2011)	RCT	7676	RR 1.73 (1.49, 2.01)	6 per 100	10 per 100 (8, 11)	Very serious[1]	Not serious	Not serious	Not serious	Low
CLUSTER RCTs: Provider reminder: electronic reminder versus control (RR >1 favours reminder)										
11-18 year olds										
1 (Wilkinson 2019)[a]	Cluster RCT	1285	RR 1.52 (0.88, 2.62)	65 per 100	98 per 100 (57, 169)	Very serious[8]	Not serious	N/A[10]	Serious[5]	Very low
1 (Zimet 2018)[a]	Cluster RCT	524	RR 1.11 (0.50, 2.47)	15 per 100	17 per 100 (7, 37)	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
CLUSTER RCTs: Provider reminder: computer or paper reminder versus control, MCV4 (OR >1 favours reminder)										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
11-18 year olds										
1 (Szilagyi 2015)[a,c]	Cluster RCT	Not provided	OR 1.08 (0.82, 1.42)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
1 (Szilagyi 2015)[a,d]	Cluster RCT	Not provided	OR 1.15 (0.64, 2.06)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
CLUSTER RCTs: Provider reminders: HPV doses, computer or paper reminder versus control (OR >1 favours reminder)										
Dose 1										
1 (Szilagyi 2015)[a,c]	Cluster RCT	Not provided	OR 0.96 (0.59, 1.56)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
1 (Szilagyi 2015)[a,d]	Cluster RCT	Not provided	OR 0.92 (0.60, 1.41)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
Dose 2										
1 (Szilagyi 2015)[a,c]	Cluster RCT	Not provided	OR 1.01 (0.57, 1.78)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
1 (Szilagyi 2015)[a,d]	Cluster RCT	Not provided	OR 1.06 (0.64, 1.76)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
Dose 3										
1 (Szilagyi 2015)[a,c]	Cluster RCT	Not provided	OR 1.13 (0.68, 1.88)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
1 (Szilagyi 2015)[a,d]	Cluster RCT	Not provided	OR 0.93 (0.64, 1.35)	N/A[7]	N/A[7]	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
Provider identification and reminders versus control (RR >1 favours reminder)										
Pooled[11]										
1 (Szilagyi 1996	RCT	1789	RR 1.00 (0.94, 1.08)	64 per 100	64 per 100 (60, 69)	Serious[3]	Not serious	Not serious	Serious[5]	Low
0-5 years, paediatric continuity clinic										
1 (Szilagyi 1996	RCT	878	RR 1.05 (0.95, 1.15)	65 per 100	68 per 100 (62, 75)	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
0-5 years, neighbourhood health centre										

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 (Szilagyi 1996	RCT	911	RR 0.96 (0.87, 1.07)	62 per 100	60 per 100 (54, 66)	Serious[3]	Not serious	N/A[10]	Serious[5]	Low
Provider reminders: physician reminders versus automatic vaccine order (RR >1 favours physician reminder)										
65 and over										
1 (Dexter 2004)	RCT	829	RR 0.61 (0.51, 0.72)	51 per 100	31 per 100 (26, 37)	Serious[3]	Serious[9]	N/A[10]	Not serious	Low
Provider reminders: hospital staff reminder versus GP reminder (RR >1 favours hospital staff reminder)										
65 and over										
1 (MacIntyre 2003)	RCT	128	RR 1.22 (0.92, 1.62)	55 per 100	67 per 100 (51, 89)	Serious[3]	Not serious	N/A[10]	Very serious[6]	Very low

a. Cluster RCT data was adjusted by the investigators for clustering.

b. Cluster RCT data was not adjusted for clustering.

c. CORNET study

d. GR-PBRN study

1. Downgraded twice: greater than 33.3% of the weight of the meta-analysis came from studies at high risk of bias.
2. Downgraded once: greater than 33.3% of the weight in this meta-analysis came from partially indirect or indirect studies.
3. Downgraded once: single study at moderate risk of bias.
4. Downgraded twice for inconsistency: the I2 was greater than 66.7%.
5. Downgraded once for imprecision: the 95% confidence interval for the effect size crossed the line of no effect.
6. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and the number of participants was <200.
7. The absolute risks are not calculable because the number of participants who received a vaccine was not provided.
8. Downgraded twice: single study at high risk of bias.
9. Downgraded once: single study which was partially indirect.
10. Single study. Inconsistency not applicable.

Sensitivity analyses

Below are the outcomes that changed when studies at high risk of bias were removed from the meta-analyses.

Reminders interventions aimed at individuals or parents/carers to increase vaccine uptake

Table 17 GRADE table for reminders interventions compared to control without studies at high risk of bias

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Patient reminders (summary) reminder versus control (RR >1 favours reminder) **Pooled result**										
35 (See the 3 subgroups below)	RCT	274955	RR 1.16 (1.11, 1.21)	19 per 100	22 per 100 (21, 23)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
0-5 year olds										
19[a]	RCT	29033	RR 1.12 (1.05, 1.20)	36 per 100	40 per 100 (37, 43)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
11-18 year olds										
9[b]	RCT	209256	RR 1.10 (1.04, 1.17)	20 per 100	22 per 100 (21, 23)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
65 and over										
7[c]	RCT	36666	RR 1.75 (1.30, 2.36)	2 per 100	4 per 100 (3, 5)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
Patient reminders: who it was sent by: reminder versus control (RR >1 favours reminder) (same studies as previous meta-analysis)										
Reminder from a pharmacy										
1 (Stolpe 2019)	RCT	22301	RR 1.03 (0.8, 1.33)	1 per 100	1 per 100 (1, 1)	Serious[8]	Serious[7]	N/A[9]	Serious[5]	Very low
Reminder from GP or primary care clinic (RR >1 favours reminder)										

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
9[e]	RCT	13757	RR 1.55 (1.14, 2.09)	13 per 100	21 per 100 (15, 28)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
Reminder from a regional health authority (RR >1 favours reminder)										
10[f]	RCT	217477	RR 1.12 (1.04, 1.20)	18 per 100	20 per 100 (19, 22)	Serious[1]	Not serious	Very serious[3]	Not serious	Very low
Reminder from school nurse or school-based health centre (RR >1 favours reminder)										
2 (Tull 2019, Kempe 2012)	RCT	4648	RR 1.29 (0.87, 1.93)	85 per 100	109 per 100 (74, 164)	Not serious	Not serious	Very serious[3]	Serious[5]	Very low
Reminder from a regional health insurance company (RR >1 favours reminder)										
2 (Lieu 1997, Rand 2015)	RCT	1925	RR 1.34 (1.01, 1.76)	15 per 100	20 per 100 (15, 26)	Serious[1]	Not serious	Serious[4]	Not serious	Low
Patient reminders: (summary for HPV doses) reminder versus control (RR >1 favours reminder)										
Dose 1										
3 (Coley 2018, Szilagyi 2020 (2 comparisons))	RCT	193493	RR 1.11 (1.09, 1.13)	17 per 100	19 per 100 (19, 19)	Not serious	Not serious	Very serious[3]	Not serious	Low
Dose 2										
1 (Coley 2018)	RCT	162422	RR 1.28 (1.23, 1.34)	5 per 100	6 per 100 (6, 7)	Not serious	Not serious	N/A[9]	Not serious	High
Dose 3										
1 (Coley 2018)	RCT	162422	RR 3.64 (1.01, 13.03)	0.004 per 100	0.01 per 100 (0.004, 0.05)	Not serious	Not serious	N/A[9]	Not serious	High

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
Patient reminders: postcard versus control (RR >1 favours reminder) **Pooled result**										
4 (Bjornson 1999, Campbell 1994, Irigoyen 2000, Coley)	RCT	164347	RR 1.09 (0.99, 1.19)	14 per 100	15 per 100 (14, 17)	Serious[1]	Not serious	Very serious[3]	Serious[5]	Very low
0-5 year olds										
3 (Bjornson 1999, Campbell 1994, Irigoyen 2000)	RCT	1925	RR 1.03 (0.97, 1.10)	58 per 100	60 per 100 (57, 64)	Serious[1]	Not serious	Not serious	Serious[5]	Low
Patient reminders: letter versus control (RR >1 favours reminder) **Pooled result**										
10 (See subgroups below)	RCT	17957	RR 1.30 (1.11, 1.52)	20 per 100	26 per 100 (22, 30)	Serious[1]	Not serious	Serious[4]	Not serious	Low
0-5 year olds										
8 (Campbell 1994, CDC 2012, Dombkowski 2014 (3	RCT	11726	RR 1.13 (1.02, 1.26)	34 per 100	39 per 100 (35, 43)	Serious[1]	Not serious	Not serious	Not serious	Moderate

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
comparisons), Hogg 1998, Lieu 1997, Vivier 2000)										
65 and over										
2 (Otsuka 2013, Terrell-Perica 2001)	RCT	6231	RR 2.23 (1.72, 2.88)	3 per 100	6 per 100 (4, 7)	Serious[1]	Not serious	Not serious	Not serious	Moderate
Patient reminders: telephone versus control (RR >1 favours reminder) **Pooled result**										
2 (Vivier 2000, Winston 2007)	RCT	2526	RR 2.20 (1.31, 3.69)	8 per 100	18 per 100 (11, 30)	Serious[1]	Not serious	Not serious	Not serious	Moderate
0-5 year olds										
1 (Vivier 2000)	RCT	234	RR 4.73 (1.03, 21.45)	3 per 100	13 per 100 (3, 60)	Serious[8]	Not serious	N/A[9]	Not serious	Moderate
65 and over										
1 (Winston 2007)	RCT	2452	RR 2.01 (1.60, 2.52)	8 per 100	17 per 100 (13, 21)	Serious[8]	Not serious	N/A[9]	Not serious	Moderate
Patient reminders: autodialer versus control (RR >1 favours reminder) **Pooled result**										
5 (Linkins 1994, Stehr-	RCT	78930	RR 1.09 (0.97, 1.23)	21 per 100	23 per 100 (20, 61)	Serious[1]	Not serious	Very serious[3]	Serious[5]	Very low

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Green 1993, Szilagyi 2006, Szilagyi 2020)										
11-18 year olds										
2 (Szilagyi 2006, Szilagyi 2020)	RCT	48788	RR 1.01 (0.99, 1.04)	36 per 100	37 per 100 (36, 38)	Serious[1]	Not serious	Not serious	Serious[5]	Low
Patient reminders: text or 'electronic' message versus control (RR >1 favours reminder)										
Pooled result										
6 (Hofstetter 2015, Menzies, O'Leary, Rand 2015, Tull 2019, Otsuka 2013)	RCT	14418	RR 1.06 (1.00, 1.13)	64 per 100	68 per 100 (64, 72)	Not serious	Not serious	Serious[4]	Not serious	Moderate
11-18 year olds										
3 (O'Leary, Rand 2015, Tull 2019)	RCT	10898	RR 1.06 (0.97, 1.14)	68 per 100	73 per 100 (66, 78)	Not serious	Not serious	Very serious[3]	Serious[5]	Very low
Patient reminders: telephone + mail versus control (RR >1 favours reminder)										
0-5 year olds										

No. of studies	Study design	Sample size	Effect size (95% CI)	Absolute risk: control	Absolute risk: intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
5[d]	RCT	2844	RR 1.24 (0.98, 1.56)	19 per 100	24 per 100 (19, 30)	Serious[1]	Not serious	Serious[4]	Serious[5]	Very low
Patient reminders: outreach reminder versus control (RR >1 favours reminder)										
0-5 year olds										
1 (Hambidge 2009)	RCT	807	RR 1.33 (1.12, 1.59)	39 per 100	44 per 100 (37, 53)	Serious[8]	Not serious	Not serious	Not serious	Moderate

a) Alto 1994, Bjornson 1999, Campbell 1994, CDC 2012, Daley 2002, Daley 2004, Dombkowski 2014 (3 comparisons), Hambidge 2009, Hofstetter 2015, Hogg 1998, Irigoyen 2000, Kempe 2001, Lieu 1997, Linkins 1994, Menzies 2020, Stehr-Green 1993, Vivier 2000
b) Coley 2018, Kempe 2012, O'Leary 2015, Rand 2015, Suh 2012, Szilagyi 2006, Szilagyi 2020 (2 comparisons), Tull 2019.
c) Hurley 2018, Hurley 2019, Otsuka 2013 (2 comparisons), Stolpe 2019, Terrell-Perica 2001, Winston 2007.
d) Alto 1994, Daley 2002, Daley 2004, Kempe 2001, Viver 2000
e) Alto 1994, Hogg, 1998, Hurley 2018, Hurley 2019, Otsuka 2013 (2 comparisons), Stehr-Green 1993, Szilagyi 2006, Winston 2007
f) Bjornson 1999, CDC 2012, Coley 2018, Dombkowski 2014 (3 comparisons), Linkins 1994, Szilagyi 2020 (2 comparisons), Terrell-Perica 2001
g) Campbell 1994, Daley 2002, Daley 2004, Hambidge 2009, Hofstetter 2009, Irigoyen 2000, Kempe 2001, O'Leary 2015, Suh 2012, Vivier 2000
h) Campbell 1994, Daley 2002m, Daley 2004, Hambidge 2009, Hofstetter 2015, Irigoyen 2000, Kempe 2001, O'Leary 2015, Suh 2012, Vivier 2000

1. Downgraded once: greater than 33.3% of the weight of the meta-analysis came from studies at moderate or high risk of bias.
2. Downgraded twice: greater than 33.3% of the weight of the meta-analysis came from studies at high risk of bias.
3. Downgraded twice for inconsistency: the I^2 was greater than 66.7%.
4. Downgraded once for inconsistency: the I^2 was between 33.3% and 66.7%.
5. Downgraded once for imprecision: the 95% confidence interval for the effect size crossed the line of no effect.
6. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and the number of participants was <200.
7. Downgraded once: single study that was partially direct.
8. Downgraded once: Single study at moderate risk of bias.
9. Single study. Inconsistency not applicable.

1

Reminders interventions aimed at providers to increase vaccine uptake

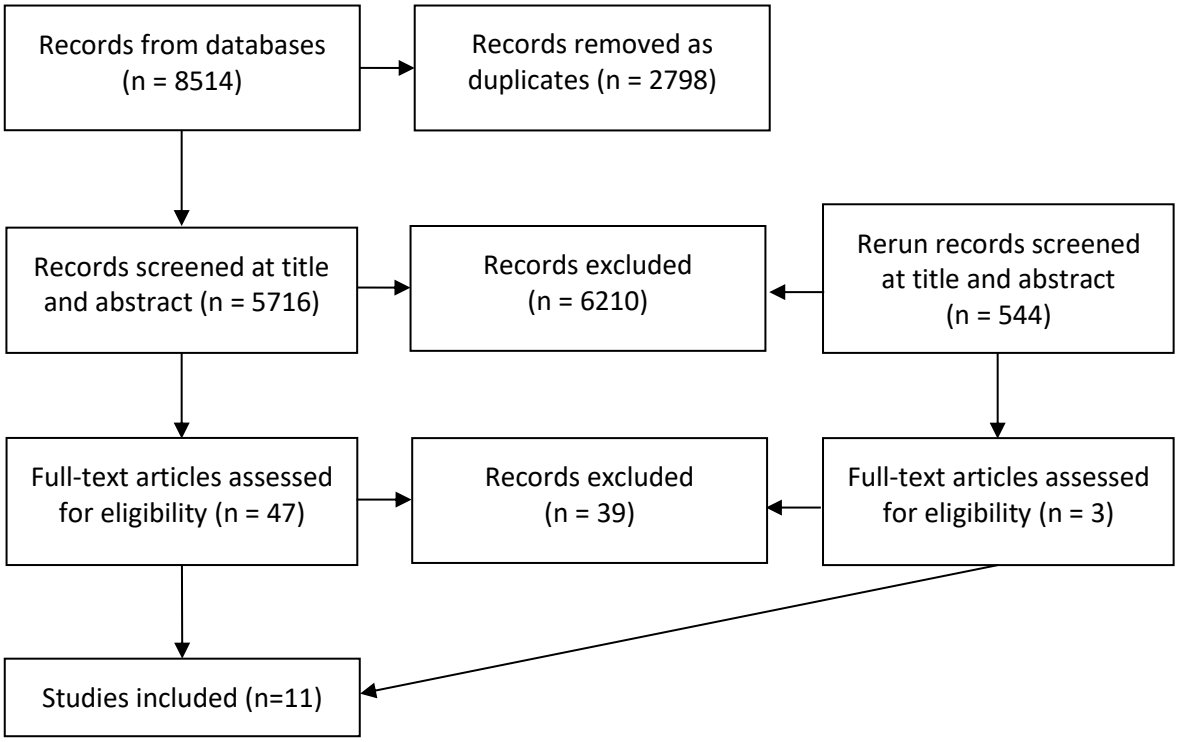
Table 18 GRADE table for reminders interventions aimed at providers

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 reminders (summary) reminder versus control (RR >1 favours reminder)										
0-5 year olds										
1 (Rodewald 1996)	RCT	1215	RR 1.00 (0.98, 1.03)	95 per 100	95 per 100 (93, 98)	Serious[1]	Not serious	N/A[3]	Serious[2]	Low

1. Downgraded once: Single study at moderate risk of bias.
2. Downgraded once for imprecision: the 95% confidence interval for the effect size crossed the line of no effect.
3. Single study. Inconsistency not applicable.

Appendix G – Economic evidence study selection

Three studies were relevant for this review.



Appendix H – Economic evidence tables

Appendix H1 – Evidence tables

Non-QALY outcome studies (Children and adolescents)

Reminders (patient)

Dini 2000

Study	Dini et al (2000) The Impact of Computer-Generated Messages on Childhood Immunization Coverage			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**
Economic analysis: Cost-effectiveness/cost-comparison Study design: Randomised controlled trial Approach to analysis: Data from a randomised controlled trial was analysed to compare rate of immunisation completion by 24 months of age across the 4 strategies. Costs of each intervention were compiled. Perspective: Public sector perspective Time horizon: 22 months (from 2 months of age to 24 months of age) Discounting: No discounting was applied other than to the start-up costs, although this was likely to be actuarial discounting.	Population: Children aged 60-90 days who had received the first dose of diphtheria/tetanus/pertussis and/or polio vaccines Intervention: Three reminder/recall interventions; (A) telephone and letter reminders, (B) telephone reminders only, (C) letter reminders only Comparator: (D) no reminder	Cost difference: Compared with control (D): (A) $4738 (£4,945 2021 GBP) (B) $4300 (£4,488 2021 GBP) (C) $2254 (£2,352 2021 GBP) Total cost per child enrolled in group A: $15.38 (£16.05 2021 GBP) Currency and cost year: USD, (cost year NR, assumed 2000) Costs included: Intervention costs only (autodialling equipment, software	Difference in outcomes versus control (D) Immunisation coverage at 24 months: (A): 9.3%, RR 1.23 (95% CI [1.00-1.52]) (B): 8.4%, RR 1.21 (95% CI [0.98-1.49]) (C): 7.3%, RR 1.18 (95% CI [0.95-1.46]) Any intervention: 8.3%, RR 1.21 (95% CI [1.01-1.44]) Immunisation coverage at 24 months in subjects with confirmed receipt of the intervention: (A): 14.2%, RR 1.30	Incremental analysis: For the primary (randomization) analysis, the cost per additional child in group A completing the immunization series by 18 months of age was $132; by 24 months, it was $226 (£138 and £236 2021 GBP). After discounting for start-up costs, the cost for each additional child completing the series was $46 and $79 (£48 and £82 2021 GBP) by 18 months and 24 months of age, respectively. Only results for group A were presented, as this was the only group with statistically significant outcomes. Analysis of uncertainty: No sensitivity analyses were conducted in this study.

Study	Dini et al (2000) The Impact of Computer-Generated Messages on Childhood Immunization Coverage			
		modification, line installation, phone-line charges, clerical costs, postage)	(95% CI [1.08-1.58]) (B): 9.8%, RR 1.21 (95% CI [0.99-1.47]) (C): 10.0%, RR 1.21 (95% CI [1.00-1.48]) Any intervention: 11.3%, RR 1.24 (95% CI [1.05-1.47])	
Data sources				
Outcomes: Data were abstracted from the computerized databases used in the scheduling of immunisation visits - i.e. directly from the RCT data. Rate ratios were calculated using the immunisation rate in the control group (D) as the baseline rate. Quality of life: Quality of life was not included as an outcome Costs: Costs were only collected for the interventions, and were equivalent to the expenditures in the 34 months total study time of the RCT.				
Comments				
Funded through Immunization Project Grant Number H23/CCH804435, National Immunization Program, Centers for Disease Control and Prevention, Atlanta, GA.				
Overall applicability: Partially applicable				
The study was a cost-effectiveness analysis, using "completion of immunisation by 24 months of age" as an outcome rather than QALYs. The study was conducted in US public health clinics. Only costs associated with the intervention were captured, additional costs to the healthcare system were not included. Discounting was not appropriately applied as only the start-up costs were discounted and this was likely actuarial discounting.				
Overall quality: Potentially serious limitations				
The analysis was conducted using direct results from the RCT so no long-term outcomes or costs were considered. Vaccination costs were not included. No sensitivity analyses were conducted, and it was unclear whether some of the resource use estimates were from the best available source.				

1 **Franzini 2000**

Study	Franzini et al (2000) Cost-Effectiveness of Childhood Immunization Reminder/Recall Systems in Urban Private Practices			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**
Economic analysis: Cost-effectiveness analysis Study design: Randomised controlled trial	Population: Children <12 months old who are eligible for their first, second or third	Cost difference: Average cost per child Study cost:	Difference in outcomes: Additional number of children immunised	Incremental analysis: Incremental cost per child immunised (compared with control): Study cost:

Study	Franzini et al (2000) Cost-Effectiveness of Childhood Immunization Reminder/Recall Systems in Urban Private Practices			
Approach to analysis: Data from a randomised controlled trial was analysed to determine the effectiveness of interventions in terms of return health visits and vaccinations delivered. Intervention costs were determined from those incurred in the trial. Perspective: Private medical provider Time horizon: The trial followed patients for up to thirty days after target immunization due date to record outcomes. Discounting: No discounting was applied other than to the autodialer costs, although this was likely to be actuarial discounting where the equipment cost is spread over the lifespan of the equipment.	diphtheria/tetanus/pertussis vaccine Intervention: Mail reminder, patients received a postcard delivered through the US mail reminding them of the date of their return appointments. Autodialer reminder, patients were reminded of their return appointment date for immunizations by a computer automated telephone message system. Comparator: No reminder	Mail: $15.09 (£15.75 2021 GBP) Autodialer: $13.43 (£14.02 2021 GBP) Control: $11.25 (£11.74 2021 GBP) Physician's office cost: Mail: $2.28 (£2.38 2021 GBP) Autodialer: $1.12 (£1.17 2021 GBP) Control: $0.21 (£0.22 2021 GBP) Cost with registry: Mail: $2.07 (£2.16 2021 GBP) Autodialer: $0.91 (£0.95 2021 GBP) Control: $0.00 (£0.00) Currency and cost year: USD, (cost year NR assumed 2000) Costs included: Enrolment costs, intervention costs (mail and autodialer), follow-up costs, study document costs	compared with control per 1000 children: Mail: 161 Autodialer: 224 Number of children immunised per 1000 children: Mail: 797 Autodialer: 860 Control: 636 Additional number of return visits compared with control per 1000 children: Mail: 217 Autodialer: 261	Mail: $23.84 (£24.88 2021 GBP) Autodialer: $9.77 (£10.20 2021 GBP) Physicians cost: Mail: $12.82 (£13.38 2021 GBP) Autodialer: $4.06 (£4.24 2021 GBP) Cost with registry†: Mail: $12.82 (£13.38 2021 GBP) Autodialer: $4.06 (£4.24 2021 GBP) Analysis of uncertainty: In the main analysis a 5-year life expectancy was assumed for the autodialer. However due to changing technology, autodialers can become obsolete in <5 years. On the other hand, the machine can perform its functions for 10 or more years with only minimal maintenance. The prorated value of the autodialer was computed assuming a life expectancy of 3 and 10 years, respectively. A 3% discount rate was also considered. The effect of varying several assumptions about the cost of repeated autodialer use was explored when computing the number of children needed for the autodialer to be as cost-effective as the mail system (including start-up costs).
Data sources				
Outcomes: Data on return visits and immunisation status were taken directly from the study. Quality of life: Quality of life was not included as an outcome				

Study	Franzini et al (2000) Cost-Effectiveness of Childhood Immunization Reminder/Recall Systems in Urban Private Practices
Costs: For the study cost, all expenses for equipment and supplies were recorded in the study and allocated to each intervention. Time spent by the study staff was estimated based on detailed activity logs completed by the study staff. For the physicians office and registry costs, the study specific costs were excluded. It was assumed that medical assistants in physicians' offices and registry personnel would implement the reminder/recall system.	
Comments	
-	
Overall applicability: Partially applicable	
Autodialers may be an outdated piece of equipment, although similar approaches are likely to still be in use, and mail reminders are relevant. The study was a cost-effectiveness analysis, using number of children immunised as an outcome rather than QALYs. The study was conducted in US private paediatric practices. Costs and outcomes were not discounted appropriately, as it was only stated that the cost of the autodialer was discounted over its lifespan.	
Overall quality: Potentially serious limitations	
The analysis was conducted on the results of the RCT and only followed patients for up to 30 days to record outcomes, so long-term costs and outcomes were not captured. The costs of the vaccinations were not included in the analysis. Only the costs of the autodialer were considered in sensitivity analysis.	

†The incremental costs for the physician's office and registry are the same – the only difference between them is a baseline cost incurred in the physician office regarding study documents, not affecting the incremental costs when compared with the control arm

Lieu 1997

Study	Lieu et al (1997) Computer-generated recall letters for underimmunized children: how cost-effective?			
Study details	**Population & interventions**	**Costs**	**Outcomes**	**Cost effectiveness**
Economic analysis: Cost-effectiveness analysis Study design: Decision analytic model Approach to analysis: A decision tree was used to determine immunisation status of the participants. Perspective: Private healthcare provider Time horizon: 4 months (i.e. children entered the model at 20 months of age and outcomes were assessed at 24 months of age)	Population: Children who were 20 months of age and had not had a gap in health plan membership between 12 and 19 months. Intervention: Computer-generated recall letters, in English and Spanish, including a brochure listing the recommended immunisations and with	Cost difference: $5031 (£5,602 2021 GBP) annual cost of the recall letter policy N=153, annual cost of the recall letter policy per child ~$32.88 (£36.61 2021 GBP) Currency and cost year: USD, 1996 Costs included: Computer program to	Difference in outcomes: 54% of the intervention group and 35% of the control group received the MMR vaccination by 24 months of age. The relative effectiveness of the intervention was 1.55	Incremental analysis: Cost per child appropriately immunised (i.e. receiving the MMR vaccine by age 24 months): $4.04 (£4.50 2021 GBP) Analysis of uncertainty: Sensitivity analyses were performed to evaluate how projected CE varied depending on key assumptions; relative effectiveness, baseline coverage rate, cost of computer time. An alternative scenario was used to

Study	Lieu et al (1997) Computer-generated recall letters for underimmunized children: how cost-effective?			
Discounting: No discounting was applied	an instruction to call the clinic to make an appointment. Comparator: No routine recall letter	identify eligible participants, clerical work, postage, printing, and stationery.	(95% CI [1.28, 1.83]). An additional 4% of the population would receive the appropriate immunisations under the recall letters strategy - giving a coverage of 90% among 24-month-olds. (86% of 24-month-olds were appropriately immunised in another analysis in the same population with no intervention)	project cost-effectiveness of using a telephone autodialer for recall messages instead of letters, with certain costs altered but effectiveness kept constant.
Data sources				
Outcomes: The probabilities of each outcome (immunisation status) were based on the results of the RCT. Quality of life: Quality of life was not included as an outcome Costs: Cost estimates were made based on assumptions. No additional costs were included for clinic visits.				
Comments				
The study was supported by grants from the Vaccine Safety Datalink Project of the National Immunization Program, Centers for Disease Control, and the Norther California Kaiser Innovation Program.				
Overall applicability: Partially applicable				
The study was a cost-effectiveness analysis, using number of children who were appropriately immunised as an outcome rather than QALYs. The study was conducted in US private healthcare provider system. Patients with a health insurance gap between 12-19 months old were excluded, so the patient sample may not be fully representative.				
Overall quality: Potentially serious limitations				
Only costs associated with the intervention were relevant for the study question - therefore costs associated with vaccination were not included (or any further future costs). The assumptions around costs and resource use were unclear. No probabilistic sensitivity analyses were conducted.				

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Appendix H2 – Study quality tables

Non-QALY outcome studies (Children and adolescents)

Reminders (patient)

Dini 2000

Study Identification: Dini et al (2000) The Impact of Computer-Generated Messages on Childhood Immunization Coverage		
Guidance topic: Vaccines in the general population		**Question no: 2**
Checklist completed by: Hannah Lomax		
Section 1: Applicability (relevance to specific review questions and the NICE reference case as described in section 7.5) **This checklist should be used first to filter out irrelevant studies.**	**Yes/partly/no/unclear/NA**	**Comments**
1.1 Is the study population appropriate for the review question?	Yes	
1.2 Are the interventions appropriate for the review question?	Yes	
1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	Partly	US public health clinics
1.4 Is the perspective for costs appropriate for the review question?	No	Only costs associated with the intervention were included in the analysis. Additional costs to the healthcare system were not considered (e.g. cost of vaccination)
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	
1.6 Are all future costs and outcomes discounted appropriately?	No	Discounting was only applied to the start-up costs, the methods used for this were not reported and it is likely that the study means actuarial discounting in this case.
1.7 Are QALYs, derived using NICE's preferred methods, or an appropriate social care-related equivalent used as an outcome? If	No	QALYs were not captured, alternative outcomes were used (completion of immunisation by 24 months of age)

Study Identification: Dini et al (2000) The Impact of Computer-Generated Messages on Childhood Immunization Coverage		
not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.5 above).		
1.8 Overall judgement: **Partially applicable** There is no need to use section 2 of the checklist if the study is considered 'not applicable'		
Section 2: Study limitations (the level of methodological quality) **This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the guideline**	**Yes/partly/no/unclear/NA**	**Comments**
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Partly	The analysis was conducted on the results of the RCT, so long-term outcomes and costs were not considered
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	The outcome is for immunisation status at 24 months of age, and this period is covered in the time horizon
2.3 Are all important and relevant outcomes included?	Partly	The question is focused on uptake of vaccination, but downstream clinical outcomes have not been included
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	Baseline outcomes from the control arm of the study
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	Relative effects were taken from the study
2.6 Are all important and relevant costs included?	Partly	The study only looked at whether children had been immunised or not - not on the health effects of immunisation. Only costs associated with the intervention were included, but vaccination costs were not included.
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: Dini et al (2000) The Impact of Computer-Generated Messages on Childhood Immunization Coverage		
2.8 Are the unit costs of resources from the best available source?	Yes	The costs included in the analysis were those incurred in the study around the interventions
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	No	No sensitivity analyses were conducted
2.11 Has no potential financial conflict of interest been declared?	Unclear	No mention of conflicts
2.12 Overall assessment: **Potentially serious limitations**		

1 **Franzini 2000**

Study Identification: Franzini et al (2000) Cost-Effectiveness of Childhood Immunization Reminder/Recall Systems in Urban Private Practices		
Guidance topic: Vaccines in the general population		**Question no: 2**
Checklist completed by: Hannah Lomax		
Section 1: Applicability (relevance to specific review questions and the NICE reference case as described in section 7.5) **This checklist should be used first to filter out irrelevant studies.**	**Yes/partly/no/unclear/NA**	**Comments**
1.1 Is the study population appropriate for the review question?	Yes	
1.2 Are the interventions appropriate for the review question?	Partly	Mail reminders are relevant, and although the autodialer may be an outdated piece of equipment, similar approaches are likely to still be in use
1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	Partly	US private paediatric practices
1.4 Is the perspective for costs appropriate for the review question?	Partly	Vaccine costs were not included in the analysis
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	
1.6 Are all future costs and outcomes discounted appropriately?	No	3% and 5% discount rates were used for the cost of the autodialer, but this was

Study Identification: Franzini et al (2000) Cost-Effectiveness of Childhood Immunization Reminder/Recall Systems in Urban Private Practices		
		actuarial discounting, and no discounting was used for other costs or outcomes.
1.7 Are QALYs, derived using NICE's preferred methods, or an appropriate social care-related equivalent used as an outcome? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.5 above).	No	Non-QALY outcomes were considered (number of children immunised)
1.8 Overall judgement: **Partially applicable** There is no need to use section 2 of the checklist if the study is considered 'not applicable'		
Section 2: Study limitations (the level of methodological quality) **This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the guideline**	**Yes/partly/no/unclear/NA**	**Comments**
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Partly	The analysis was conducted on the results of the RCT, so long-term outcomes and costs were not considered
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Partly	The trial followed patients for up to thirty days after target immunization due date to record return visit and vaccine delivery status. This is a very short time horizon, and it is unclear whether all differences in vaccination status would be captured.
2.3 Are all important and relevant outcomes included?	Partly	The question is focused on uptake of vaccination, but downstream clinical outcomes have not been included
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	Baseline outcomes from the control arm of the study
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	Relative effects were taken from the study
2.6 Are all important and relevant costs included?	No	Vaccination costs were not included in the analysis - the system was private practices so the vaccination cost is likely to be incurred by the patient/insurer, not the health system

Study Identification: Franzini et al (2000) Cost-Effectiveness of Childhood Immunization Reminder/Recall Systems in Urban Private Practices		
2.7 Are the estimates of resource use from the best available source?	Yes	Resource use was recorded during the study
2.8 Are the unit costs of resources from the best available source?	Yes	Costs were those incurred in the study for equipment and materials, and average staff salaries were used to calculate the costs of staff time
2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	Yes	
2.10 Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	No	Sensitivity analyses were explored around the cost of the autodialer, but no other parameters
2.11 Has no potential financial conflict of interest been declared?	Unclear	No mention of conflicts
2.12 Overall assessment: **Potentially serious limitations**		

1 **Lieu 1997**

Study Identification: Lieu et al (1997) Computer-generated recall letters for underimmunized children: how cost-effective?		
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 study excluded patients with a health insurance gap between 12-19 months old, which may have resulted in the patient sample not being fully representative
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 private healthcare provider
1.4 Is the perspective for costs appropriate for the review question?	Yes	
1.5 Is the perspective for outcomes appropriate for the review question?	Yes	

Study Identification: Lieu et al (1997) Computer-generated recall letters for underimmunized children: how cost-effective?		
1.6 Are all future costs and outcomes discounted appropriately?	Yes	No discounting was applied but the time horizon was only 4 months so this is acceptable
1.7 Are QALYs, derived using NICE's preferred methods, or an appropriate social care-related equivalent used as an outcome? If not, describe rationale and outcomes used in line with analytical perspectives taken (item 1.5 above).	No	Non-QALY outcomes were considered (number of children who were appropriately immunised i.e. received all vaccinations)
1.8 Overall judgement: **Partially applicable** There is no need to use section 2 of the checklist if the study is considered 'not applicable'		
Section 2: Study limitations (the level of methodological quality) This checklist should be used once it has been decided that the study is sufficiently applicable to the context of the guideline	**Yes/partly/no/unclear/NA**	**Comments**
2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	Yes	
2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	Yes	4 months was sufficient to capture the immunisation status and costs associated with the interventions
2.3 Are all important and relevant outcomes included?	Partly	Only outcomes around vaccination status were captured, no downstream clinical outcomes were included - however this is the relevant outcome for the study question
2.4 Are the estimates of baseline outcomes from the best available source?	Yes	Baseline outcomes from the control arm of the study
2.5 Are the estimates of relative intervention effects from the best available source?	Yes	Relative effects were taken from the study
2.6 Are all important and relevant costs included?	No	Only costs associated with the intervention were relevant for the study question - therefore costs associated with vaccination were not included (or any further future costs)
2.7 Are the estimates of resource use from the best available source?	No	It was unclear what assumptions informed the resource use estimates

Study Identification: Lieu et al (1997) Computer-generated recall letters for underimmunized children: how cost-effective?		
2.8 Are the unit costs of resources from the best available source?	No	It was unclear where the costs had come from, as the estimates were made using assumptions
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	Two-way sensitivity analyses were conducted, and a scenario analysis with autodialer messages instead of letters were considered. No PSA was conducted
2.11 Has no potential financial conflict of interest been declared?	Unclear	No mention of conflicts
2.12 Overall assessment: **Potentially serious limitations**		

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Appendix I – Health economic model

The committee noted that it is important that vaccinations in infants and toddlers are given on time and wanted to recommend that a direct conversation should be held with parents/carers if these vaccinations are delayed. These direct conversations would be associated with additional costs for staff time, so a costing exercise was undertaken to estimate the resource impact of this recommendation.

The costing exercise made use of the following assumptions:

- The committee agreed that these direct contacts would likely be a phone call from a GP receptionist in the first instance
  - The time taken for these phone calls was assumed to be the same as a practice nurse telephone triage (6.56 mins, PSSRU; Unit Costs of Health and Social Care 2020)
  - The cost per 6.56 minute appointment with a GP receptionist was estimated as £3.86
    - NHS receptionists are typically paid on the Agenda for Change band 2 or 3. The salary for band 3 administration staff is £19,355 (PSSRU; Unit Costs of Health and Social Care 2020)
    - Assuming the same absolute oncosts, overheads, and capital as stated for a band 4 nurse, and the same staff training and computer decision support software as for a nurse-led telephone triage the total annual cost for a member of administration staff is £55,599 (PSSRU; Unit Costs of Health and Social Care 2020)
    - Assuming a full-time staff member works 1,575 hours per year (PSSRU; Unit Costs of Health and Social Care 2020), the cost per hour is £35.30, and cost per 6.56 minute appointment is £3.86
- The committee indicated that a proportion of those contacted would need a further contact with a practice nurse to address any outstanding concerns
  - The cost per telephone appointment lasting 6.56 minutes with a practice nurse is £7.80 (PSSRU; Unit Costs of Health and Social Care 2020)
  - In the base-case it was assumed that 10% of people required this additional nurse contact, and due to uncertainty around this proportion scenarios in 5% increments up to 20% were also considered
- There are 3 time points for vaccination in the first year of the routine schedule, and the committee agreed that one reminder would be required per time point, and that for most individuals all vaccinations at each time point would happen concurrently
- The average uptake of vaccinations in the first year of life in England is 92.08% (NHS Digital Childhood Vaccination Coverage Statistics 2019-20)
  - Scenarios were considered with uptake rates for the highest and lowest uptake CCGs

Table 19: Vaccine uptake rates

2019-20 rates	% vaccinated by 1st birthday				
	DTaP/IPV/Hib/HepB	Pneumococcal	Rotavirus	MenB	Average uptake
England average uptake rate	92.57%	93.18%	90.09%	92.47%	92.08%
Lowest local authority uptake rate	73.59%	74.81%	70.87%	74.21%	73.37%
Highest local authority uptake rate	98.52%	98.68%	97.58%	98.56%	98.33%

To calculate the additional cost per person vaccinated, the outcomes data from the relevant effectiveness studies comparing phone and letter interventions with letter only interventions

were pooled (Ferson 1995, Vivier 2000). The odds ratio associated with vaccine uptake with the phone plus letter intervention compared with letter only was 2.34 (95% CI: 0.70, 7.83).

For estimating the additional people vaccinated with reminders, the following process was followed:

- The baseline probability of being vaccinated was taken as the uptake rate of the overall population (92.08% as per Table 19), which gives a baseline odds of being vaccinated of 11.62.
- Applying the OR of 2.34, the odds of being vaccinated when receiving the direct contact intervention are 27.20, giving a 96.45% probability of being vaccinated after receiving the phone and letter intervention.
- Using the cost of a phone call from a receptionist plus 10% of cases having an additional nurse phone call (£4.64), the cost per additional person vaccinated when direct telephone contacts are made is £8.40.

The cost per additional person vaccinated in the alternative scenarios is presented in Table 20, and ranges between £6.79 in the CCGs with the highest uptake rates and assuming 0% of people require the additional nurse contact, to £10.93 in the CCGs with the lowest uptake rates, and the assumption that 20% of people would require the additional nurse contact.

Table 20: Cost per additional person vaccinated

Proportion of people requiring the additional nurse phone call	0%	5%	10%	15%	20%
Average England uptake rate	£6.99	£7.69	£8.40	£9.11	£9.81
Lowest uptake rate	£7.79	£8.57	£9.36	£10.15	£10.93
Highest uptake rate	£6.79	£7.47	£8.16	£8.85	£9.53

The committee noted that this telephone follow-up is already standard practice in many areas, and therefore this would not represent a new intervention. This estimated cost-effectiveness is applicable in situations where such phone reminders are not routinely happening.

1 Appendix J – Excluded studies

2 Clinical studies

3 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 opportinities 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

1 **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

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1 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

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