National Institute for Health and Care Excellence

Final

Vaccine uptake in the general population

[A] Evidence review for identification and recording of vaccination eligibility and status

NICE guideline NG218

Evidence review underpinning recommendations 1.1.1, 1.1.2, 1.1.4 to 1.1.6, 1.2.1 to 1.2.12, 1.2.17 to 1.2.19 and 1.2.20 to 1.2.26 in the NICE guideline

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Final

This evidence review was developed by the Guideline Development Team

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1.1 Review question

What are the most effective interventions for identifying and recording a person's vaccination eligibility and status?

What are the barriers to, and facilitators for, identifying and recording a person's vaccination eligibility and status?

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 Gypsy, Roma and Travellers and migrants) have lower levels of vaccination than the general public and additional or different actions may be required to increase their vaccination rates.

Reasons for low uptake may include poor access to healthcare services; inaccurate claims about safety and effectiveness, which can lead to increased concerns and a reduction in the perceived necessity of vaccines; and insufficient capacity within the healthcare system for providing vaccinations. In addition, problems with the recording of vaccination status and poor identification of people who are eligible to be vaccinated may have contributed to this problem. This review is comprised of 2 related parts. It aims to examine the barriers to and facilitators for identifying and recording vaccination eligibility and status, and identify effective interventions to improve these processes with the overall goal of improving vaccine uptake. This review follows the protocol detailed in Appendix A and summarised in Table 1 and Table 2.

1.1.2 Summary of the protocol

Table 1 PICO table for effective interventions for identifying and recording vaccination eligibility and status.

Population	All people who are eligible for vaccines on the routine UK immunisation schedule and staff who are recording and identifying vaccination status
Intervention	Interventions which address problems with identification and recording of a person's vaccination eligibility and status including issues concerning, but not limited to:

	• Data linkage, such as:
	  ○ Integration of identification and/or recording systems
	• Data accuracy, such as:
	  ○ Methods of recording (electronic, such as e-red books, mobile apps or paper, such as red books)
	  ○ Changes to vaccine status coding processes
	  ○ Training of staff to improve the accuracy of recording and coding
	• Data sharing, such as:
	  ○ Changes to the way information about vaccine status is received by the GP or service tasked with recording the information
	  ○ Electronic sharing
	  ○ Data sharing agreements
	  ○ People having access to their own records
	• Resources/tools to help identify eligibility and missed vaccinations, such as
	  ○ Web-based information about vaccination schedules in other countries (e.g. UK and international immunisation schedules comparison tool) and WHO vaccine-preventable diseases: monitoring system.
	  ○ Web-based information to help identify missed vaccinations including the Public Health England algorithms Vaccination of individuals with uncertain or incomplete immunisation status and Screening of individuals with uncertain or incomplete screening status.

Comparators	• Usual approaches to identify and record a person's vaccination eligibility and status • Other interventions to identify and record a person's vaccination eligibility and status
Outcomes	Changes in: • Identification of vaccine eligibility and status • Recording of vaccine eligibility and status • Accuracy and completeness of data records, including administration errors • Vaccine uptake • Offers of vaccination • An individual's knowledge of their own immunisation status • Cost/resource use associated with the intervention

Table 2 SPIDER table for barriers to and facilitators for identifying and recording vaccination eligibility and status

Sample	• People who are eligible for vaccines on the routine UK immunisation schedule and staff who are recording and identifying vaccination status. • Staff including, but not limited to, those providing advice about or administering vaccines and those people with relevant administrative or managerial responsibilities
Phenomenon of interest	Vaccinations on the routine NHS schedule
Design	Studies using qualitative methods: • Systematic reviews of included study designs • Qualitative studies that collect data from focus groups and interviews • Qualitative studies that collect data from open-ended questions from questionnaires/ surveys • Mixed method study designs (qualitative evidence that matches the above study designs only)
Evaluation	Barriers to, and facilitators for, the identification and recording of a person's vaccination eligibility and status in general or in relation to specific interventions, including, but not limited to: • Thoughts, views and perceptions, including knowledge of the vaccination schedule • Factors that could affect acceptability • Factors that could affect accessibility (including accessibility in a timely manner to the relevant people) of the recorded information • Factors that could account for variability in effectiveness

	• Factors that could affect the feasibility of implementation
Research type	Qualitative and mixed methods

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.

The following additional methods apply to this review:

1. This review refers to the UK routine vaccination schedule. The November 2019 schedule was used for these reviews and is available with the current version of the complete routine immunisation schedule.
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. In the qualitative findings in this review, Gypsy, Roma and Travellers, have been abbreviated to GRT to simplify the findings, however the findings apply to all 3 groups unless otherwise specified. (Jackson 2016 and its associated publications looked at the views of all three groups.)
4. The definitions of eligibility and status used in this review are as follows:
   - Vaccine eligibility: the state of having the right (satisfying the appropriate conditions) to be vaccinated on the routine immunisation schedule. This should include consideration of vaccination history, age, pregnancy and disclosed contraindications.
   - Vaccine status: Whether someone has been fully or partially vaccinated or not vaccinated at all.
5. The committee limited the countries included in the evidence review to all OECD (Organisation for Economic Co-operation and Development) countries because less economically developed countries may have different systems in place to record vaccine eligibility and status.
6. 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.
7. The committee noted 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 and therefore studies would not be excluded for using different formulations to the UK.
8. If a qualitative study is looking at barriers and facilitators to uptake for non-specified vaccines, but the country has some differences between its routine vaccine schedule compared to the UK's, then the study may be marked down for indirectness based on the opinion of the guideline committee.
9. Routine vaccination schedules of countries other than the UK will be checked using the WHO vaccine-preventable diseases: monitoring system.
10. The comparisons for the quantitative review include usual approaches used in vaccination programmes. Usual approaches refer to any existing system that was in place to identify and record vaccine eligibility and status at the time the study was carried out.
11. 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.

12. Where no or limited direct evidence was available, indirect evidence was obtained by looking at the NICE guideline on Flu vaccination: increasing uptake. This evidence was limited that covering routine flu vaccination, not vaccination of high-risk groups (that are not covered by the routine schedule) or vaccinations that are purchased privately. Where the flu guideline did not address the review question directly, we referred to any relevant recommendations the flu committee made instead.
13. Due to the shortage of evidence for this review, the flu guideline was checked for relevant references. However, the guideline did not contain an equivalent review question and we were unable to use references from the flu guideline. Instead, the committee looked at the relevant recommendations from the flu guideline itself (see Appendix K).
14. Changes in uptake rates were included for this review in relation to interventions that target identification and recording of eligibility and vaccination status only. This evidence will be cross-referred to from the reviews looking at improving vaccine uptake as necessary, but the studies included here will not be included again in the reviews focusing on different types of interventions to increase uptake.
15. For the qualitative review, information about barriers and facilitators to uptake was only included here where they related to the identification and recording of eligibility and status as a means to improve uptake. Where these studies contain information about uptake that is not related to these issues, these themes have been extracted and analysed as part of the review question about barriers and facilitators to uptake (evidence review B).
16. Additional qualitative evidence was identified as part of the barriers to and facilitators for uptake review (evidence review B) and these studies have been added to the qualitative part of this review. None of the identified studies focused solely on identification and recording of eligibility and vaccination status, however, they contained sections or single themes that fitted the criteria for this review.
17. Since non-randomised trials and cohort studies are assessed for risk of bias using ROBINS-I they could be combined in a meta-analysis with RCTs in GRADE (starting at high quality). However, although the inclusion of these NRS could be used to provide more precise estimates in summary effects they were not combined in the intervention reviews because the NRS are expected to be much larger and may dominate such estimates.
18. Different risk of bias checklists for different study designs 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
19. The line of no effect was used to downgrade for imprecision in GRADE because the committee could not identify any relevant minimally important differences.
20. The interpretations in the GRADE summary of evidence Table 3 are as follows
    - We state that the evidence showed that there is an effect (e.g. increase or decrease) if the 95% 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.
21. A mixed methods summary was made which combined the main qualitative findings with the quantitative results from this review. The qualitative findings were summarised to produce a diagram with key barriers and facilitators to identification and recording of eligibility and status. Where possible links were made between barriers and corresponding facilitators that had been raised in the findings themselves or that were logically linked. So, for example, if a barrier concerned literacy problems and there was quantitative evidence from a study using video information about vaccines then the results of this study were summarised and placed in a box linked to the relevant barrier or facilitator. The quantitative evidence was then 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.

Protocol deviations

The protocol specified that only controlled before and after studies were to be included in the review. Several uncontrolled before and after studies were identified that were directly relevant to this review and due to the lack of evidence for this question, the committee agreed that these studies should also be included. An additional uncontrolled before and after study was also considered from the related NICE guideline NG103 on increasing uptake of flu vaccination but was excluded due to indirectness of the population (see below).

1.1.4 Effectiveness and qualitative evidence

A literature search was conducted which identified 6873 quantitative and qualitative articles. One additional study was included for screening from the flu guideline (see excluded studies for rationale) therefore there were 6874 studies to screen at title and abstract. Of these, 42 potentially relevant studies, (36 quantitative and 6 qualitative studies) were identified after screening the titles and abstracts against the review protocol. Once assessed in full, 6 quantitative studies and 4 qualitative studies were included.

Ten additional qualitative papers were identified as part of the barriers to and facilitators for vaccine uptake review (evidence review B) and included here because they had findings that were relevant to this evidence review. Of those papers, 3 were different publications from the same study (Jackson 2016, Jackson 2017a, Mytton 2020). Therefore, there were 12 qualitative studies in total.

The search was rerun to find newly published references prior to consultation and identified 1449 quantitative and qualitative articles. Of these, 8 potentially relevant quantitative studies were identified after screening the titles and abstracts against the review protocol. No potentially relevant qualitative studies were identified. Once assessed in full, 2 additional quantitative studies were included. There were therefore 8 quantitative studies and 12 qualitative studies included for this review.

1.1.4.1 Included studies

Quantitative evidence

The 8 studies targeted individuals, parents, carers or health care providers (Table 3).

The studies were as follows:

- 3 studies (1 non-randomised controlled trial, 1 non-randomised comparison from an RCT, and 1 cluster non-randomised controlled trial) looked at interventions aimed at individuals, parents and carers. These studies focused on a vaccination status app, personal health records, and active nurse follow-up of vaccination status.
- 5 studies (3 before-and-after studies, and 2 cohort studies) looked at interventions aimed at healthcare providers. These studies focused on electronic or paper records, pharmacist or physician managed annual wellness visits; nurse or physician driven assessments of vaccine eligibility; an immunisation information system, electronic health records, a community pharmacy database and electronic health records with a compulsory vaccination status entry field.

Qualitative evidence

The 12 studies targeted individuals, parents, carers and health care providers (Table 4) and consisted of semi-structured interviews and focus groups. Most of these studies looked at the views of individuals, parents or carers and healthcare providers about vaccinations in general but had sections or themes that fitted in this review. (The findings from the other sections of these studies are included in evidence review B, where relevant, instead.)

The studies were as follows:

- Two semi-structured interview studies focused on vaccination of pregnant women. One aimed to understand the views of midwives and the other healthcare providers about vaccination to help with the design of an intervention to increase vaccine uptake and the other focused on the barriers to implementing maternal vaccine recommendations in Australia.
- Three studies (1 semi-structured and 2 focus group studies) looked at the views of healthcare providers or parents concerning vaccinations for children aged 0-5 years old.
- Three semi-structured interview studies looked the views of parents and adolescents, commissioners or healthcare providers concerning vaccination of young people aged 11-18 years old against HPV.
- Four studies (2 focus group and 2 semi-structured studies) were grouped in a category for studies spanning age groups/ life stages because they focused on views concerning a wider range of vaccinations than could be assigned to a category above. These included:
    - One study with 3 papers (Jackson 2016, Jackson 2017a, Mytton 2020) looking at the barriers to and facilitators of acceptability and uptake of immunisations in Gypsy, Roma and Travellers (Roma gypsies, Scottish showpeople, Irish travellers and English gypsies) and healthcare staff working with them.
    - One study looking at views of nurses, GPs and paediatricians concerning childhood vaccinations.
    - One study looking at the views of Polish and Romanian community members concerning vaccinations in general.
    - One study looking at the views of parents with regards to online immunisation records.

See Table 4 for a summary of the characteristics of these included studies.

The references for included studies are listed in included studies Section 1.1.14

Indirect evidence from NICE guideline NG103 Flu vaccination: increasing uptake

Due to the shortage of evidence the guideline committee decided to include indirect evidence from the related NICE guideline on increasing uptake of flu vaccination (NG103). The flu guideline did not contain a review question on identification or recording of eligibility and status. However, one potentially relevant study (Pollack 2014) was identified and screened at full text, but it was not eligible for inclusion (see below).

1.1.4.2 Excluded studies

The reasons for excluding studies at the full text stage are detailed in appendix J. Common reasons for excluding studies were ineligible study designs, not reporting a relevant intervention, and studies examining selective rather than routine vaccination.

One study (Pollack 2014) from the flu guideline was identified as potentially relevant to this review but was excluded by the committee because it looked at high risk paediatric patients and was therefore not generalisable to vaccines given on a routine schedule.

1.1.5 Summary of included studies

Quantitative evidence

Table 3 Summary of characteristics of included effectiveness studies

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Comparators	Vaccine(s)	Relevant outcomes
Bakare 2007	USA	306	Uncontrolled before and after study	Community inpatient hospital	Acute care inpatients admitted for chronic diseases (>50% were 65 and over; >70% were 50 and over in each group)	Nurse-driven model for assessing vaccination status and eligibility	Physician-driven model for assessing vaccination status and eligibility	Pneumococcal and influenza[3]	Vaccine uptake, identification of vaccine eligibility and status
Hawley 2014	Australia	100	Uncontrolled before and after study	Tertiary maternity hospital	Tertiary maternity care providers	Electronic patient record	Paper handheld record	Pertussis	Accuracy and completeness of data records
Lam 2019	USA	127 for shingles, 118 for pneumococcal	Cohort study	Community pharmacies	People collecting prescriptions and who already had, or were eligible for shingles or pneumococcal vaccine	**Intervention 1:** Regional immunization information system **Intervention 2:** Community pharmacy database	Electronic health record	Shingles, pneumococcal valency 23 and valency 13, Tdap/DTaP (tetanus, diphtheria, pertussis), HepB (hepatitis B), HPV (Human papillomavirus)[4]	Patients who had an immunisation record

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Comparators	Vaccine(s)	Relevant outcomes
O'Mara 1993	Canada	14 centres n=514 children	Cluster non-randomised trial	Childcare centres	Children over 18 months in community childcare	Active follow-up with parents to update records	Regular follow-up to update records (parents left to return information)	Primary series Booster MMR (Measles, mumps and rubella) HIB (Haemophilus influenzae type b)	Vaccine uptake
Orefice 2019	Australia	Before = 275 After = 299	Uncontrolled before -and-after study	Hospital antenatal clinic	Women who gave birth at a hospital. They had attended antenatal clinics beforehand.	Electronic health records with a compulsory antenatal pertussis vaccination field (after)	Electronic health records without a compulsory antenatal pertussis vaccination field (before)	Pertussis	Vaccine uptake
Otsuka 2013	USA	2589	Non-randomised comparison from an RCT*	General internal medicine clinic	Primary care patients over 60 years	B. Electronic message with active personal health record D. Postal message without active personal health record C. Standard care without active personal health record	A. Standard care with active personal health record C. Standard care without active personal health record A. Standard care with active personal health record	Herpes zoster	Vaccine uptake

Author (year)	Country	Sample size	Study design	Setting	Target population for vaccination	Interventions	Comparators	Vaccine(s)	Relevant outcomes
Seeber 2017	Germany	456	Non-randomised controlled	Emergency department and hospital	Parents of children aged 0 to 18 years of age	Parents using a vaccination status app on a tablet.	Parents knowledge of their child's immunisation status from memory.	Tetanus, diphtheria, polio, pertussis, Hib, HepB, mumps, measles, rubella, pneumococcus, rotavirus, HPV[1]	Accuracy of data on immunisation status.
Sewell 2016	USA	108	Cohort study	Medical centre	Adults 65 years old and over	Annual Wellness Visits conducted by 1 pharmacist (includes identification of vaccination status and vaccinations recommended)	Annual Wellness Visits conducted by 3 physicians (includes identification of vaccination status and vaccinations recommended)	Pneumococcal 13 serotypes, pneumococcal 23 serotypes, herpes zoster, influenza, Tdap, Hep B[2]	Offers of vaccination and vaccine uptake

* 4 arm trial with 2 randomised comparisons (A versus B and C versus D) that are not relevant for this review. The comparison of A versus C was not randomised, but was relevant to this review question.

1. We excluded varicella vaccine data from the analysis because it was not on the UK routine vaccination schedule. We also excluded influenza as this is not within the scope of this guideline and the special indication vaccines: HepA, tick-born encephalitis, RSV, tuberculosis, typhoid fever, yellow fever, rabies, cholera, Japanese encephalitis, small pox.

2. We used data for pneumococcal 23 serotypes rather than for 13 serotypes because the former vaccine is used for vaccinations for people aged 65 years and above, whereas the latter is not. We did not include the data for influenza, Tdap or HepB because influenza vaccine is not the subject of this review and Tdap and HepB are not on the routine vaccination schedule for people aged 65 years and over.

3. Data on influenza vaccination was not analysed because this vaccination is not within the scope of the current guideline.

4. We used data for pneumococcal 23 serotypes and shingles. We did not use the data for Tdap/DTaP, pneumococcal vaccine 13 serotypes, HepB and HPV because these vaccines were administered to adults over the age of 18 years, not to children. Therefore, this data was not relevant to the UK vaccination schedule.

Qualitative evidence

Table 4 Summary of characteristics of included qualitative studies

Author	Design and type of analysis	Country	Setting	Sample size	Objective	Population	Vaccine(s)
Bell 2019	Semi-structured interviews with thematic analysis	UK	Community	20 Polish and 10 Romanian immigrants and 20 healthcare workers	To explore vaccination attitudes and behaviours among Polish and Romanian community members in England, and related access to primary healthcare.	Polish and Romanian immigrants and healthcare workers who work with these groups	All vaccines on the UK routine schedule including influenza[1]
Boyce 2012	Semi-structured interviews with thematic analysis	UK	Education and healthcare	80	To confirm or challenge existing findings and identify additional and as yet unidentified issues related to the delivery of the HPV vaccine programme and health inequalities.	School nurses and other health professionals including practices nurses, administrators, civil servants, health visitors and pharmacists	HPV
Evans 2001	Focus groups with grounded theory	UK	Community	48	To investigate factors that influenced parents' decisions about MMR, with emphasis on the impact of the then recent Wakefield MMR controversy.	Parents	MMR
Hansen 2017	Semi-structured interviews with thematic analysis[4]	USA	School-based health centres	40	To examine the acceptability of and facilitators/barriers to HPV vaccination at school-based health centres.	Parents and adolescents	HPV vaccine
Jackson 2016,	Semi-structured	UK	Community (travellers)and	174 travellers, 22 frontline staff and 17	To investigate the barriers to and facilitators of acceptability	Travellers (Roma gypsies, Scottish showpeople, Irish	Focus was on all childhood

Jackson 2017a, Mytton 2020*	interviews with framework analysis		healthcare (staff)	people in strategic roles	and uptake of immunisations among six Traveller communities across four UK cities; and identify possible interventions to increase uptake of immunisations in these Traveller communities that could be tested in a subsequent feasibility study.	travellers and English gypsies) Frontline healthcare staff and people in more strategic roles in the NHS and local government.	vaccines, but the following were also covered: pertussis during pregnancy, the influenza vaccination in pregnancy and for older and at risk adults.[1,2]
Kaufman 2019	Semi-structured interviews with thematic analysis	Australia	Hospitals	12	To understand how midwives think and feel about vaccination to inform design of an intervention to promote uptake of maternal and childhood vaccines.	Midwives	Pertussis
Kitayama 2014	Focus groups with thematic analysis	USA	Community	29	To examine desired characteristics of an online immunisation record for parents from a predominantly Latino, low-income population.	Parents	Childhood vaccinations (not specified)
New 1991	Semi-structured interviews with thematic analysis	UK	Community	253	To explore the reasons underlying missed vaccination appointments and parental knowledge of, and attitudes towards immunisation including the type of advice that parents had received.	Parents	DTaP, IPV, Hib
Paterson 2019	Semi-structured interviews with thematic analysis	UK	Offices of providers and commissioning level service delivery	39[a]	To examine whether service-related factors may have contributed to a downward trend in adolescent girls' HPV vaccination coverage and identify best practices	Immunisation programme commissioners and service providers	HPV

Thomas 2018	Focus groups and semi-structured interviews with thematic analysis	Australia	Community	59	To gain a deeper understanding of the factors influencing immunisation in order to develop tailored strategies for increasing immunisation coverage.	Health service providers (and parents[1])	DTaP, IPV, Hib, HepB, RV, PCV, MenC, MMR
Webb 2014	Semi-structured interviews with thematic analysis	Australia	Tertiary maternity hospital	15	To examine the barriers to implementing maternal vaccine recommendations	Healthcare professionals (GPs, obstetricians and midwives)	Maternal vaccines
Wiot 2019	Focus groups with thematic analysis	UK, India, Germany and USA[3]	Healthcare	75 in total[3] (10 GPs and 10 nurses in the UK; 10 paediatricians, 10 GPs / family physicians and 8 nurses in the USA; 9 paediatricians and 8 GPs in Germany and in India 10 paediatricians)	To investigate perceived gaps between the expectations of healthcare professionals in their role as vaccinators and the reality of the world they operate in.	Nurses, GPs and paediatricians	Childhood vaccinations (not specified)

*Collectively called Jackson 2016 in the rest of the review.

1. Themes specific to influenza vaccination were not extracted as this is covered by another guideline and is out of scope for this review.
2. Where possible the views of high-risk adults eligible for the flu vaccine who are not pregnant, grandparents or parents were not extracted as they do not match the populations of interest for this review.
3. Data was only extracted for the UK staff.
4. Hansen 2017 also reported quantitative evidence from survey data, but this was not included as it does not meet the inclusion criteria of the protocol.

a) 7 immunisation programme commissioners and 32 service providers.

See appendix D for full evidence tables for the effectiveness and qualitative evidence.

1.1.6 Summary of the effectiveness and qualitative evidence

Effectiveness evidence summary table

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

Interventions aimed at individuals, parents and carers

Table 5 Summary of effectiveness findings for interventions aimed at individuals, parents and carers

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: control or before	Absolute risk intervention or after (95% CI)	Interpretation	Quality
NON-RCT: vaccination status app on a tablet versus recall from memory (RR >1 favours vaccination status app) Outcome = accuracy of data on vaccination status							
Tetanus							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.34 (2.03, 2.71)	41 per 100	96 per 100 (83, 100)	Increased with vaccination status app on a tablet.	Low
Diphtheria							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.62 (2.23, 3.08)	36 per 100	94 per 100 (80, 100)	Increased with vaccination status app on a tablet.	Low
Polio							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.66 (2.26, 3.13)	35 per 100	94 per 100 (80, 100)	Increased with vaccination status app on a tablet.	Low
Pertussis							
1 (Seeber 2017)	Non-randomised	456	RR 2.66 (2.26, 3.13)	35 per 100	94 per 100 (80, 100)	Increased with vaccination status app on a tablet.	Low

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: control or before	Absolute risk intervention or after (95% CI)	Interpretation	Quality
	controlled trial						
Hib							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 3.05 (2.53, 3.67)	30 per 100	91 per 100 (76, 100)	Increased with vaccination status app on a tablet.	Low
HepB							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 3.0 (2.51, 3.58)	31 per 100	94 per 100 (79, 100)	Increased with vaccination status app on a tablet.	Low
Mumps							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.29 (1.96, 2.68)	39 per 100	90 per 100 (77, 100)	Increased with vaccination status app on a tablet.	Low
Measles							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.32 (1.99, 2.71)	39 per 100	91 per 100 (78, 100)	Increased with vaccination status app on a tablet.	Low
Rubella							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.37 (2.03, 2.77)	39 per 100	92 per 100 (79, 100)	Increased with vaccination status app on a tablet.	Low
Pneumococcus							
1 (Seeber 2017)	Non-randomised	456	RR 3.75 (3.03, 4.65)	24 per 100	90 per 100 (73, 100)	Increased with vaccination status app on a tablet.	Low

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: control or before	Absolute risk intervention or after (95% CI)	Interpretation	Quality
	controlled trial						
Meningococcus							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 3.6 (2.89, 4.48)	24 per 100	85 per 100 (69, 100)	Increased with vaccination status app on a tablet.	Low
Rotavirus							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.56 (2.20, 2.98)	38 per 100	98 per 100 (84, 100)	Increased with vaccination status app on a tablet.	Low
HPV							
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.28 (2.00, 2.61)	44 per 100	99 per 100 (87, 100)	Increased with vaccination status app on a tablet.	Low
Standard care with active personal health record versus standard care without active personal health record (RR >1 favours active PHR)							
Vaccine uptake, 65+ years old							
1 (Otsuka 2013)[1]	Non-randomised comparison from an RCT	2089	RR 2.78 (1.59, 4.68)	2 per 100	5 per 100 (3, 8)	Increased with active personal health record.	Low
Active verses regular nurse follow-up of vaccination status for preschool children attending childcare centres (RR >1 favours active follow-up)							
Uptake, 0-5 years, primary series (general vaccinations)							
1 (O'Mara 2013)	Cluster NRT	514	RR 0.91 (0.35, 2.34)	5 per 100	4 per 100 (2, 11)	The study could not differentiate change in vaccine uptake between active or regular approaches to nurse follow-up.	Very low
Uptake, 0-5 years, booster (general vaccinations)							

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: control or before	Absolute risk intervention or after (95% CI)	Interpretation	Quality
1 (O'Mara 2013)	Cluster NRT	514	RR 1.30 (0.67, 2.52)	7 per 100	10 per 100 (5, 19)	The study could not differentiate change in vaccine uptake between active or regular approaches to nurse follow-up.	Very low
Uptake, 0-5 years, MMR							
1 (O'Mara 2013)	Cluster NRT	514	RR 1.89 (0.90, 3.97)	5 per 100	10 per 100 (5, 20)	The study could not differentiate change in vaccine uptake between active or regular approaches to nurse follow-up.	Very low
Uptake, 0-5 years, Hib							
1 (O'Mara 2013)	Cluster NRT	514	RR 1.17 (0.72, 1.90)	13 per 100	16 per 100 (10, 26)	The study could not differentiate change in vaccine uptake between active or regular approaches to nurse follow-up.	Very low

1. The study included 4 arms; electronic message with active PHR, standard care with active PHR, postal message without PHR and standard care without PHR, but was randomised as 2 blocks (+/- PHR).

Interventions aimed at healthcare providers

Table 6 Summary of effectiveness findings for interventions aimed at healthcare provider

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: before or 2nd intervention	Absolute risk: after (95% CI) or 1st intervention	Interpretation	Quality
NON-RCT: Electronic records (after) versus paper handheld records (before) for pregnant women attending maternity unit (RR >1 favours electronic records)							
Pregnant women. Outcome – Completeness of documentation for pertussis vaccinations							
1 (Hawley 2014)	Before and after study	100	RR 7.09 (4.04, 12.45)	12 per 100	83 per 100 (47, 100)	Increased with electronic records.	Low
NON-RCT: Regional immunisation information system versus electronic health records (RR >1 favours immunisation information system)							
65+ years old. Outcome – Patients who had an immunisation record for shingles							
1 (Lam 2019)	Cohort study	127	RR 0.22 (0.13, 0.28)	51 per 100	11 per 100 (7, 18)	Increased with electronic health records.	Low

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: before or 2nd intervention	Absolute risk: after (95% CI) or 1st intervention	Interpretation	Quality
65+ years old. Outcome – Patients who had an immunisation record for pneumococcal							
1 (Lam 2019)	Cohort study	118	RR 0.17 (0.10, 0.28)	66 per 100	11 per 100 (7, 19)	Increased with electronic health records.	Low
NON-RCT: Community pharmacy database versus electronic health records (RR >1 favours community pharmacy database)							
65+ years old. Outcome – Patients who had an immunisation record for shingles							
1 (Lam 2019)	Cohort study	127	RR 0.03 (0.01, 0.12)	51 per 100	2 per 100 (1, 6)	Increased with electronic health records.	Low
65+ years old. Outcome – Patients who had an immunisation record for pneumococcal							
1 (Lam 2019)	Cohort study	118	RR 0.01 (0.00, 0.09)	66 per 100	1 per 100 (0, 6)	Increased with electronic health records.	Low
NON-RCT: Regional immunisation information system versus community pharmacy database (RR >1 favours immunisation information system)							
65+ years old. Outcome – Patients who had an immunisation record for shingles							
1 (Lam 2019)	Cohort study	127	RR 7.00 (1.62, 30.17)	2 per 100	11 per 100 (3, 48)	Increased with immunisation information system.	Low
65+ years old. Outcome – Patients who had an immunisation record for pneumococcal							
1 (Lam 2019)	Cohort study	118	RR 13.00 (1.73, 97.79)	1 per 100	11 per 100 (1, 83)	Increased with immunisation information system.	Low
NON-RCT: Electronic health records with a compulsory vaccination status entry field (after) versus electronic health records (before) (RR >1 favours electronic health records with a compulsory vaccination status entry field)							
Pregnant women. Outcome – Uptake of pertussis vaccine							
1 (Orefice 2019)	Before-and-after	574	RR 1.73 (1.54, 1.95)	53 per 100	92 per 100 (82, 100)	Increased with compulsory vaccination field.	Low
NON-RCT: Pharmacist managed annual wellness visits versus physician managed annual wellness visits (RR >1 favours pharmacist managed)							
Offers to vaccinate with pneumococcal vaccine							
1 (Sewell 2016)	Cohort study	108	RR 4.68 (1.02, 21.45)	3 per 100	16 per 100 (3, 72)	Increased with pharmacist managed annual wellness visits	Low
Uptake of pneumococcal vaccine							

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: before or 2nd intervention	Absolute risk: after (95% CI) or 1st intervention	Interpretation	Quality
1 (Sewell 2016)	Cohort study	108	RR 7.03 (1.26, 39.21)	2 per 100	16 per 100 (3, 88)	Increased with pharmacist managed annual wellness visits	Low
Offers to vaccinate with herpes zoster vaccine							
1 (Sewell 2016)	Cohort study	108	RR 8.20 (2.66, 25.23)	4 per 100	12 per 100 (12, 100)	Increased with pharmacist managed annual wellness visits	Low
Uptake of herpes zoster vaccine							
1 (Sewell 2016)	Cohort study	108	RR 2.34 (0.22, 24.53)	2 per 100	5 per 100 (0, 55)	The study could not differentiate change in uptake between pharmacist managed annual wellness visits or physician managed annual wellness visits	Very low
NON-RCT: Nurse driven (after) versus physician driven (before) assessment of eligibility for pneumococcal vaccine (RR > favours nurse driven assessment)							
Outcome – vaccine uptake							
1 (Bakare 2007)	Before and after study	306	RR 2.05 (0.40, 10.42)	1 per 100	3 per 100 (1, 15)	The study could not differentiate change in vaccine uptake between physician-driven and nurse-driven assessment.	Very low
Outcome – Identification of vaccine eligibility and status							
1 (Bakare 2007)	Before and after study	306	RR 1.93 (0.88, 4.23)	7 per 100	14 per 100 (6, 31)	The study could not differentiate change in Identification of vaccine eligibility and status between physician-driven and nurse-driven assessment	Very low

Qualitative evidence summary table

Table 7 Summary of barriers to and facilitators for the identification and recording of vaccination status of pregnant women

Studies	Finding	Illustrative quotes (where available)	CERQual explanation	Confidence
No designated place in electronic medical records to document vaccinations				
1 (Webb 2014)	Healthcare practitioners agreed that there was no designated place in the electronic medical record to mention pertussis vaccines. Maternal vaccines were not included as a discussion point in the South Australian Pregnancy Record (SAPR). In those cases where vaccination was recommended, there was no mechanism for documenting the response or following up.	"But there isn't a tick box or something in the handheld record even. So the handheld record could have a box where it could be ticked influenza vaccine as a prompt. Because I might see somebody once in their pregnancy and they could see a different person every time".1 (Midwife, Webb 2014)	Downgraded once for relevance and twice for adequacy	Very low
Identification of eligible women and recording of vaccination				
1 (Kaufman 2019)	Midwives said that they would have liked to have had a sticker in the pregnant women's medical records that prompted aspects of discussion and recorded whether the vaccination was done.	None	Downgraded once for adequacy	Moderate
1 (Kaufman 2019)	Midwives said that they were proactive in identifying suitable pregnant women who should have been vaccinated and discussed vaccines with them.	None	Downgraded once for adequacy	Moderate

Table 8 Summary of barriers to and facilitators for the identification and recording of vaccination status of babies and children aged 0-5 years old

Studies	Finding	Illustrative quotes (where available)	CERQual explanation	Confidence
Missing medical records				
3 (Evans 2001, New 1991, Thomas 2018)	Parents and staff working in obstetrics and gynaecology departments said that missing vaccination histories, missing medical records and illegible entries can waste time and resources. For example, children can be given too many doses of vaccine.	None	Downgraded once for adequacy	Moderate

Table 9 Summary of barriers to and facilitators for the identification and recording of vaccination status of young people aged 11-18 years old

Studies	Finding	Illustrative quotes (where available)	CERQual explanation	Confidence
Fragmentation of care impacting record accuracy				
1 (Hansen 2017)	Some parents expressed desires to maintain their child's medical records in one location and feared that receiving vaccines at multiple locations, such as both the primary care provider's office and school-based health centres (SBHCs), would disrupt record keeping. Parents had concerns about completing the 3-dose HPV vaccine series as records might be inaccurate, and result in daughter receiving an unnecessary, extra dose.	"…sometimes they mess things up. Nobody's perfect. I certainly wouldn't want somebody to mess up with my kid. Maybe they are thinking they are giving her the first shot, and it is actually the second shot. No, I don't like it, it is confusing." (Parent)	Downgraded twice for adequacy	Low
Problems with databases				
2 (Boyce 2012, Paterson 2019)	Many school nurses reported problems with the accuracy of the lists of girls to vaccinate that were provided by the local education authority (or its equivalent). The type of information supplied was also inconsistent making it harder to know who had been offered vaccination or to contact the families of girls who were not in school.	None	Downgraded twice for adequacy	Low
1 (Paterson 2019)	The movement of girls between schools and areas made it hard to ensure that they received both doses of the HPV	None	Downgraded twice for adequacy	Low

Studies	Finding	Illustrative quotes (where available)	CERQual explanation	Confidence
	vaccination. Providers who used a 1-year delivery model reported less disruption to the vaccination schedule.			
1 (Paterson 2019)	Inputting and cleaning data in database systems was highlighted as labour intensive, especially the parts of the data management system that are not yet automated.		Downgraded twice for adequacy	Low
Automated databases and communication				
1 (Paterson 2019)	Automated database systems prevented delays between records appearing on GP or school provider servers by using bulk processing to increase efficiency. They reduced inaccuracies in data monitoring that could lead to missed or duplicated vaccinations. Data inaccuracies also arose when GPs did not send updated vaccination records to CHIS in a timely fashion.	None	Downgraded twice for adequacy	Low
1 (Paterson 2019)	Real-time database systems helped manage keeping track of the movement of girls between schools and areas, as did troubleshooting meetings between commissioners, Child Health Information Services (CHIS) leads and service providers, and regular communication with General Practice.	None	Downgraded twice for adequacy	Low
Updating records				
1 (Hansen 2017)	Parents expressed desires to be notified of vaccination so they could update their records.	"Well, as far as they notify me they need to get the shot it's no problem…I need to put it down in the records so I make sure they got everything up to date." (Parent, Hansen 2017)	Downgraded twice for adequacy	Low

Table 10 Summary of barriers to and facilitators for the identification and recording of vaccination status identified from studies spanning multiple age/ life stage categories

In the following table Gypsy, Roma and Travellers have been abbreviated to GRT to simplify the findings, however these apply to all 3 groups unless otherwise specified.

Studies	Finding	Illustrative quotes (where available)	CERQual explanation	Confidence
Recording vaccinations takes time				

Studies	Finding	Illustrative quotes (where available)	CERQual explanation	Confidence
1 (Wiot 2019)	Health care practitioners noted that vaccination recording was a complicated process that could take longer than the vaccination itself. Reducing the logistical burden of recording and improved sharing of patient information would help make vaccinations easier for staff to carry out.	None	Downgraded twice for adequacy	Low
What parents of children aged 0-18 years thought about online immunisation records				
1 (Kitayama 2014)	Parents said they liked to see what vaccines their children had already had and what vaccines their children should be having (whether they were up to date). They liked the information on the vaccines that was included.	"If they are missing any vaccinations, how many they've had." (Parent, Kitayama 2014)	Downgraded once for relevance and twice for adequacy	Very low
1 (Kitayama 2014)	Parents said that using an online immunisation record was relatively easy, fast, convenient, and saves time. They liked being able to print out the information so they could show the information to people who needed to know. They liked being able to print out vaccination reminders for themselves.	"You can do a lot of things automatically. It saves a lot of time." (Parent, Kitayama 2014)	Downgraded once for relevance and twice for adequacy	Very low
1 (Kitayama 2014)	Many parents said they had misgivings about protecting privacy with regards to having details about their children online.	"Parents like their privacy so you have to emphasize that." (Parent, Kitayama 2014)	Downgraded once for relevance and twice for adequacy	Very low
What further features parents of children aged 0-18 years wanted to see for online immunisation records				
1 (Kitayama 2014)	Parents suggested safeguards to ensuring confidentiality, including password verification and limited access to the online record. Parents said that many immigrant parents were scared – it should be noted on the online immunisation record that immigration status was confidential.	"I think that sometimes you have in the computer, you have to have your personal – lock? . . . only you can see it." (Parent, Kitayama 2014)	Downgraded once for relevance and twice for adequacy	Very low
1 (Kitayama 2014)	Some parents were interested in extending access to their child's school and doctor's office, whereas others were adamant about exclusive access remaining with the parent.	"No, I'm saying I would recommend something maybe in three different places: school, doctor's office and at home . . . because a lot of parents don't have computers." (Parent, Kitayama 2014)	Downgraded once for relevance, and twice for adequacy	Very low
1 (Kitayama 2014)	Parents said they would have liked information on what disease(s) each vaccine aimed to prevent. They said that they would have liked the information to be available in a choice of languages – not just English. They would have liked	"And why they gave each immunization, what it's for, you know, if they give you a shot,	Downgraded once for relevance and twice for adequacy	Very low

Studies	Finding	Illustrative quotes (where available)	CERQual explanation	Confidence
	the information to have been presented in a simple, jargon-free way.	what the function of it is." (Parent, Kitayama 2014)		
1 (Kitayama 2014)	Parents said that they would have liked face-to-face training or an information guide on how to use the online immunisation record.	"An information guide on how to arrive at the point . . ." (Parent, Kitayama 2014)	Downgraded once for relevance and twice for adequacy	Very low
Lack of documentation, including for migrants and Gypsy, Roma and Travellers				
2 (Jackson 2016, Bell 2019)	Inaccurate or undocumented vaccination history may be barrier to accurate record keeping and identification of eligible people. Health care practitioners noted that families coming to the UK with children may not bring vaccination records from their home countries. In addition, Polish and Romanian immigrants may go home for vaccinations and do not necessarily provide this information to UK health services on their return.	None	Downgraded once for adequacy	Moderate
Gypsy, Roma and Traveller specific issues				
2 (Jackson 2016, Wiot 2019)	The lack of centralised records was seen to be a problem because vaccinations in one setting are not necessarily accessible to staff in other places and the GP practice may not be informed. This was raised by a staff concerning vaccination of GRT. In addition, other health care practitioners thought that the lack of centralized record system was also problematic when people moved within the UK and that obtaining a vaccination history in this situation is an unnecessary waste of consultation time.	None	Downgraded once for adequacy	Moderate
1 (Jackson 2016)	Collaboration between health providers, schools and Initiatives such as GRT Education Services were raised by healthcare providers as being helpful in enabling them to identify children and young people who have missed their vaccinations and follow up with their families, however this service is no longer funded in some areas.	None	Downgraded once for adequacy	Moderate
1 (Jackson 2016)	A number of strategies were used to identify GRT eligible for vaccination. These included: using the postcodes of GRT sites and common Roma surnames to try to identify people in GP records; using CHIS across regions to check vaccination status; verbal handovers between health practitioners to keep	None	Downgraded once for adequacy	Moderate

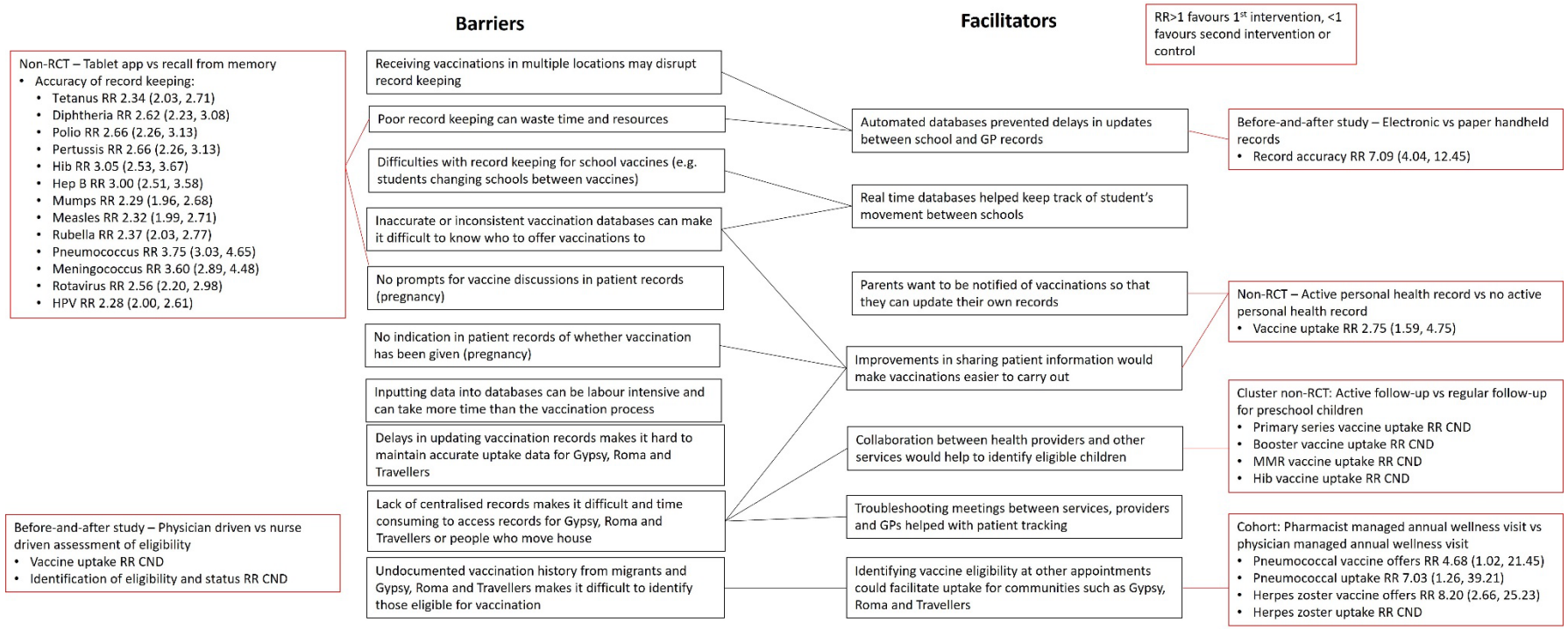
Studies	Finding	Illustrative quotes (where available)	CERQual explanation	Confidence
	track of families and using flags on Roma GP records to help identify them.			
1 (Jackson 2016)	Delays in recording vaccinations carried out in different settings in CHIS and GP records made it hard to maintain accurate immunisation uptake data for GRT. The time lag from administering an immunisation in a GP practice or school and it being recorded on the CHIS system, or in informing GP practices of immunisations given in hospital could be a problem for GRT who have may have moved on before records are updated.	None	Downgraded once for adequacy	Moderate
1 (Jackson 2016)	The lack of accurate, consistent methods of recording GRT identity in medical records makes it hard to assess uptake in these communities and target funding and services appropriately. Some staff also worry that recording this information could be seen to be discriminatory.	None	Downgraded once for adequacy	Moderate
2 (Jackson 2016, Wiot 2019)	Opportunistic identification of eligibility and discussions of vaccinations when attending other appointments for long term health conditions or general healthcare were viewed favourably by GRT and could facilitate vaccine uptake for their community and others. However, nurse vaccinators were concerned that other providers (such as pharmacists) would not adhere to the same care practices nor engage in appropriate clinically relevant discussions with patients. They were also concerned about the logistics of managing vaccination targets if vaccine responsibilities were shared.	None	Downgraded once for adequacy	Moderate

See Appendix F for full GRADE and/or GRADE-CERQual tables.

Mixed methods summary of the quantitative and qualitative evidence

The findings in the diagram are those that were considered to be the most important from the qualitative evidence relating to recording vaccine eligibility and status in Table 7 to Table 10. Possible links between barriers and corresponding facilitators are shown in the diagram, with the quantitative evidence mapped onto the related qualitative findings.

Figure 1 Diagrammatic summary of the barriers and facilitators to the identification and recording of vaccine eligibility and status mapped onto the facilitators they relate to and the quantitative evidence.. RR= risk ratio, CND = could not differentiate, non-RCT = non-randomised controlled trial. For other study types that are not RCTs, the specific study design is stated in the diagram**.**



1.1.7 Economic evidence

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

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

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

1.1.7.1 Included studies

None of the 11 studies identified in the systematic review looked at interventions for identification and recording of vaccination eligibility and status.

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 Economic model

No economic modelling was conducted for this review question.

1.1.9 The committee's discussion and interpretation of the evidence

1.1.9.1. The outcomes that matter most

This evidence review includes both qualitative and quantitative outcomes.

The committee agreed that the main aim of this guideline is to increase vaccine uptake in the general population, so therefore the key quantitative outcome was an increase in uptake. However, to achieve this, it is necessary to have accurate records about whether someone has been vaccinated to determine their eligibility to be vaccinated. Following vaccination, it is important to record the details accurately to avoid unnecessary repeat vaccinations amongst other issues. Therefore, other important outcomes for this review question were changes in identification or recording of vaccine eligibility and status, and accuracy and completeness of data records. However, only 1 study reported the former and only 2 studies reported results for the latter outcome, while most included studies reported changes in vaccine uptake. Finally, only 1 study reported offers of vaccination.

The committee agreed that it is also useful for an individual to know their own (or their family's/person being cared for) immunisation status because this informs and empowers them to be able to seek vaccinations if they are aware that they have been missed/due. If a health practitioner asks them about their vaccine status, they would also be well informed and able to respond. No evidence was identified for this outcome.

For the qualitative review, the committee agreed that the most important themes identified related to:

- the parent's wish to keep update records following vaccinations
- parental and healthcare provider concerns that accurate record keeping is hampered by a fragmented system that both provides vaccinations and records them in multiple places.
- documentation problems for migrant and GRT vaccination histories and problems with the identification of GRT who are eligible for vaccination.

However, they noted that there was limited qualitative evidence and that other important themes may have emerged had there been more evidence.

The opinions of individuals being targeted for vaccination or their parents/carers (where relevant) were considered to be very important as they make the final decisions about whether to be vaccinated or vaccinate a child or other dependent. Where their views about barriers or facilitators differed from healthcare staff the views of the individual or parent/carer were considered to be more important if they were related to issues affecting these people directly. However, where findings related to systems or processes that were areas of staff expertise the views of the healthcare staff were prioritised but the views of individuals being targeted for vaccination remained important.

1.1.9.2 The quality of the evidence

Quantitative evidence

Five studies reported change in vaccine uptake (Bakare 2007, O'Mara 1993, Orefice 2019, Otsuka 2013, Sewell 2016). Bakare 2007 also reported identification of eligibility, while Hawley 2014 and Seeber 2017 reported change in accuracy and completeness of data records. Sewell 2016 also reported offers of vaccination. The evidence for these outcomes ranged from low to very low quality. The committee noted that the included studies differed in type, setting and interventions and agreed that, as a result, no meta-analysis was possible.

A single four arm RCT (Otsuka 2013) was included in the review, but its paired randomised comparisons of email or postal alerts for people with incomplete herpes zoster vaccination records versus standard care (with/without active health records) was judged by the committee to be more relevant for a later review, which will focus on other interventions to increase uptake (including methods of contact). However, the committee agreed that a non-randomised comparison between standard care groups with and without active personal health records was relevant to this review and therefore the study was retained as part of the evidence base. The quality of the evidence from this comparison was low due to the high risk of bias resulting from the lack of randomisation and the imbalanced baseline characteristics between the people with the active personal health records compared to those without. The committee agreed that although this study included people over 60 years old rather than 65 years old for herpes zoster vaccination it was not necessary to downgrade for indirectness because they did not expect that the effectiveness of the intervention would be different between these age groups.

The remaining studies were all judged to provide very low quality evidence, mainly due to the studies being at high risk of bias. In addition, Bakare 2007 was downgraded once for indirectness because it looked at pneumococcal vaccination for people admitted to an acute care hospital rather than people who are 65 and over as in our routine schedule. Since over 50% of the participants in each comparison group were 65 or over, and over 70% were 50 and over this study was downgraded rather than being excluded.

Bakare 2007 and Sewell 2016 looked at interventions that involved using different people to identify vaccine eligibility and status rather than interventions aimed at improving these processes. As such they could have been included in the infrastructure review under

organisation of systems (evidence review G). However, the committee agreed that these studies could remain in this review as they reported relevant outcomes and there was a shortage of quantitative evidence for this review.

The committee discussed the shortage of evidence concerning interventions to address identifying and recording of vaccination eligibility and status. They expected that more evidence would emerge from multicomponent intervention studies aimed at increasing uptake as these were likely to include components to improve these processes. However, although some of the studies identified as part of the other reviews for this guideline included an identification component (for example, as part of a study looking at opportunistic vaccination or reminders that vaccinations were due or overdue) the method of identification was not reported in detail and was used as a process to facilitate the intervention rather than being an active part of the intervention. Therefore, the committee were unable to draw any conclusions regarding the identification and recording or eligibility and status from these studies.

Due to the shortage of evidence the guideline committee decided to consider including indirect evidence from the related NICE guideline on increasing uptake of flu vaccination (NICE guideline NG103). One uncontrolled before and after study (Pollack 2014) was identified, but it was excluded from this review because the committee agreed that since the study covered high risk paediatric patients, it was not useful in informing recommendations for vaccines on the routine schedule. No other relevant evidence was identified from the flu guideline and the committee decided against looking for more evidence by updating any of the flu searches as they were not judged to be sufficiently relevant to this review question.

Qualitative evidence

The evidence base was comprised of 12 qualitative studies; 8 were semi-structured interviews and 4 were focus groups. All were judged to have low levels of methodological concern except for Webb 2014, which had issues with data collection. Most of the studies were judged to be highly relevant, although the finding from Webb 2014 was downgraded once (see below) and Kitayama 2014 was downgraded once as the ages of the children whose parents had been recruited were unclear. The confidence of the findings ranged from moderate to very low with downgrading for adequacy mainly due to the finding being based on single or very few studies that provided evidence that was not very rich or detailed for the topic of interest.. Most of the studies were not focused on identification and recording of eligibility and status but rather on general views about vaccination, although they did include small numbers of findings that were relevant for this review. However, Kitayama 2014, which aimed to examine desired characteristics of an online immunisation record for parents from a predominantly Latino, low-income population, was specific to this review.

One study (Hansen 2017) was conducted in the United States and examined the acceptability and barriers and facilitators to providing HPV vaccination in school-based health centres. While the committee agreed that this study was less applicable in general to the UK as HPV vaccinations are currently offered in schools, they noted that the findings were relevant to the UK and so this study was not downgraded for relevance. The committee noted that while vaccinations are offered in schools in the UK, there are concerns as to how and when to notify GP surgeries of this, and this may differ nationally. They also noted that there are problems with the identification, offer and recording of HPV vaccinations in relation to children who are home-schooled or out of mainstream schooling.

Webb (2014) examined the views of healthcare professionals on maternal vaccines in Australia, but the committee noted that the theme reported (incomplete documentation for pertussis vaccination) is not generalisable to the UK as the UK has a national maternity register. Therefore, the finding was downgraded once for relevance, resulting in very low confidence for this finding.

1.1.9.3 Advantages and disadvantages

The committee discussed the quantitative evidence and agreed none of these studies were of value in informing recommendations for this review question, apart from Orefice 2019 and Seeber 2017 (see below). However, they agreed that these studies were relevant to this review question and should be retained. They noted that although uptake was increased with an active (electronic) personal health record (PHR) (Otsuka 2013) or an electronic patient health record (Hawley 2014) compared to no PHR or a paper record respectively, the quality of the evidence was low to very low and was therefore not considered useful in determining the effectiveness of electronic personal health records for increasing uptake (or for identifying and recording vaccine eligibility and status). Where the evidence was separated by types of vaccine, the effect sizes were similar between different vaccines. As a result, the committee did not think it was necessary to provide different recommendations for different vaccines.

The committee agreed that while improving the identification and recording or eligibility and status was likely, but not guaranteed, to improve vaccine uptake, it was very unlikely that interventions aimed at improving these issues would have harmful side effects for the individual being vaccinated. Therefore, the advantages of improving the accuracy and completeness of data records; the identification of eligibility; the recording offers and administration of vaccines, and the updating of records following immunisation would likely outweigh any disadvantages to the individual. However, these improvements could be time and resource consuming for the NHS and would need to be associated with increased vaccine uptake to be beneficial to society overall.

The committee discussed the problems associated with the identification and recording of eligibility and status. They identified the following issues:

- a lack of someone with responsibility for ensuring that ensuring that vaccination records are validated and updated and for identifying people who are eligible for vaccination
- fragmented systems that do not communicate information (lack of data linkage)
- lack of standardised data coding, misleading terminology in records, inaccurate recording (poor data accuracy)
- lack of sharing of data between systems and providers, and individuals (poor data sharing).

Some of these issues were also reflected in the qualitative evidence (see Figure 1 for a summary of these barriers and facilitators).

They divided the processes involved in the identification and recording of eligibility and status into the following sections to help with making recommendations: accuracy and completeness of data records; identification of eligibility; recording offers and administration of vaccines; and reporting vaccinations to primary care and CHIS.

The committee noted that there are vaccine related NHS England enhanced service specifications for GP contracts. The committee considered generic (recommendations common to multiple specifications) and specific recommendations (referring to individual vaccines) from the enhanced service specifications covering pneumococcal, pertussis and shingles vaccinations. They agreed that recommendations contained within these documents covering accuracy and completeness of records, identification of eligibility, recording offers and updating records were relevant and generalisable to other vaccines on the routine schedule. Please see below for more information about how these specifications were used to help the committee make recommendations.

Accuracy and completeness of data records

The committee discussed current problems with data accuracy and completeness. In particular, they were aware that certain areas of the country appeared to have very low vaccination rates, but when records were cleaned by removing people who had moved away

and updated to accurately reflect vaccinations administered, the vaccination rate improved to acceptable levels. This highlighted the need to frequently check for discrepancies between local and national records concerning individuals' vaccine status and update the records accordingly and also ensure that new vaccinations are recorded in a timely manner. The committee identified that one of the key issues affecting the ability to update records accurately and in a timely manner is the lack of compatibility between systems used by different providers to record vaccination status. This can make it difficult to coordinate the flow of information between different systems to facilitate the update of vaccination records. They therefore decided to include a recommendation that highlights the importance of improving the compatibility of these systems to avoid these issues in future. In addition, if compatible systems are in place to enable the sharing of information between different parts of the health and care system then this will also make it easier for staff in these systems to check vaccination status opportunistically and for other providers, such as community pharmacies, to record the vaccinations they deliver. Updating these systems may take time and so the committee recommended that compatible processes could also be used. This means that even if information cannot be directly transferred between systems, providers can record vaccination data in a way that can be easily understood by other providers and used to accurately update their records.

The committee noted that child health information service (CHIS) departments across the country have responsibilities for maintaining vaccination records for 0-19 year olds and the current (2020) GP contract also includes maintaining up to date immunisation records. They were also aware that there can be differences in the way that CHIS and GP practices report vaccination data, and that it is crucial that they understand each other's reporting systems and processes to facilitate the efficient updating of vaccination records. Taking these responsibilities into account and using their experience and expertise, the committee made a series of consensus recommendations. They agreed that when CHIS receives new information about a person's vaccination status, they should ensure that these records are updated within 5 days or within service specifications if they exist, whichever is shorter. They agreed that it is important that when GP surgeries receive notification that vaccinations have been carried out by other vaccination providers, they update their vaccination records to reflect this in a timely manner. The committee agreed that this would ideally occur within one week but may take longer (up to 2 weeks) if a large number of records arrive at once. However, they agreed that should the GP contract specify another time frame then this should be followed instead if it is shorter.

The committee agreed that a named lead within the GP surgery should be identified to ensure that someone would be responsible for completing this process or supervising the completion of this process. In their experience, in the absence of a named lead important vaccination related tasks may not be completed due to time constraints and competing priorities. The committee noted that the need for a named lead was wider than just to ensure that records were kept up to date and validated (see below) in GP practices. They agreed that there also needs to be a named lead in each organisation that coordinates, provides or organises vaccinations with responsibility for identifying people who are eligible for vaccination, sending invitations and reminders, administering vaccinations or coordinating with vaccine providers, ensuring that there is coordination between different reporting systems and ensuring that best practice is followed for the ordering, storage and disposal of vaccines. They made a consensus recommendation to reflect these points and the one above about GP practices and CHIS needing to understand each other's reporting systems and processes. They also made a recommendation to highlight the importance of commissioners and providers making sure that these leads have access to the necessary information and facilities they need to ensure they can succeed in their roles.

The committee also noted that record keeping in primary care may be both incomplete and inconsistent due to the use of old coding templates, some of which have a variety of clinical codes for the same vaccination leading to confusion and inaccurate record keeping. They agreed that it is important to use up to date templates, including accurate SNOMED CT

codes, and that these are easy to complete accurately. In addition, they recognised that there need to be policies in place to ensure that the people recording the immunisation are able to use the templates correctly.

Another key step to ensure that records are accurate involves validating them against other data sources where they exist (for example, notifications from CHIS departments) to ensure that the list of registered people and the information about their vaccination eligibility and status is correct and complete (for example, that people have not moved into or out of the area) and that any discrepancies are investigated and resolved.

The committee discussed how frequently this process would need to be repeated and agreed that this should be completed at least monthly to ensure the records are up to date. They recognised that this would place an increased initial burden on primary care providers, but that over time the workload would decrease as fewer changes will be required. For this validation process to be possible for 0-19 year olds, the committee noted that GPs need to receive regular vaccine notifications from the CHIS departments and agreed that this bulk transfer of information should take place monthly. CHIS departments routinely send information about unvaccinated children each month and these lists can also be used to help in targeting these children for vaccination invitations or reminders and opportunistic vaccination. The committee also discussed the importance of GP practices informing CHIS if 3 invites or reminders have been sent when a child or young person is eligible for vaccination, but they remain unvaccinated. This will provide CHIS with information about families that may need further follow-up or support to enable a child or young person to be vaccinated. If GP practices are aware of the reason that the child or young person has not been vaccinated then this could also be shared with CHIS, as different follow-up strategies may be needed depending on what this reason is.

The qualitative evidence provided additional support for these recommendations. Parents and healthcare staff raised problems with missing and inaccurate vaccination records, in part due to vaccinations being provided in multiple settings, but also due to movement of people between areas or pupils between schools. This was particularly relevant for Gypsies, Roma and Travellers and staff highlighted problems with identifying Gypsy, Roma and Travellers who were eligible for vaccination. Parents also wanted to have up to date vaccination records (see below for more on this point).

Another issue that came up as part of the reminders review (evidence review C) was the difficulty of contacting people to invite them to or remind them about missed vaccinations if their contact details were incorrect. This can easily happen when a person moves house or changes phone/ mobile phone numbers.

The recommendation for GPs to ensure they have up to date contact information also included two other key sets of information:

- recording the preferred method of contact to help make it more likely the person receives any invitations or messages sent by the GP surgery.
- whether there are additional literacy issues or language requirements so that these can be met, where possible, during contacts.

See evidence review C for more details on this part of the recommendation.

Identification people eligible for vaccination and opportunistic vaccination

The committee agreed to examine indirect evidence from the NICE flu guideline NG103 (2018) because it also included recommendations for identifying eligible groups for vaccination. The committee agreed that recommendation 1.3.1 in the 2018 version of NG103 was particularly relevant and generalisable to vaccines on the routine schedule with a few amendments (see appendix K for this recommendation from NG103 and additional information about the amendments).

The committee adapted the wording to remove any references to flu or to groups of people who were specific targets for flu vaccination and not relevant for vaccinations on the routine schedule because flu is not included in the scope of this guideline. The committee added a number of settings, including those outside of the health system, or points of contact with the health system where they agreed eligible people could be identified. However, the committee recognised that it would not be practical to check vaccine status regularly in non-healthcare settings and therefore specified points of admission (for example, to nurseries and care homes) or transition (for example, between schools) when this should be carried out. The list of settings and chances to check for opportunistic vaccination were not intended to be exhaustive, but to provide key examples.

The committee included a separate point about checking eligibility for vaccination for women who have a newly confirmed pregnancy and at antenatal and postnatal reviews. Pertussis vaccination is usually provided antenatally but can also be provided to the mother postnatally to provide passive protection to the baby if she has not been vaccinated during pregnancy. In addition, checking the vaccination status of women who are trying to conceive would help to ensure that they are up to date with their vaccinations before they become pregnant. They also included a bullet on checking people's vaccination history when they start work in a clinical or social care setting because, although not all of these people will be in health care related roles, they may still come into contact with many members of the public and be susceptible to contracting or spreading vaccine preventable diseases.

The committee noted that special consideration needs to be given to certain particularly vulnerable groups of people (such as people who misuse alcohol, the homeless, drug users, asylum seekers, and people in prisons) to ensure that they are assessed for vaccination eligibility as they may not be in routine contact with vaccine providers. They included settings such as sexual health services, drug and alcohol services and emergency departments to try to cover healthcare settings these people might use. In addition, they included separate bullet points for homeless people, new migrants and people in prisons or young offender institutions to draw attention to these groups of people. The committee noted that looked after children and those who are home educated or not in mainstream schooling are also at higher risk of missing vaccinations and also included them as a named group in the recommendation to highlight this (see the other factors the committee took into account section for more details).

The committee were aware of the NICE guideline Physical health of people in prison which covers adults over 18 in prisons or young offender institutions. This recommends that the second stage health assessment, which is carried out within 7 days of arrival in prison, includes a review of vaccination records (recommendation 1.1.14) and referral to a GP or a relevant clinic if further assessment is needed. The committee therefore set a limit of within 7 days for initial vaccination eligibility check within prisons and extended this to cover people under 18 in young offender institutions. Additional times (during any contact with healthcare services in these places, and when people leave) were also included to ensure that people in these settings are kept up to date with any vaccinations that they become eligible for after admittance.

The committee agreed that it would be useful for individuals, parents or carers (as appropriate) to be able to view their own vaccination records online to help them keep track of vaccinations have been administered, vaccinations they are currently eligible for and those due in the future. This was supported by the qualitative findings from Kitayama 2014 that parents liked being able to see their children's vaccination history and used online immunisation records to help remind themselves when vaccinations were due. In addition, the committee noted that in Seeber 2017 the use of a vaccination status app was associated with more accurate record keeping than parental recall from memory. The committee envisaged that this functionality could be added to existing systems which allow people to look at their medical records and agreed that it should ideally contain hyperlinks to information about the routine vaccination schedule to enable people to keep track of their

eligibility. The committee were also aware that people can see their COVID vaccination status on the NHS app and agreed that it would be helpful if this could be expanded to cover routine vaccination status as well. They noted that automatic availability of vaccination status and eligibility would be preferable to the individual having to request access to this information specifically from their GP and made a recommendation to reflect this point and another to cover people being able to access their own vaccination records (or those of their child or the person they care for) online or using apps.

The committee noted that people who are temporary residents in an area are often not asked about their vaccination status and may miss out on vaccinations as a result. A separate recommendation to have a mechanism in place to check their vaccination status was made for these people to try to ensure that they are not overlooked.

The committee discussed how eligible people could be identified in the settings listed in the opportunistic identification recommendation. They noted that vaccine providers could use prompts and reminders from electronic medical records to facilitate opportunistic identification of eligible people. They recommended this course of action based on evidence in the reminders review (see evidence review C for more detail). In other healthcare settings, staff may have access to NHS summary care records, and these could be used to check vaccination status and eligibility. However, these records do not show vaccination status routinely. This is available in the enhanced care record, which must be activated on request by the patient. They agreed that ideally this information would be available automatically to aid with identifying eligible people for vaccination. Where summary care records are not available, any other vaccination record, including patient held records, could be consulted instead. In non-healthcare settings, such as care homes and nurseries, eligibility could be checked by examining patient held vaccination records such as the red book/ digital red book or online NHS immunisation records that the individual, parent or carer (as appropriate) has access to. This ties in with their earlier recommendation about enabling people to have access online to their vaccination records.

The committee noted the importance of opportunistic vaccination and adopting the making every contact count approach at the time of identifying eligibility. This was reflected in the recommendation which advised vaccination to be offered when eligibility has been identified. However, the committee noted that vaccines would not be available in all settings where eligibility could be identified (for example, in nurseries) and so they also included the option to signpost individuals to other places where they can receive the vaccination if it cannot be administered on the spot. The committee noted that in some situations there may be a perceived contraindication to vaccination, for example where babies are discharged from neonatal intensive care units and special care baby units. In these cases, it is important that the healthcare provider makes it clear that vaccination is possible and desirable to the individual, parent or carer (as appropriate) and their GP. In addition, they also agreed that once eligibility had been identified it was important to discuss outstanding vaccinations with the individual or their family members or carers (as appropriate) where possible. The committee also noted that in the case of children who had been opportunistically identified as being eligible for vaccination, it might be helpful to refer their parents to their health visitor or school nurse, depending on the age of the child, who could provide additional support and information. In cases where there was insufficient time for discussion, or the person was not suitably qualified or knowledgeable then they should encourage the individual to book an appointment to discuss the vaccinations with an appropriate person. This latter case would be expected to apply in all non-healthcare settings. (See also evidence review D for additional evidence for opportunistic vaccination and committee discussions.)

The committee agreed that it is important to have a named person who is responsible for each organisation's approach to identification, including opportunistic identifications, and vaccination where possible to ensure there is a policy in place and that it is implemented in practice. They included this within the overarching recommendation about having a named lead for providers or organisers of vaccination services. However, they recognised that other

healthcare providers in settings included in the opportunistic vaccination recommendation may not provide vaccinations. For any secondary and tertiary care providers that do not provide vaccinations they agreed that it is also important to have a named vaccination lead who can identify people eligible for vaccinations and signpost them to relevant services. Finally, the committee also recommended named leads for social care providers and providers of other non-healthcare services who work in non-healthcare settings where opportunistic identification could occur, such as nurseries or during social care home visits. The people would be responsible for the organisation's approach to identifying people who are eligible for vaccination and would be expected to then signpost them to vaccination services as detailed in a separate recommendation (see above). The committee were aware that people could miss out on access to vaccinations in supported living settings and care homes if there is not a clear procedure in place regarding what should happen if a vaccine invitation is received. They therefore decided to specify that a policy should be in place to ensure these invites are responded to and that people are able to access their vaccinations. The committee also added supported living settings to the opportunistic identification recommendation as a setting of interest because they recognised that this is another type of group home environment where residents are at risk of being under vaccinated.

Recording vaccination offers and administration

The committee highlighted the importance of keeping medical records up to date regarding immunisation status, regardless of where the vaccination is administered. This is also stipulated in the pneumococcal, pertussis and shingles vaccinations enhanced service specifications, which all include a requirement to record vaccination offers, consent and details about the vaccine, including batch and site of administration, and adverse reactions.

The committee agreed that it is important to record more information than whether a vaccine was accepted. In particular, if a vaccination had been offered and there was no response then this could be an indication that the offer had not been received and the individual should be contacted again or in a different manner. They also agreed that refusals of offers of immunisation should be included in immunisation records because this decision could be revisited with the individual at a later date.

The committee also discussed the need to ensure that information is recorded accurately and consistently so that vaccinations are included in uptake data, and to avoid wasting resources by inviting people to attend appointments unnecessarily or duplicating vaccination. They agreed that it is important to include information regarding consent for vaccination to ensure that consent has been received and prevent vaccinations occurring where there is a lack of consent from parents or carers if the individual is unable to consent for themselves. They also agreed that the dose, batch number, expiry date and title of the vaccine; date of administration; and route and site of administration needed to be recorded at a minimum. The committee noted that severe adverse reactions to vaccines are recorded as standard, but that less severe side effects such as fever or swelling may dissuade an individual or their parent/ carer from having someone vaccinated subsequently. They agreed that it would be useful to have these milder side effects recorded, as well as severe side effects, because the person giving consent could be counselled by the healthcare practitioners on what to expect and how to respond (for example, what mild side effects look like and when they will pass). This could be done by asking people to report mild side effects to their GP to be added to their records. In the committee's experience this would make it more likely that people (or parents/ carers of people) who experienced mild side effects after vaccination, but did not have a serious adverse event, would consent to be vaccinated/ allow their child or dependent to be vaccinated in the future. Finally, they agreed that it is useful to record whether the vaccine was administered under Patient Specific Directions (PSDs) or Patient Group Directions (PGDs) in case this information is required at a later date.

The committee noted that it is also important to ensure that any clinical and patient held records (such as the red book or e-red book for children) are updated at the same time as

vaccination, or at subsequent visits if the patient-held record was not available at the time. In these cases providing a printout of the vaccination would act as a temporary record until the main record could be updated. This will help to ensure that the individual or their parents/carers are able to keep track of vaccines that have been administered. In support of the importance of up-to-date patient held records, in the qualitative evidence parents wanted to be notified of vaccination so they could update their records and they liked to be able to consult online immunisation records. Up to date patient held records may help empower people to seek out vaccinations that are due or have been missed and could facilitate discussions during opportunistic checks of vaccination status and eligibility.

Taking the service specifications, the green book, the points discussed above and their experience and expertise into account, the committee made consensus recommendations covering the information to be recorded when a vaccination is offered and/or administered, and ensuring patient held records are updated at the same time. They also discussed the finding from Orefice 2019 that the use of a compulsory vaccination status entry field in electronic health records increased uptake of pertussis vaccination in pregnant women compared to electronic health records that lacked these fields. This result came from an uncontrolled before and after study and was low quality evidence, but the committee agreed that in their experience using compulsory fields could be useful method of forcing healthcare providers to check vaccination status and to force providers to fill in all the required information before they could move onto their next task, thus increasing the accuracy of data recording. The committee made a recommendation to reflect this.

The committee raised concerns about the fragmentation of recording systems making it harder to keep accurate records about status. This view was also reflected in a theme from the qualitative review reflecting parental concerns that fragmentation of care would disrupt record keeping. In addition, a lack of centralised records it made it harder to obtain accurate vaccination records for Gypsy, Roma and Travellers and other people who moved within the UK according to healthcare providers. The committee recognised the need to update the individual's GP and CHIS records (where relevant) following a vaccination, which may have been carried out by another healthcare provider to ensure that the records can be used to identify eligible individuals (see earlier section of discussion on this topic) and vaccine status in the future. In addition, this ensures that accurate uptake data is fed into programmes such as the UKHSA (previously known as Public Health England) COVER programme for children 1,2 and 5 years old. The committee noted that the Summary Care Records also contain a section on immunisations which can be updated by GPs and are available for individuals to view at GP practices.

The committee agreed that accurate and timely updating of records following immunisation is essential. This requires frequent reporting of vaccinations to primary care by other immunisation providers and prompt updating of records in primary care (see recommendation in the section on accuracy and completeness of data recording). The committee set a time limit of 5 working days because the records may be sent in batches. Some vaccination providers report vaccinations to CHIS directly which passes this information onto GPs. The committee agreed that providers should report vaccinations to CHIS within the same time frame. However, they noted that service requirements may be shorter than this and the shortest time frame should be used when reporting vaccinations to GPs directly or to CHIS. For example, according to the 2019/2020 service specification 11 for the HPV immunisation programme, data should be transferred to the relevant CHIS within 2 days, where possible. The committee agreed that CHIS departments should inform GP surgeries of vaccinations administered outside of the GP practices within two weeks or less if required by the local contract or CHIS service specifications. The committee also noted the importance of providing this information to GP surgeries in a format that is both clear and readily accessible to facilitate accurate and rapid updating of records without the need for manual data re-entry as this is time consuming and prone to errors. The committee made consensus recommendations to reflect these points.

1.1.9.4 Cost effectiveness and resource use

In the absence of economic evidence for this evidence review, the committee used their expertise to inform discussion around the expected resource and cost impact of these recommendations.

The committee recommended that organisations that provide or organise vaccinations should have a named immunisation lead. This individual would likely be an existing member of staff in most cases who would, where relevant, be responsible for ensuring validation and updating of vaccination records, identifying people eligible for vaccination, sending invitations and reminders, and administering or coordinating vaccination. There would likely be a resource impact in reallocating staff time and responsibilities so that the named individual has capacity to carry out these responsibilities, but the committee felt that the benefit of having this named individual to ensure these tasks are completed would outweigh the costs associated with this reallocation. It was noted that the named individual could for example be a member of administration staff or a practice nurse rather than a GP to contain costs, and also that these activities would currently be being done, just by multiple members of the team rather than coordinated by a named individual. Similarly, the committee recommended that social care providers, providers of other non-healthcare services, and secondary and tertiary care providers who do not provide vaccinations should have a named lead responsible for the approach that organisation takes to identify people eligible for vaccination, and the resource impact is expected to be similarly small.

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 discussed the need for vaccination records to be accurate and up to date and recommended by informal consensus that GP surgeries should ensure records are updated within 2 weeks when new information about an individual's vaccination status is provided. Additionally, the committee recommended that GP surgeries validate their vaccination records against the data received on a monthly basis from other vaccine providers (e.g., CHIS – Child health information services). These recommendations are unlikely to have a substantial resource impact as these activities are already the responsibility of GP surgeries, and the small administrative costs around allocating time for these record checks would likely be outweighed by the benefits of having up to date records (e.g., allowing for accurate eligibility checks for opportunistic vaccination).

The committee recommended that CHIS departments should provide information about vaccine administration and status on a monthly basis to GP surgeries. CHIS already passes this information to GP surgeries and this recommendation is simply providing a time frame in which to do this, and so is unlikely to have a resource impact.

The committee recommended that an up-to-date template is used for recording vaccinations. Although there may be a cost associated with this recommendation in terms of the computer system providers ensuring a consistent template is used across areas, this is expected to be minimal.

The committee recommended that every opportunity be used to identify people eligible for vaccination, including social care and non-healthcare settings. This recommendation is

unlikely to have resource implications, as it would simply involve the practitioners in these settings asking about vaccination status and signposting eligible individuals to the relevant vaccination services if appropriate. It is unlikely that specific training would be needed for these practitioners to provide the correct information on vaccination services, as this information could easily be on hand for those practitioners e.g., a list of relevant services in the area.

The committee discussed individual immunisation records and recommended that individuals, parents and carers (if appropriate) should be able to view their own records on an online system. The committee noted that the NHS app is currently set up so that patients can access their GP health record, which by default is the summary care record that does not include immunisation status. However, it was also noted that the enhanced portion of the record including immunisation status is able to be included in the summary care record if requested by the individual, indicating that the resources and mechanisms for doing this are already available. There would likely be some resource impact in terms of contacting people who already have the NHS app to check whether they want to include this extra information, but for new users this could be included as part of the terms of signing up. Additionally, contacting current app users would not necessarily be expensive, as it could be done using the contact details that GP surgeries already hold and would not need to be personalised to the individual.

The committee discussed opportunistic vaccination and highlighted the need for better information around vaccine eligibility and status to be able to administer vaccines opportunistically. The committee recommended that existing records be used to make sure these eligibility checks can be done quickly. The mechanisms for sharing and accessing these records are in place so it would be a case of ensuring they are up to date and accessible by the appropriate people, which is not anticipated to have a significant resource burden.

Following the identification of eligible individuals the committee recommended that, as appropriate, practitioners should either discuss and offer vaccination, or encourage individuals to book an appointment for vaccination or discussion, or signpost them to vaccination services. This recommendation is unlikely to have resource implications as practitioners would simply need to know what services to signpost people to or where people should book appointments to discuss vaccination or be vaccinated. Vaccination and discussion of vaccination would only be appropriate for practitioners whose role already encompasses those activities.

The committee recommended that providers ensure patient-held records (for example, the red book) are updated at the time of the vaccination. Updating those records at the vaccination appointment where possible will reduce the amount of follow-up required to check these records later on, and therefore save costs associated with contacting individuals.

The committee recommended that vaccination providers ensure new vaccinations are reported promptly to GP surgeries, or to CHIS to pass on to GPs. This recommendation is unlikely to have resource implications as this task should already be being completed, and the recommendation is more focused on the timescale to ensure that records are as up to date as possible.

The committee discussed the accessibility of vaccination information and recommended that vaccination providers ensure this information provided to GP surgeries and CHIS is clear and in a readily accessible format. There may be some administrative costs associated with putting a clear format in place for providers, but these costs are anticipated to be small, and it is likely that this recommendation will reduce the likelihood that further costs associated with processing this information will be incurred.

1.1.9.5 Other factors the committee took into account

Equalities considerations

During protocol writing and when making the recommendations, the committee took account of equalities issues that could affect specific groups of people at risk of being under vaccinated. The committee agreed that 2 settings should be separated for analysis: schools, which may involve specific targeted interventions and issues with consenting to recording, and prisons which have a specific health service. These settings were thought to be particularly important due to difficulties with recording and identifying of and individual's vaccination status. However, there was a lack of quantitative evidence on these settings to inform new recommendations.

The qualitative evidence raised problems with the identification of eligible people in the following groups: pupils moving between schools; migrants to the UK who may not have vaccination histories; Polish and Romanian immigrants who return home for vaccinations and do not update their UK records; and Gypsy, Roma and Travellers, due to difficulties with keeping accurate records as they move around. The committee took this information into account and agreed that that certain groups of people were at a greater risk of being under vaccinated due to a lack of identification of eligibility and status. These included:

- people who are less likely to be registered with a GP and/or may move around frequently, such as homeless people, migrants, looked-after children and young people, Gypsies, Roma and Travellers. Children from these groups may not attend school regularly or may move school frequently. In addition, their records may not follow them when they move (for example, CHIS records may not follow looked-after children and young people when they move).
- newly arrived migrants may have an uncertain vaccine history in addition to the above
- pregnant women because there may be confusion about whether primary or secondary care is responsible for recording and identification.
- people in prisons or young offenders institutes who may are subject to a different health system and may have additional issues around their lack of agency. This could be of particular importance for pregnant women in these settings.
- home schooled children who are likely to miss many of the school-based stages where vaccination eligibility and status is checked.

The committee tried to ensure that these groups of people would not be disadvantaged by the recommendations by specifying particular settings and points in time to opportunistically identify eligible people.

The committee were also aware that a potential barrier to vaccination is uncertainty about someone's eligibility for a particular vaccine, such as when someone potentially has contraindications. For example, there can be some questions over eligibility when a person is immunocompromised, such as when they have HIV, or if they have certain allergies. In these circumstances, the committee agreed that healthcare professionals should refer to the Green book and expert advice to ensure that people are not missing out on vaccinations unnecessarily. This could also include consulting other resources, such as the BHIVA guidelines on the use of vaccines in HIV positive adults.

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.

1.1.10 Recommendations supported by this evidence review

This evidence review supports recommendations 1.1.1-1.1.2, 1.1.4-1.1.6, 1.2.1-1.2.12, 1.2.17-1.2.19, 1.2.20-1.2.26. Other evidence supporting these recommendations can be found in evidence C: reminders interventions to increase the uptake of routine vaccines and evidence review D: interventions to increase the uptake of routine vaccines by improving access.

1.1.11 References – included studies

1.1.11.1 Quantitative data

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Kitayama K; Stockwell MS; Vawdrey DK; Peña O; Catallozzi M; Parent perspectives on the design of a personal online pediatric immunization record.; Clinical pediatrics; 2014; vol. 53 (no. 3)

Mytton J; Bedford H; Condon L; Jackson C; ; Improving immunization uptake rates among Gypsies, Roma and Travellers: a qualitative study of the views of service providers.; Journal of public health (Oxford, England); 2020

New, S.J.; Senior, M.L.; I don't believe in needles: Qualitative aspects of a study into the uptake of infant immunisation in two English Health Authorities; Social Science and Medicine; 1991; vol. 33 (no. 4); 509-518

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Thomas, S.; Cashman, P.; Islam, F.; Baker, L.; Clark, K.; Leask, J.; Butler, R.; Durrheim, D.N.; Tailoring immunisation service delivery in a disadvantaged community in Australia; views of health providers and parents; Vaccine; 2018; vol. 36 (no. 19); 2596-2603

Webb, Heather; Street, Jackie; Marshall, Helen; Incorporating immunizations into routine obstetric care to facilitate Health Care Practitioners in implementing maternal immunization recommendations.; Human vaccines & immunotherapeutics; 2014; vol. 10 (no. 4); 1114-21

Wiot, F.; Shirley, J.; Prugnola, A.; Di Pasquale, A.; Philip, R.; Challenges facing vaccinators in the 21st century: results from a focus group qualitative study; Human Vaccines and Immunotherapeutics; 2019; vol. 15 (no. 12); 2806-2815

1.1.11.2 Economic

No economic studies were identified for this review question.

1.1.11.3 Other

Pollack AH, Kronman MP, Zhou C et al. (2014) Automated Screening of Hospitalized Children for Influenza Vaccination. Journal of the Pediatric Infectious Diseases Society 3(1): 7-14

Appendices

Appendix A – Review protocols

Review protocol for interventions to improve the identification and recording of a person's vaccination eligibility and status and barriers to, and facilitators for, identification and recording.

ID	Field	Content
1.	Review title	Interventions to improve the identification and recording of a person's vaccination eligibility and status and barriers to, and facilitators for, identification and recording.
2.	Review question(s)	1.1 What are the most effective interventions for identifying and recording a person's vaccination eligibility and status? 1.2 What are the barriers to, and facilitators for, identifying and recording a person's vaccination eligibility and status?
3.	Objective	To find interventions for identifying and recording a person's vaccination eligibility and status and to try to explore the barriers and facilitators that affect identification and recording of these factors.
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 e publications ahead of print • Emcare • Health Management Information Consortium (HMIC) • Database of Abstracts of Reviews of Effects (DARE) Searches will be restricted by: • Publications from 1990 • English language • Human studies • McMaster balanced RCT filter • Health-evidence.ca Systematic Review filter • NICE Qualitative studies filter • Amended NICE Observational Studies Filter

		Searches for economic evidence will be run in the following databases: • Medline • Medline in Process • Medline e publications ahead of print • Embase • Econlit • NHS EED • Health Technology Assessment Database Searches will be restricted by • Publications from 1990 • English language • Human studies • NICE cost utility filter Other searches: If key papers are identified during the initial sift reference and citation searching will be used. 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 staff who are recording and identifying vaccination status. Exclusion: None

7.	Interventions and factors of interest	<u>RQ1.1 Quantitative review</u>
		
		Interventions which address problems with identification and recording of a person's vaccination eligibility and status including issues concerning, but not limited to:
		
		- Data linkage, such as:
		  o Integration of identification and/or recording systems
		
		- Data accuracy, such as:
		  o Methods of recording (electronic, such as e-red books, mobile apps or paper, such as red books)
		  o Changes to vaccine status coding processes
		  o Training of staff to improve the accuracy of recording and coding

		- Data sharing, such as:
		  o Changes to the way information about vaccine status is received by the GP or service tasked with recording the information
		  o Electronic sharing
		  o Data sharing agreements
		  o People having access to their own records
		
		- Resources/tools to help identify eligibility and missed vaccinations, such as
		  o Web-based information about vaccination schedules in other countries (e.g. UK and international immunisation schedules comparison tool) and WHO vaccine-preventable diseases: monitoring system.
		  o Web-based information to help identify missed vaccinations including the Public Health England algorithms Vaccination of individuals with uncertain or incomplete immunisation status and Screening of individuals with uncertain or incomplete screening status.
		
		RQ1.2 Qualitative review
		
		Barriers to, and facilitators for, the identification and recording of a person's vaccination eligibility and status in general or in relation to specific interventions, including:
		- Thoughts, views and perceptions, including knowledge of the vaccination schedule
		- Factors that could affect acceptability
		- Factors that could affect accessibility (including accessibility in a timely manner to the relevant people) of the recorded information
		- Factors that could account for variability in effectiveness
		- Factors that could affect the feasibility of implementation

8.	Comparators	RQ1.1 Quantitative review. • Usual approaches to identify and record a person's vaccination eligibility and status • Other interventions to identify and record a person's vaccination eligibility and status RQ1.2 Qualitative review Not applicable
9.	Types of study to be included	RQ1.1 Quantitative review. • Systematic reviews of included study designs • Randomised controlled trials • Non-randomised controlled trials • Controlled before-and-after studies • Interrupted time series

		• Cohort studies • Mixed method study designs (quantitative evidence that matches the above study designs only) <u>RQ1.2 Qualitative review</u> • Systematic reviews included qualitative study designs • Qualitative studies that collect data from focus groups, interviews and open-ended questions from questionnaires • Mixed method study designs (qualitative evidence that matches the above study designs only) For the mixed methods synthesis, published / existing mixed methods studies will also be included if the study does not present quantitative and qualitative evidence separately, but only if the design of individual primary studies included meet the inclusion criteria for both the qualitative and quantitative reviews as detailed above.
10.	Other exclusion criteria	Strategies to identify and record a person's vaccination eligibility and status for these vaccines/ conditions: • Selective immunisation programmes, as defined in the Green Book and additional vaccines for people with underlying medical conditions because they form 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.
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, such as 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. Multiple settings exist for vaccine recording, identification of status and administration such as: all healthcare settings (including primary care and hospitals) and educational settings, (including schools, colleges and universities).
12.	Primary outcomes (critical outcomes)	1.1 <u>Quantitative outcomes:</u> Changes in: • Identification of vaccine eligibility and status • Recording of vaccine eligibility and status • accuracy and completeness of data records, including administration errors • vaccine uptake • Offers of vaccination • An individual's knowledge of their own immunisation status • Cost/resource use associated with the intervention 1.2 <u>Qualitative outcomes</u> The outcomes will be generated using emergent coding, but are expected to include the following: • Thoughts, views and perceptions about problems concerning identification and recording of eligibility and status and possible solutions (facilitators) • Thoughts, views and perceptions about interventions that target identification and/or recording of eligibility and status • Factors that could affect acceptability of interventions • Factors that could affect accessibility (including accessibility in a timely manner to the relevant people) of the recorded information • Factors that could account for variability in the effectiveness of interventions • Factors that could affect the feasibility of implementation of interventions
13.	Secondary outcomes (important outcomes)	None
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. Priority screening will be used for the review, but no criteria have been set for stopping abstract screening. Consequently, the whole abstract database will be searched . 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. For the qualitative review, extracted information will include study type; study setting; sample characteristics; study methodology; inclusion and exclusion criteria; themes reported 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 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 or Cochrane risk of bias v2.0, as appropriate. Qualitative studies will be assessed using CASP qualitative checklist. Any mixed methods studies with qualitative data that can be extracted separately will be

		assessed using CASP qualitative checklist. 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 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). RQ1.1 Quantitative review 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>RQ1.2 Qualitative review:</u> Where multiple qualitative studies are identified for a single question, information from the studies will be combined using a thematic synthesis. By examining the findings of each included study, descriptive themes will be independently identified and coded in NVivo v.11. If there are less than 5 studies, Nvivo v.11 will not be used. Once all of the included studies have been examined and coded, the resulting themes and sub-themes will be evaluated to examine their relevance to the review question, the importance given to each theme, and the extent to which each theme recurs across the different studies. The qualitative synthesis will use these 'descriptive themes' to develop 'analytical themes', which will be interpreted by the reviewer in light of the overarching review questions. Code saturation may be used as a reason to stop extracting data from new qualitative studies. CERQual will be used to assess the confidence we have in the summary findings of each of the identified themes. Evidence from all qualitative study designs (interviews, focus groups etc.) is initially rated as high confidence and the confidence in the evidence for each theme will be downgraded from this initial point. <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, 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. Mixed method synthesis of findings from the quantitative and qualitative reviews Where appropriate, a synthesis matrix will be produced to combine results from the two different analytical approaches. 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 for example, barriers to identification may be paired up with interventions that address these barriers (). The agreement between the findings of the two approaches will be qualitatively assessed, with each paired set of findings put into 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	RQ1.1. Quantitative review Results will be separated into the following for analysis: o 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) o mixed levels o Settings, including: o Schools o Prisons and secure settings Population groups with potential equality issues specific to this question: o Prisoners (covered in prisons and secure settings above, pregnant prisoners covered under pregnancy below) o Migrants, including newly arrived migrants o Homeless people o Looked-after children

		○ Home schooled children ○ Transient populations (including but not confined to travellers, Roma and gypsy communities) ○ Pregnant women (including those in prison) These groups were identified due to potential issues with recording and identification of vaccination status. <u>RQ1.2 Qualitative review</u> Views of individual users, their parents and carers (where relevant) and staff. Views of staff, parents, carers and children about recording of vaccination status and eligibility in schools. Views of prisoners and people in other secure settings and staff about recording of vaccination status and eligibility in prisons and secure settings. Views of population groups with potential equality issues: ○ Prisoners (covered in prisons and secure settings above) ○ Migrants, including newly arrived migrants ○ Homeless people ○ Looked-after children ○ Home schooled children ○ Transient populations (including but not confined to travellers, Roma and gypsy communities) ○ Pregnant women (including those in prison) System level issues: ○ health system level (for example clinical commissioning group [CCG], local authority, regional and national level) ○ service provider level (for example GP practices, practitioners) ○ individual level (for example patients or service users) ○ mixed levels
18.	Type and method of review	☐ Intervention ☐ Diagnostic ☐ Prognostic ☐ Qualitative ☐ Epidemiologic ☐ Service Delivery

		☒ Other (please specify) Mixed method		
19.	Language	English		
20.	Country	England		
21.	Anticipated or actual start date	23/11/2019		
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 • Omnia Abdulrazeg • Stephen Sharp • Joshua Pink • Stacey Chang-Douglass • 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	Identification and recording of vaccine eligibility and status, NHS routine vaccination schedule, interventions and barriers and facilitators
33.	Details of existing review of same topic by same authors	None
34.	Current review status	☒ Ongoing ☐ Completed but not published ☐ Completed and published ☐ Completed, published and being updated ☐ Discontinued
35..	Additional information	None
36.	Details of final publication	www.nice.org.uk

Appendix B – Literature search strategies

The searches were run on 22nd November 2019 in Medline, Medline in Process, Medline e publications ahead of print, Embase, Emcare and HMIC all via the Ovid platform, CENTRAL and the Cochrane Database of Systematic Reviews via the Wiley platform and DARE via the Centre for Reviews and Dissemination platform. The searches were limited to English language studies published since 1990. The following study design filters were applied where possible; observational and qualitative studies (internally developed), randomised controlled trials (McMaster balanced in Medline and Embase), systematic reviews (health-evidence.ca in Medline and Embase). In addition an internally developed OECD country geographic filter was applied where appropriate. The searches were rerun on 14th April 2021.

The study design filter for intervention evidence has been amended to only search for the specific study designs that the committee thought would provide useful evidence for this review. Terms for the following observational study designs have been removed: historically controlled studies, cross-sectional studies, case control studies and case-series.

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)).
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).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 16 or "hpv-16" or "human papillomavirus 16" or "human papillomavirus type 16" or hpv 18 or "hpv-18" or "human papillomavirus 18" or "human papillomavirus type 18" or hpv 11 or "hpv-11" or "human papillomavirus 11" or "human papillomavirus type 11" or hpv 11 or "hpv-11" or "human papillomavirus 11" or "human papillomavirus type 11").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 Medical Records/
45 ((record* or document* or confirm* or evidence* or proof or register*) adj2 (method* or process* or scheme* or intervention* or protocol* or procedure* or practice* or system*) adj2 (vaccin* or immuni*)).tw.
46 ("personal child health record*" or "pchr*" or "red book*" or "e-red book*" or "e red book*" or "electronic red book*").tw.
47 Data Accuracy/
48 ((data or information) adj4 (accura* or inaccura* or qualit* or correct* or incorrect*)).tw.
49 Information Dissemination/
50 ((data or information) adj4 (distrib* or shar* or disseminat* or exchang* or integrat*)).tw.
51 "Information Storage and Retrieval"/
52 Classification/
53 ((data or information) adj4 (link* or stor* or classifi* or misclassif* or code* or coding*)).tw.
54 or/44-53
55 Education/ or exp InService training/ or exp Education,professional/ or learning/
56 (train* or educ* or learn* or skill* or coach* or mentor*).tw.
57 55 or 56
58 (record* or code* or coding or accurat* or inaccura* or classifi* or misclassifi* or correct* or incorrect*).tw.
59 57 and 58
60 Health Information Systems/
61 ("child health information service" or "chis").tw.
62 eligibility determination/
63 ((eligibil* or ineligibil* or status or document* or identif* or verif* or history) adj4 (vaccin* or immunis* or immuniz*)).tw.
64 or/60-63
65 Algorithms/
66 (online* or on-line* or internet* or www or web or website* or webpage* or portal or search engine*).tw.
67 algorithm*.tw.
68 or/65-67
69 (eligibil* or ineligibil* or identif* or status).tw.
70 68 and 69
71 Mobile Applications/
72 ((mobile or electronic* or digital* or device* or software*) adj3 application*).tw.
73 71 or 72
74 54 or 59 or 64 or 70 or 73
75 43 and 74
76 animals/ not humans/

77 75 not 76
78 limit 77 to english language/
79 limit 78 to ed=19900101-20191122
80 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/
81 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/
82 80 not (80 and 81)
83 79 not 82
84 Observational Studies as Topic/
85 Observational Study/
86 Epidemiologic Studies/
87 exp Cohort Studies/
88 Controlled Before-After Studies/
89 Interrupted Time Series Analysis/
90 Comparative Study.pt.
91 (cohort adj (study or studies)).tw.
92 cohort analy$.tw.
93 (follow-up adj (study or studies)).tw.
94 (observational adj (study or studies)).tw.
95 longitudinal.tw.
96 prospective.tw.
97 retrospective.tw.
98 or/84-97
99 Qualitative Research/
100 Nursing Methodology Research/
101 Interview.pt.
102 exp Interviews as Topic/
103 Questionnaires/
104 Narration/
105 Health Care Surveys/
106 (qualitative$ or interview$ or focus group$ or questionnaire$ or narrative$ or narration$ or survey$).tw.
107 (ethno$ or emic or etic or phenomenolog$ or grounded theory or constant compar$ or (thematic$ adj4 analys$) or theoretical sampl$ or purposive sampl$).tw.
108 (hermeneutic$ or heidegger$ or husser$ or colaizzi$ or van kaam$ or van manen$ or giorgi$ or glaser$ or strauss$ or ricoeur$ or spiegelberg$ or merleau$).tw.
109 (metasynthes$ or meta-synthes$ or metasummar$ or meta-summar$ or metastud$ or meta-stud$ or metathem$ or meta-them$).tw.
110 "critical interpretive synthes*".tw.

111 (realist adj (review* or synthes*)).tw.
112 (noblit and hare).tw.
113 (meta adj (method or triangulation)).tw.
114 (CERQUAL or CONQUAL).tw.
115 ((thematic or framework) adj synthes*).tw.
116 or/99-115
117 randomized controlled trial.pt.
118 randomi?ed.mp.
119 placebo.mp.
120 or/117-119
121 (MEDLINE or pubmed).tw.
122 systematic review.tw.
123 systematic review.pt.
124 meta-analysis.pt.
125 intervention$.ti.
126 or/121-125
127 98 or 116 or 120 or 126
128 83 and 127

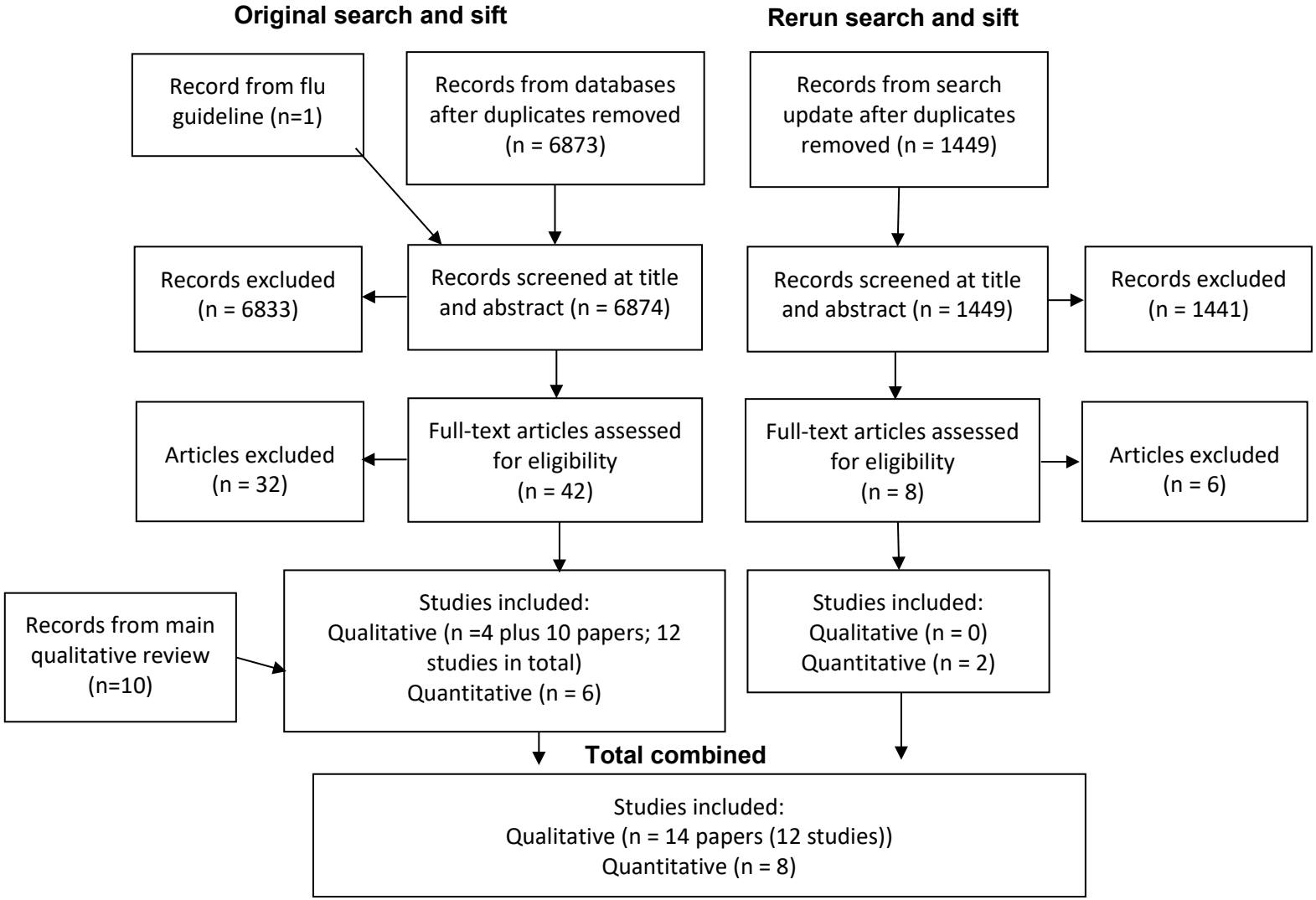
A single search to identify economic evidence for all review questions was run on 12th February 2020.The following databases were searched: Medline, Medline in Process, Embase, Econlit (all via the Ovid platform) NHS Economic Evaluation Database (NHS EED) and the Health Technology Assessment Database (HTA) (via the CRD platform). The searches were re run on 13th April 2021 with the HTA database replaced by the International Health Technology Database (INAHTA). The Medline strategy is presented below

1 Diphtheria/
2 diphtheria*.tw.
3 Tetanus/
4 (tetanus or tetani).tw.
5 Whooping Cough/
6 (pertuss* or "whooping cough").tw.
7 Haemophilus influenzae type b/
8 ("Haemophilus influenza* type b" or "Hemophilus influenza* type b" or hib).tw.
9 Hepatitis B/
10 "hepatitis b".tw.
11 exp Poliomyelitis/
12 (Polio* or (infantile adj1 paralysis)).tw.
13 exp Pneumococcal Infections/
14 (Pneumococcal adj4 (disease* or infection*)).tw.
15 (streptococcus pneumoniae adj4 Infection*).tw. (
16 exp Meningococcal Infections/
17 (Meningococcal adj4 (disease* or infection*)).tw.
18 Rotavirus Infections/ or Rotavirus/
19 rotavirus.tw.
20 Measles/
21 (measles or rubeola or mmr).tw.
22 Mumps/
23 (mumps or (epidemic adj2 (parotitides or parotitis))).tw.
24 Rubella/ or Rubella virus/
25 (rubella or ((german or "three day") adj2 measle*)).tw.

26 human papillomavirus 16/ or human papillomavirus 18/ or exp papillomavirus Infections/ or exp human papillomavirus 11/
27 (hpv or papillomavirus).tw.
28 Condylomata Acuminata/
29 (condyloma* adj1 acuminat*).tw.
30 ((genital or veneral) adj2 wart*).tw.
31 exp Herpes Zoster/
32 (shingles or herpes zoster or zona).tw.
33 or/1-32
34 exp Vaccination/
35 Vaccines/ or exp bacterial vaccines/ or cancer vaccines/ or exp toxoids/ or exp vaccines combined/ or exp viral vaccines/
36 exp Immunization programs/
37 vaccin*.tw.
38 exp Immunization/
39 (immunis* or immuniz*).tw.
40 (immunologic* adj4 (sensitiz* or sensitis* or stimulation*)).tw.
41 (immunostimul* or variolation*).tw.
42 or/34-41
43 33 and 42
44 exp Diphtheria toxoid/ or exp tetanus toxoid/ or Haemophilus Vaccines/ or meningococcal Vaccines/ or exp Pertussis Vaccine/ or exp Streptococcal vaccines/ or exp Vaccines Combined/ or exp Measles vaccine/ or exp Mumps Vaccine/ or exp papillomavirus vaccines/ or exp Poliovirus Vaccines/ or Rotavirus Vaccines/ or exp Rubella Vaccine/ or Hepatitis B vaccines/ or Herpes Zoster Vaccine/
45 43 or 44
46 animals/ not humans/
47 45 not 46
48 limit 47 to english language/
49 limit 48 to ed=19900101-20200212
50 afghanistan/ or exp africa/ or albania/ or andorra/ or antarctic regions/ or argentina/ or exp asia, central/ or exp asia, northern/ or exp asia, southeastern/ or exp atlantic islands/ or bahrain/ or bangladesh/ or Bhutan/ or bolivia/ or borneo/ or "bosnia and Herzegovina"/ or brazil/ or bulgaria/ or exp central america/ or exp china/ or colombia/ or "Commonwealth of Independent States"/ or croatia/ or "Democratic People's Republic of Korea"/ or ecuador/ or gibraltar/ or guyana/ or exp india/ or indonesia/ or iran/ or iraq/ or jordan/ or kosovo/ or kuwait/ or lebanon/ or liechtenstein/ or macau/ or "macedonia (republic)"/ or exp melanesia/ or moldova/ or monaco/ or mongolia/ or montenegro/ or nepal/ or Netherlands Antilles/ or New Guinea/ or oman/ or pakistan/ or paraguay/ or peru/ or philippines/ or qatar/ or "republic of Belarus"/ or romania/ or exp russia/ or saudi arabia/ or serbia/ or sri lanka/ or suriname/ or syria/ or taiwan/ or exp transcaucasia/ or ukraine/ or uruguay/ or united arab emirates/ or exp ussr/ or venezuela/ or yemen/ (1062747)
51 australasia/ or exp australia/ or austria/ or exp Baltic States/ or belgium/ or exp canada/ or chile/ or czech republic/ or europe/ or European Union/ or exp france/ or exp germany/ or greece/ or hungary/ or ireland/ or Israel/ or exp italy/ or exp japan/ or korea/ or luxembourg/ or mexico/ or netherlands/ or new zealand/ or north america/ or poland/ or portugal/ or exp "republic of korea"/ or exp "Scandinavian and Nordic Countries"/ or slovakia/ or slovenia/ or spain/ or switzerland/ or turkey/ or exp united kingdom/ or exp united states/ or "Organisation for Economic Co-Operation and Development"/ or Developed Countries/
52 50 not (50 and 51)
53 49 not 52 (53810)
54 Cost-Benefit Analysis/
55 Quality-Adjusted Life Years/
56 Markov Chains/
57 exp Models, Economic/

58 cost*.ti.
59 (cost* adj2 utilit*).tw.
60 (cost* adj2 (effective* or assess* or evaluat* or analys* or model* or benefit* or threshold* or quality or expens* or saving* or reduc*)).tw.
61 (economic* adj2 (evaluat* or assess* or analys* or model* or outcome* or benefit* or threshold* or expens* or saving* or reduc*)).tw.
62 (qualit* adj2 adjust* adj2 life*).tw.
63 QALY*.tw.
64 (incremental* adj2 cost*).tw.
65 ICER.tw.
66 utilities.tw.
67 markov*.tw.
68 (dollar* or USD or cents or pound or pounds or GBP or sterling* or pence or euro or euros or yen or JPY).tw.
69 ((utility or effective*) adj2 analys*).tw.
70 (willing* adj2 pay*).tw.
71 (EQ5D* or EQ-5D*).tw.
72 ((euroqol or euro-qol or euroquol or euro-quol or eurocol or euro-col) adj3 ("5" or five)).tw.
73 (european* adj2 quality adj3 ("5" or five)).tw.
74 or/54-73
75 53 and 74

Appendix C – Effectiveness and qualitative evidence study selection



Appendix D – Effectiveness and qualitative evidence tables

Quantitative Evidence

Bakare, 2007

Bibliographic Reference	Bakare, Mobolaji; Shrivastava, Rakesh; Jeevanantham, Vinodh; Navaneethan, Sankar D; Impact of two different models on influenza and pneumococcal vaccination in hospitalized patients.; Southern medical journal; 2007; vol. 100 (no. 2); 140-4

Study details

Study type	Before and after study
Study location	USA
Study setting	Community inpatient hospital
Study dates	2002 to 2003
Sources of funding	Not provided
Inclusion criteria	Patients discharged from hospital
Exclusion criteria	None
Intervention(s)	Nurse-driven model
Comparator	Physician-driven model
Outcome measures	Eligibility for PPV vaccination In-hospital PPV vaccination rate
Number of participants	306 (physician-driven model n=138 and nurse-driven model n=168, selected from 1400 and 1674 charts, respectively)
Duration of follow-up	Not applicable
Additional comments	December 2002 represented the physician-driven model, where physicians were responsible for assessing the influenza and pneumococcal vaccination status of patients and writing orders based on their assessment. December 2003 represented the nurse-driven model, where nurses were given the authority to complete an assessment form and vaccinate patients based on their assessment. Information was obtained by reviewing the standardised immunisation assessment form in the charts. Information collected for both models included the completion rate for vaccination status assessment, the percentage of patients eligible for vaccination, the percentage of eligible patients who received vaccination, and the reason for not administering the vaccine to eligible patients. The data were collected and analysed for both influenza vaccination and pneumococcal vaccination, using the Centers for Disease Control (CDC) eligibility criteria for vaccination.

Study arms

Nurse-driven model (N = 168)
Physician-driven model (N = 138)

Characteristics
Arm-level characteristics

	Nurse-driven model (N = 168)	**Physician-driven model (N = 138)**
% Female *(%)*		
Nominal	52.3%	51.4%

The risk of bias assessment below uses EPOC (for assessing risk of bias in before and after studies)

Section	**Question**	**Answer**
Random sequence generation	Was the allocation sequence adequately generated?	N/A
Allocation concealment	Was the allocation adequately concealed?	N/A
Baseline outcome measurements	Were baseline outcome measurements similar?	Unclear
Baseline characteristics	Were baseline characteristics similar?	Partly *(Gender distribution similar but there were imbalances between groups for age groups (under 50, 50 to 64 and 65 and over) and in medical and non-medical service)*
Incomplete outcome data	Were incomplete outcome data adequately addressed?	N/A
Knowledge of the allocated interventions	Was knowledge of the allocated interventions adequately prevented during the study?	Unclear
Protection against contamination	Was the study adequately protected against contamination?	Unclear *(No adjustments reported for effect of the time lapse between interventions)*
Selective outcome reporting	Was the study free from selective outcome reporting?	No
Other risks of bias	Was the study free from other risks of bias?	No *(Selection of charts was conducted by taking every 10th chart, which does not constitute random selection. 2) It was assumed that patients from long-term care facilities had been vaccinated; and these patients were documented as having been previously vaccinated, which may have influenced results. 3) Patients' eligibility was assessed based on the standard immunisation form. More eligible patients may have been found by looking for the discharge diagnosis and medical history in the charts, especially for patients with high risk conditions. 4) The impact of readmitted patients was not assessed in either intervention.)*
Overall judgements of risk	Overall risk of bias	High risk of bias

Section	Question	Answer
of bias and directness		*(The interventions were delivered to two different groups at two different timepoints, with awareness campaigns in the interim period potentially influencing the vaccination rate in the nurse-led intervention.)*
	Overall directness	Directly applicable (Data applicable for PPV vaccination)

Hawley, 2014

Bibliographic Reference	Hawley, Glenda; Jackson, Claire; Hepworth, Julie; Wilkinson, Shelley A; Sharing of clinical data in a maternity setting: how do paper hand-held records and electronic health records compare for completeness?.; BMC health services research; 2014; vol. 14; 650
Study details	
Study type	Before and after study
Study location	South East Queensland (Australia)
Study setting	Tertiary maternity hospital with an established shared-care arrangement with GPs
Study dates	The data analysed in Phase 1 were obtained from conducting a chart audit of patient handheld records (PHRs) used by pregnant women during the period of 01 July 2011 and 31 December 2011. Phase 2 data were extracted from the obstetric database; a repository for antenatal information from the electronic health record (EHR) at the MH during the period of 01 January 2013 and 31 June 2013.
Sources of funding	The principal author was funded with an Australian Postgraduate Scholarship and additional funding provided through the Australian Primary Health Care Research Institute. The additional author was supported by a National Health and Medical Research Council Translating Research Into Practice Fellowship.
Inclusion criteria	Pregnant women Women who participated in the GP shared-care maternity model of care Aged 18 years and over Able to understand and speak English
Exclusion criteria	None
Intervention(s)	Electronic patient record
Comparator	Paper handheld record
Outcome measures	Differences in individual variables between the records; relevant variable was pertussis vaccination. Note primary outcome reported was a composite of 31 variables, but only the pertussis vaccine variable was relevant.
Number of participants	100
Duration of follow-up	Not applicable; before and after study design.
Loss to follow-up	PHR: 6 (6%) loss to follow-up EHR: 0 (0%) loss to follow-up
Additional comments	Phase 1 data collection was completed before the introduction of the EHR. In consultation with the MH statistician, Phase 2 data were collected 6 months after the introduction of the EHR in 2012.

	The data analysed in Phase 1 of this study were obtained from conducting a chart audit of PHRs used by pregnant women during the period of 01 July 2011 and 31 December 2011. Phase 2 data were extracted from the obstetric database; a repository for antenatal information from the EHR at the MH during the period of 01 January 2013 and 31 June 2013. The data analysed in Phase 1 were obtained from conducting a chart audit of PHRs used by pregnant women. Phase 2 data were extracted from the obstetric database; a repository for antenatal information from the EHR at the maternity hospital. The data collected for both the PHR and the EHR were predominantly collected at the first antenatal visit. There were 94 pregnant women in the paper handheld arm because the notes for 6 went missing.

Study arms

Before: Paper handheld record (N = 100)
After: Electronic patient record (N = 100)

The risk of bias assessment below uses EPOC (for assessing risk of bias in before and after studies)

Section	Question	Answer
Random sequence generation	Was the allocation sequence adequately generated?	N/A *(The study was uncontrolled)*
Allocation concealment	Was the allocation adequately concealed?	N/A *(No control group)*
Baseline outcome measurements	Were baseline outcome measurements similar?	Unclear *(Baseline outcome measurements were not reported - only phase 1 and phase 2)*
Baseline characteristics	Were baseline characteristics similar?	Unclear *(Baseline characteristics were not reported)*
Incomplete outcome data	Were incomplete outcome data adequately addressed?	No *(In consultation with a statistician the chi-square analysis could not be performed, as neither Phase 1 or Phase 2 had a complete data set of best practice variables.* *Only 94 records were available for the paper held records phase of the study, but the power calculation had indicated a minimum of 97 records for each phase to detect a significant difference in the primary outcome. No measures to address this were reported.)*
Knowledge of the allocated interventions	Was knowledge of the allocated interventions adequately prevented during the study?	Unclear (Blinding of outcome assessment was not reported)
Protection against contamination	Was the study adequately protected against contamination?	N/A (No control group)
Selective outcome reporting	Was the study free from selective outcome reporting?	Yes *(The relevant vaccination outcomes were prespecified according to clinical practice guidelines)*

Section	Question	Answer
Other risks of bias	Was the study free from other risks of bias?	Unclear *(The lack of a control group increased the risk of bias.)*
Overall judgements of risk of bias and directness	Overall risk of bias	High risk of bias *(The lack of a control group and unclear reporting of baseline characteristics and outcome assessment indicate a high risk of bias.)*
	Overall directness	Directly applicable

Lam, 2019

Bibliographic Reference	Lam, Jason H; Singh, Serinna; Kuo, Grace M; Comparisons of immunization records between a community pharmacy, a regional registry, and a health system.; Journal of the American Pharmacists Association : JAPhA; 2019; vol. 59 (no. 1); 30-34

Study details

Study type	Retrospective cohort study
Study location	USA
Study setting	Community pharmacies
Study dates	2016 to 2017
Sources of funding	The source of funding was not mentioned
Inclusion criteria	People who were collecting prescriptions from a pharmacy and who already had, or were eligible for, the shingles vaccine or the 23 valent pneumococcal vaccine.
Exclusion criteria	None
Intervention(s)	**Intervention 1:** Regional immunization information system (IIS). An IIS is a confidential, population-based database that records all immunisation doses administered by participating providers. The IIS in California, the California Immunisation Registry (CAIR), promotes the electronic storage of immunization records. One noted drawback to CAIR is that it does not contain all immunisation records because reporting of immunisations is not mandatory in all care settings. Some states may also have regional IIS databases such as the San Diego Regional Immunization Registry (SDIR).7 An IIS website provides online resources on how immunization records can be entered manually or electronically to the IIS. **Intervention 2:** Community pharmacy database. No further information about this database was provided in the study.
Comparator	Electronic health record (EHR). This generally includes the patient's medical, prescription, and immunisation records. Medical provider offices and hospitals have been implementing EHRs as part of the Health Information Technology for Economic and Clinical Health (HITECH) Act of 2009, which incentivises providers

	and health systems to shift from paper to electronic charts. The Centers for Medicare & Medicaid Services (CMS) established Meaningful Use criteria for EHRs that included quality measures to promote vaccination screening and administration.
Relevant outcome measures	Changes in identification of vaccine eligibility and status (Patients who had an immunisation record)
Number of participants	For shingles, there were 127 relevant participants according to the study criteria. For pneumococcal 23 serotypes, there were 118 relevant participants according to the study criteria.
Duration of follow-up	N/A - this was a retrospective study.
Loss to follow-up	None
Additional comments	This study also had data for the following vaccines that were not included in our data extraction. This is because the ages at which they were administered did not match the UK vaccination schedule: Tdap/DTaP, pneumococcal vaccine valency 13, HepB and HPV (they administered them to adults over the age of 18 years, not to children).

Study arms

Electronic health record (EHR) (N = 127 for shingles vaccine, N = 118 for pneumococcal vaccine)
Regional immunization information system (IIS) (N = 127 for shingles vaccine, N = 118 for pneumococcal vaccine)
Community pharmacy database (N = 127 for shingles vaccine, N = 118 for pneumococcal vaccine)

Characteristics

Arm-level characteristics

	Electronic health record (EHR)	**Regional immunization information system (IIS)**	**Community pharmacy database**
% Female *(%)*			
Nominal	61	61	61

The risk of bias assessment below uses ROBINS-I (for assessing risk of bias in non-randomised studies of interventions)

Section	**Question**	**Answer**
1. Bias due to confounding	Risk of bias judgement for confounding	Low

Section	Question	Answer
2. Bias in selection of participants into the study	Risk of bias judgement for selection of participants into the study	Moderate *(The investigators did not state what the eligibility criteria were for the different vaccines.)*
3. Bias in classification of interventions	Risk of bias judgement for classification of interventions	Low
4. Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Low
5. Bias due to missing data	Risk of bias judgement for missing data	Low
6. Bias in measurement of outcomes	Risk of bias judgement for measurement of outcomes	No information *(Measurement of outcomes was not blinded. However, the study does not indicate how much effort was required to measure the outcomes using the databases.)*
7. Bias in selection of the reported result	Risk of bias judgement for selection of the reported result	Low
Overall bias	Risk of bias judgement	Serious *(There were issues with participant selection.)*
	Directness	Directly applicable *(For shingles vaccine, 76% were over the age of 65 years and 24% were between the ages of 50 to 64 years. For Pneumococcal valency 23 vaccine, 68% were 65 years of age or older and 18% were between the ages of 50 to 64 years.)*

O'Mara, 1993

Bibliographic Reference	O'Mara, LM; Isaacs, S; Evaluation of registered nurses follow-up on the reported immunization status of children attending child-care centres; Canadian journal of public health. Revue canadienne de sante publique; 1993; vol. 84 (no. 2); 124-127

Study details

Study type	Cluster non-randomised controlled trial
Study location	Hamilton-Wentworth, Ontario, Canada.
Study setting	Childcare centres including day care centres, preschool centres, co-op centres and special needs centres.
Study dates	1990 to 1991
Sources of funding	Not reported (likely to be Department of Public Health Services)
Inclusion criteria	Children 18 months or older attending childcare centres

Exclusion criteria	None
Intervention(s)	Active follow-up. Between the first and second review, one nurse actively sought to identify missing information by telephone or visits to allocated CCCs after 2 to 5 weeks. The nurse also left a phone number in the CCC for parents to call with updated information.
Comparator	Regular follow-up. For regular follow-up, the nurse did not actively follow-up in any way. Parents were expected to return immunisation information to CCCs without follow-up.
Outcome measures	Observed % change in immunisation rate
Number of participants	14 childcare centres n=514 children
Duration of follow-up	2 to 8 months
Loss to follow-up	132 (25%) not reported by intervention Note: The reported loss to follow-up is 122 but this is an error and should be 132; 382 children remained at follow-up from the original sample of 514.
Additional comments	No relevant baseline characteristics were provided.

Study arms

Active follow-up (N = 166)
7 childcare centres
Regular follow-up (N = 216)
7 childcare centres

The risk of bias assessment below uses ROBINS-I (for assessing risk of bias in non-randomised studies of interventions)

Section	Question	Answer
Risk of bias due to confounding	Risk of bias judgement for confounding	Serious *(The child care centres in the sample were not representative of the population overall, according to the age distribution of children attending. 2) length of time in a centre could contribute to the improved reporting of immunisation status. 3) Length of follow up varied from 2 to 8 months rather than the planned 16 weeks. Potential geographical, socioeconomic or demographic confounding by area of active and regular follow up.)*
Bias in selection of participants into the study	Risk of bias judgement for selection of participants into the study	Serious *(Selection into the study was related (but not very strongly) to intervention and outcome; and This could not be adjusted for in analyses. A sample of 14 centres were selected to achieve a 10% sample of all children. This sampling took place after the intervention had been delivered. The method of random selection of centres was not reported.)*
Bias in classification of interventions	Risk of bias judgement for classification of interventions	Serious *(The active follow up intervention was not described in detail. For example, frequency of phoning or revisiting centres was not reported. The 'passing on' of newly*

Section	Question	Answer
		acquired information to centres was not reported clearly. The definition of regular follow up did not state whether there was strictly no active follow up or whether partial follow up happened in some cases.)
Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	No information *(It is unclear how successfully the active follow up intervention was implemented.)*
Bias due to missing data	Risk of bias judgement for missing data	Serious *(132 (25%) dropout where children left the centres in the sample. Active follow up n=166 analysed, regular follow up n=216 analysed. Baseline numbers of participants in each group was not reported.)*
Bias in measurement of outcomes	Risk of bias judgement for measurement of outcomes	No information *(Blinding status of outcome assessors was not reported. The method of recording immunisation status and by whom was not reported clearly.)*
Bias in selection of the reported result	Risk of bias judgement for selection of the reported result	Moderate *(Selection of sample (n=14 centres) from a larger cohort (n=89 centres): The cohort for analysis may have been selected from a larger cohort for which data were available on the basis of a more interesting finding. However, it is not possible to make a firm judgement of this based on the limited information reported.)*
Overall bias	Risk of bias judgement	Serious
	Directness	Directly applicable

Orefice, 2019

Bibliographic Reference	Orefice, Roberto; Quinlivan, Julie A.; 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; 2019; vol. 26 (no. 1); 0

Study details

Study type	Uncontrolled before-and-after studies
Study location	Australia
Study setting	Hospital antenatal clinic
Study dates	2015 to 2017
Sources of funding	Source of funding was not stated.

Inclusion criteria	Women who gave birth at a hospital. They had also attended antenatal clinics beforehand.
Exclusion criteria	None
Intervention(s)	Electronic health records with a compulsory antenatal pertussis vaccination field (after). In the follow-up period, the intervention was the same as the 'before' period (read below) except that a small interface change was made to the antenatal attendance screen. The pertussis question became compulsory. The electronic health record antenatal attendance screen could not be closed unless the clinician had entered a specific response to the query about pertussis vaccination. (All earlier strategies for vaccination compliance remained in place.)
Comparator	Electronic health records without a compulsory antenatal pertussis vaccination field (before). In the baseline period, staff were educated about pertussis vaccination, a free clinic was established to vaccinate pregnant women, and patient education posters were displayed in clinical areas. The electronic health record antenatal attendance screen prompted staff to indicate whether pertussis vaccination. had been offered and accepted or declined. Answers could be selected from a pull-down list. Once the prompt was answered, the response was auto-populated for future antenatal encounters. However, clinicians could close the antenatal attendance screen leaving the question blank, as completion of the question was not compulsory.
Relevant outcome measures	Vaccine uptake
Number of participants	Before = 275 After = 299
Duration of follow-up	N/A - this was a retrospective study.
Loss to follow-up	None

Study arms

Electronic health records without compulsory antenatal pertussis vaccination field (before) (N = 275)
Electronic health records with compulsory antenatal pertussis vaccination field (after) (N = 299)

Characteristics

Arm-level characteristics

	Electronic health records without compulsory antenatal pertussis vaccination field (before) (N = 275)	Electronic health records with compulsory antenatal pertussis vaccination field (after) (N = 299)
Mean age of mothers *(years)*		
Mean/SD	33.3 (5.12)	31.5 (4.99)

The risk of bias assessment below uses EPOC (for assessing risk of bias in before and after studies)

Section	Question	Answer
Random sequence generation	Was the allocation sequence adequately generated?	No *(There was no randomisation.)*
Allocation concealment	Was the allocation adequately concealed?	No *(There was no blinding.)*
Baseline outcome measurements	Were baseline outcome measurements similar?	N/A
Baseline characteristics	Were baseline characteristics similar?	Yes
Incomplete outcome data	Were incomplete outcome data adequately addressed?	N/A
Knowledge of the allocated interventions	Was knowledge of the allocated interventions adequately prevented during the study?	No *(There was no blinding.)*
Protection against contamination	Was the study adequately protected against contamination?	Yes
Selective outcome reporting	Was the study free from selective outcome reporting?	Yes
Other risks of bias	Was the study free from other risks of bias?	Yes
Overall judgements of risk of bias and directness	Overall risk of bias	High risk of bias *(The people involved with the study were not blinded.)*
	Overall directness	Directly applicable

Otsuka, 2013

Bibliographic Reference	Otsuka, Shelley H; Tayal, Neeraj H; Porter, Kyle; Embi, Peter J; Beatty, Stuart J; 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); 832e1-6

Study details

Study type	Randomised controlled trial (RCT) (but used to provide information about a non-randomised comparison)
Study location	Ohio, USA.
Study setting	General Internal Medicine clinic at The Ohio State University
Study dates	April 1, 2011 to May 15, 2011.
Duration of follow-up	6 months
Sources of funding	Grants from the National Centre for Advancing Translational Sciences and the Ohio State University Medical Centre Institutional Review Board.
Inclusion criteria	Aged 60 years and older Note: guideline population for herpes zoster vaccine is 70 years and older Did not have herpes zoster vaccine recorded in the electronic medical record Received primary care from physicians at The Ohio State University Martha Morehouse General Internal Medicine Clinic in Columbus, Ohio
Exclusion criteria	None reported
Interventions	**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**
Outcome measures of interest	Number of people vaccinated
Additional comments	Although this study was an RCT, the data used for this review was a non-randomised comparison.

Study arms

Arm 1 (N = 250) Electronic vaccination alert for patients with an active personal health record
Arm 2 (N = 424) Standard care for patients with an active personal health record
Arm 3 (N = 250) Postal vaccination alert for patients without an active personal health record
Arm 4 (N = 1665) Standard care for patients without an active personal health record

Arm-level characteristics

	Arm 1 (N = 250)	**Arm 2 (N = 424)**	**Arm 3 (N = 250)**	**Arm 4 (N = 1665)**
Loss to follow-up*	24		9	
% Female	48	57	58	56
Mean age (SD)	69.8 (8.3)	68.6 (7.9)	74.4 (10.0)	74.0 (9.8)
Race/Ethnicity:				
White (%)	87	88	73	73

	Arm 1 (N = 250)	Arm 2 (N = 424)	Arm 3 (N = 250)	Arm 4 (N = 1665)
African American/Black (%)	6	8	20	21
Asian (%)	3	1	2	2
Other ethnicity (%)	5	2	5	5
* Loss to follow-up was not reported for individual arms; it was reported as 24 across arms 1 and 2, and 9 across arms 3 and 4				

The risk of bias assessment below uses ROBINS-I (for assessing risk of bias in non-randomised studies of interventions)

Section	Question	Answer
Risk of bias due to confounding	Risk of bias judgement for confounding	Serious *(There were imbalances in patient baseline characteristics)*
Risk of bias in selection of participants into the study	Risk of bias judgement for selection of participants into the study	Low
Risk of bias in classification of interventions	Risk of bias judgement for classification of interventions	Low
Risk of bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Low
5. Risk of bias due to missing data	Risk of bias judgement for missing data	Low
Risk of bias in measurement of outcomes	Risk of bias judgement for measurement of outcomes	Moderate *(There was a lack of information about how data was collected)*
Risk of bias in selection of the reported result	Risk of bias judgement for selection of the reported result	Low
Overall risk of bias	Risk of bias judgement	Serious *(The imbalance in patient baseline characteristics may have confounded the results. Concerns with data collection.)*
	Directness	Directly applicable

Seeber, 2017

Bibliographic Reference	Seeber, L.; Conrad, T.; Hoppe, C.; Obermeier, P.; Chen, X.; Karsch, K.; Muehlhans, S.; Tief, F.; Boettcher, S.; Diedrich, S.; Schweiger, B.; Rath, B.;

Educating parents about the vaccination status of their children: A user-centered mobile application; Preventive Medicine Reports; 2017; vol. 5; 241-250

Study details

Study type	Non-randomised controlled trial
Study location	Germany
Study setting	Recruitment occurred in an emergency department and hospital.
Study dates	2012 to 2014
Sources of funding	Vienna Vaccine Safety
Inclusion criteria	Parents of children Parents of infants and children (0–18 years of age) presenting to the ED or hospitalised with suspected vaccine-preventable diseases (e.g. influenza-like illness or infections of the central nervous system). Parents were fluent in German
Exclusion criteria	None
Intervention(s)	The VAccApp was designed to help parents understand the vaccination record of their children. The visual language of the VAccApp was non-threatening and playful, using graphical representations of health care practitioners and vaccine recipients (avatars) keeping the user engaged. During the evaluation period, the VAccApp remained on the tablet computers provided by the investigators. Parents entered the requested information autonomously and anonymously while waiting for their child to be seen by a doctor. When using the VAccApp, parents were instructed to open the vaccination record and to look up any of the requested information in the WHO Immunization Certificate of Vaccination. The questions in the App were presented by avatars representing either a physician or a nurse, asking for example “Is your child vaccinated against tetanus?” After the initial yes/no/unknown response, the avatar assisted the user in localizing pertinent information in the WHO-ICV and on product labels. Parents could also enter the name and number of immunizations received, including booster vaccinations, batch numbers, and vaccination dates. The queries were repeated for every vaccine type separately including special indication and travel vaccines.
Comparator	Parents were asked whether their children were up to date by trained quality management staff. Parents had to recall the answers from memory.
Outcome measures	Parents knowledge of their child's immunisation status.
Number of participants	456
Duration of follow-up	Data was collected during the same visit that the intervention was given.

Loss to follow-up	None
Additional comments	We included data for the following vaccines because they are on the UK vaccination schedule for children: tetanus, diphtheria, polio, pertussis, Hib, HepB, mumps, measles, rubella, pneumococcus, rotavirus, HPV. We excluded varicella vaccine data from the analysis because it was not on the UK routine vaccination schedule. We excluded the special indication vaccines: influenza, HepA, tick-born encephalitis, RSV, tuberculosis, typhoid fever, yellow fever, rabies, cholera, Japanese encephalitis, small pox.

Study arms

Vaccination status app (N = 178)
Recall group (non-intervention control) (N = 278)

Arm-level characteristics

	Vaccination status app (N = 178)	**Recall group (non-intervention control) (N = 278)**
% Female	43.8%	50.7%
Mean age (SD)	38.7 months	82.1 months

The risk of bias assessment below uses ROBINS-I (for assessing risk of bias in non-randomised studies of interventions)

Section	**Question**	**Answer**
Bias due to confounding	Risk of bias judgement for confounding	Low
Bias in selection of participants into the study	Risk of bias judgement for selection of participants into the study	Serious *(The recall group were selected for this arm because they had initially forgotten their child's vaccination record. Therefore, the control arm might have been naturally more forgetful than the intervention arm. Furthermore, the baseline characteristics were not the same for each arm.)*
Bias in classification of interventions	Risk of bias judgement for classification of interventions	Low
Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Low

Section	Question	Answer
Bias due to missing data	Risk of bias judgement for missing data	Low
Bias in measurement of outcomes	Risk of bias judgement for measurement of outcomes	Moderate *(Data was collected differently for each arm. The intervention arm used the app, the recall group were asked by staff.)*
Bias in selection of the reported result	Risk of bias judgement for selection of the reported result	Low
Overall bias	Risk of bias judgement	Serious *(Issues with recruitment and data collection.)*
	Directness	Directly applicable

Sewell, 2016

Bibliographic Reference	Sewell, M.J.; Riche, D.M.; Fleming, J.W.; Malinowski, S.S.; Terry Jackson, R.; Comparison of pharmacist and physician managed annual medicare wellness services; Journal of Managed Care and Specialty Pharmacy; 2016; vol. 22 (no. 12); 1412-1416

Study details

Study type	Retrospective cohort study
Study location	USA
Study setting	A medical centre.
Study dates	Not provided
Sources of funding	There was no financial contribution to this study.
Inclusion criteria	Participants had Medicare, which means they were aged 65 years and over.
Exclusion criteria	None
Intervention(s)	Annual Wellness Visits conducted by 1 pharmacist. These took place in a clinic. No further details were provided.
Comparator	Annual Wellness Visits conducted by 3 physicians. These took place in a clinic. No further details were provided.
Outcome measures	Vaccine uptake

Number of participants	108
Duration of follow-up	N/A - it was a retrospective cohort study.
Loss to follow-up	None
Additional comments	This study included data for vaccinations offered and uptake for: pneumococcal 13 serotypes, pneumococcal 23 serotypes, herpes zoster, influenza, Tdap, and Hep B. We used data for pneumococcal 23 serotypes rather than for 13 serotypes because the former vaccine is used for vaccinations for people aged 65 years and above, whereas the latter is not. We used data for herpes zoster vaccine because this is also on the UK routine vaccination schedule for people aged 65 years and above. The other vaccines were not included in this review because they are not used routinely for people aged 65 years and above in the UK. Baseline characteristics of participants was not provided.

Study arms

Pharmacist managed annual wellness visits (N = 19)
Physician managed annual wellness visits (N = 89)

The risk of bias assessment below uses ROBINS-I (for assessing risk of bias in non-randomised studies of interventions)

Section	Question	Answer
Bias due to confounding	Risk of bias judgement for confounding	Low
Bias in selection of participants into the study	Risk of bias judgement for selection of participants into the study	Serious *(Allocation of participants to a physician or the pharmacist may not have been random. There were no baseline characteristics to judge whether allocation to the arms was equal.)*
Bias in classification of interventions	Risk of bias judgement for classification of interventions	Low
Bias due to deviations from intended interventions	Risk of bias judgement for deviations from intended interventions	Low
Bias due to missing data	Risk of bias judgement for missing data	Low
Bias in measurement of outcomes	Risk of bias judgement for measurement of outcomes	Low

Section	Question	Answer
Bias in selection of the reported result	Risk of bias judgement for selection of the reported result	Low
Overall bias	Risk of bias judgement	Serious *(Allocation of participants may not have been random or equal.)*
	Directness	Directly applicable

Qualitative evidence

Bell, 2019

Bibliographic Reference	Bell, S.; Edelstein, M.; Zatonski, M.; Ramsay, M.; Mounier-Jack, S.; 'I don't think anybody explained to me how it works': Qualitative study exploring vaccination and primary health service access and uptake amongst Polish and Romanian communities in England; BMJ Open; 2019; vol. 9 (no. 7); e028228

Study Characteristics

Study design	Semi-structured interviews
Aim of study	This study explored vaccination attitudes and behaviours among Polish and Romanian community members in England, and related access to primary healthcare.
Behavioural model used	Social Ecological Model The SEM acknowledges that health behaviours, such as vaccination uptake, are shaped by multiple factors at the following levels: intrapersonal/individual (e.g., knowledge, attitudes), interpersonal (e.g., family, friends), institutional (e.g., workplaces), community (e.g., neighbourhoods, community groups, local organisations) and policy (e.g., laws, national or local policies). The SEM has previously been used in the context of vaccination behaviours.
Study location	UK. Recruitment focused on three geographical areas (Boston, Lincolnshire; Slough, Berkshire; Brent, London).
Study setting	Community
Study dates	Not stated
Sources of funding	The research was funded by the National Institute for Health Research, Health Protection Research Unit in Immunisation at the London School of Hygiene & Tropical Medicine in partnership with Public Health England
Study methods	Potential participants were given an information sheet, fully detailing the study objectives and explaining all aspects of participation, including the right to withdraw from the research. Participants were interviewed in person or via telephone. Community members were offered the option of being interviewed in English, Polish or Romanian. Interviews were audio recorded and reflective notes were taken during interviews. Face-to-face interviews were conducted in community venues (eg, libraries and quiet coffee shops) in a location convenient for the participant. Face-to-face interviews with healthcare workers were performed in workplaces, in quiet environments away from clinical areas. Most interviews with community members lasted 30–60 min, and approximately 20–40 min with healthcare workers. Community members were asked about their vaccination and related public healthcare experiences. Healthcare workers were interviewed about vaccination service delivery to Polish and Romanian service users. Community members and healthcare workers were solicited for service improvement suggestions. Interview topic guides were developed for this study with community involvement. Interviews were transcribed verbatim and analysed thematically using the stages outlined by Braun and Clarke: data familiarisation, coding and theme identification and refinement. To enhance the rigour of the analysis, coding approaches and data interpretations were discussed between the researchers. Interviews were coded using initial codes generated from the interview

	topic guide and levels of the Social ecological model (SEM). Use of the SEM helped to identify where to focus policy and practice recommendations. The study received ethical approval from the London School of Hygiene and Tropical Medicine Observational Research Ethics Committee, the Health Research Authority and from Research and Development departments in the recruitment areas. Written informed consent was obtained from all study participants.
Population and perspective	Twenty Polish and 10 Romanian community members and 20 healthcare workers were interviewed. Community members were identified through community venues (including schools, nurseries and churches), and advertisements in Polish newspapers, EE shops and via Twitter and Facebook pages. Of the 30 recruited participants, 27 were parents (mainly mothers), 2 were pregnant, 1 was the male partner of a pregnant woman and 1 woman was neither a parent or pregnant but given the flu vaccination due to her having asthma. The average time spent living in the UK was 11 years for Polish participants and 9 years for Romanian ones. The researchers intended to recruit more Romanian community members, to match the number of Polish participants; however, this was not possible during the timeframe of the study due to challenges with recruitment. The study received some negative responses when advertised via social media on Romanian pages that appeared to reflect a mistrust in taking part in research, antivaccination attitudes and concerns around living in England following the Brexit vote. Healthcare workers were identified via general practices and community providers. They included specialist health visitors, school nurses, a vaccination advisor, specialist nurses focused on health inequalities and practice nurses.
Inclusion Criteria	Women who are currently pregnant Parents People aged 65 years or older People with certain health conditions People in the target groups for flu vaccination due to specified long term health conditions such as diabetes and heart disease. Family members Grandparents Immigrants Romanian and Polish
Exclusion criteria	None reported
Relevant themes	CMs = community members, HCWs = healthcare workers in the following text. Seven main themes were identified: 1. Challenges to navigating the health system. These were institutional level issues such as challenges in registering with general practices due to uncertainties around entitlement to care and difficulties in producing proof of address as requested by some practices. CMs perceived the English PHC system as markedly different to systems in Poland and Romania and had faster access to treatment in Poland and Romania. "….in Poland a GP is a GP and they accept the fact that they are GPs….so if they cannot deal with something, they will very easily refer you somewhere else…. If you feel dizzy or you've got a headache, they will send you to a neurologist. It's not a

problem. Here, trying to get a referral somewhere is just like God help you." (Polish mother, Cornwall)

2. Transnational use of health services. CMs often reported ongoing use of health services in Poland and Romania; in some instances, this was done to avoid relying on public healthcare in England to gain direct access to secondary care. Vaccinating children in more than one country could cause disruption of the UK immunisation schedule and affect the accuracy of documentation of vaccination histories.

3. Language and literacy. Communication barriers during healthcare consultations were reported by both HCWs and CMs. The lack of information in languages other than English was noted. Several HCWs reported using online translation tools to aide communication. HCWs also struggled to translate vaccination histories. An additional challenge in working with Roma Romanian communities was overcoming literacy barriers.

4. Expectations of vaccination delivery. CMs based their expectations on intrapersonal knowledge and experiences in Poland and Romania. This meant their expectations were often unmet because of policy and institutional level differences in vaccination programmes.

The number of childhood vaccinations administered within a short space of time was also reported as a concern by parents. Choice of formulations in Poland or Romania was compared to the lack of choice on the NHS.

In Poland vaccines are administered by doctors. Some Polish participants were concerned that nurses in England might not be qualified for this role. The absence of segregated areas between healthy and sick patients in GP practices in England was found to be alarming.

5. Vaccine acceptance. Although most CMs regarded vaccines as essential for protection against disease, certain vaccines created greater concern or were considered less important than others. MMR hesitancy was linked to the Wakefield controversy but was reported not to be at any greater level than in the general population.

6. Accessibility of vaccines. CMs reported that it was straightforward and easy to book vaccination appointments at GP practices; however, dissatisfaction was often noted around the time allocated. HCWs considered it generally difficult to provide vaccine information, administer vaccines and document vaccine delivery within the time allotted (approximately 10–15 min), and this was made even more challenging because of communication barriers.

CMs reported not always receiving vaccination reminders and appointments were often missed due to frequent travel to their home countries.

7. Trust. Trust in healthcare was partially shaped by different expectations of health services and a lack of understanding of how the English system works. Some CMs were particularly sceptical about the quality of healthcare in England:

“I have more confidence in the doctor in Poland. Doctors in Poland are trained doctors. They study medicine for several years…Here, I have the impression that a doctor….they have everything on the computer. He’s typing in a computer that you come, have a cold, a fever, and [it] jumps out [from the computer], what he has to give me.” (Polish mother, Wellingborough)

Additional information	The study participants included one person who was not a parent/carer, pregnant or soon to be a parent. Data was not extracted for flu vaccination or non-parents/ parents to be.

Section	**Question**	**Answer**
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Yes
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Highly relevant *(Views about flu vaccination were not extracted and only 1 participant out of 30 community members was not in our review population of interest (not a parent/ carer or pregnant or eligible for vaccination herself on the routine schedule excluding flu vaccination)*

Boyce, 2012

Bibliographic Reference	Boyce, Tammy; Holmes, Alison; Addressing health inequalities in the delivery of the human papillomavirus vaccination programme: examining the role of the school nurse.; PloS one; 2012; vol. 7 (no. 9); e43416

Study Characteristics

Study design	Semi-structured interviews
Aim of study	The interviews aimed to confirm or challenge existing findings and identify additional and as yet unidentified issues related to the delivery of the HPV vaccine programme and health inequalities.
Behavioural model used	None stated
Study location	UK
Study setting	Schools and other locations where the HPV immunisation programme is delivered.
Study dates	June–August 2011
Sources of funding	Sanofi Pasteur MSD, National Institute for Health Research (NIHR) Biomedical Research Centre, UK Clinical Research Collaboration.
Study methods	The study had 2 components: a rapid evidence assessment of the literature and a series of interviews of health professionals. Two methods of sampling to identify health professionals who deliver the HPV immunisation programme were used; convenience sampling and snowballing. The Royal College of Nurses and the School and Public Health Nurses Association were contacted and agreed to send an email to school and practice nurses outlining the research and a request to be interviewed. The aim of the convenience sample was to interview school nurses from a range of areas across the UK, including areas of high deprivation. Sampling did not seek to be representative but to reflect diversity within the group. Snowballing techniques were then applied; interviewees were asked to suggest others who might be willing to be interviewed or provide alternate or innovative examples of addressing health inequalities. This purposive sampling technique sought to achieve wider representation and to include special or unique cases. Extensive efforts were made to interview health professionals from each of the four home nations, rural and urban areas and areas of deprivation. The decision to stop interviews was made when thematic saturation was reached (when new themes did not arise) and when an appropriate range and geographical representation of health professionals from across the UK were interviewed. 71 interviews were held over the telephone and notes recorded. The use of note-taking (instead of recording) may introduce a risk of bias but it was a deliberate decision to take notes as this forces the researcher to concentrate more closely. In addition, recording interviews can [alter] conversations and create [particular contexts for what is said]. Often the default is to record qualitative interviews, however there was concern that as the interviews aimed to be short, there would not be time to build up trust between the interviewer and interviewee or time to discuss permission to

	record the conversation. The interviews were semi structured, based on open-ended questions and typically lasted 15–20 minutes. Nine interviews took place over email. These email interviews included detailed descriptions of their services and an exchange between the author and interviewee covering questions in the topic guide. All interview participants were informed of the purpose of the research and that notes were being recorded and assured their comments would be anonymised. Interviews were analysed using a two-level systematic thematic analysis. A list of deductive codes was initially created. Inductive codes emerged during the second level of the thematic analysis and findings from the rapid evidence assessment also helped to create these codes. The theme concerning record keeping is analysed in a separate review question looking at the identification and recording of eligibility and status.
Population and perspective	80 Health professionals who deliver the HPV immunisation programme across the UK: school nurses and other health professionals including practices nurses, administrators, civil servants, health visitors and pharmacists.
Inclusion Criteria	Practicing healthcare professionals School nurses
Exclusion criteria	None reported
Relevant themes	The thematic analysis identified three key themes concerning health inequalities and the HPV vaccination programme: 1. Variations in delivery of the HPV vaccination programme: School nurses described that a typical school-based HPV vaccination of the routine cohort involved a number of opportunities for girls to be vaccinated. Mop up clinics were held in some places and reflect the efforts of school nurses to address health inequalities. The location of these clinics was important with those more convenient location for the girls achieved better uptake. For example one area covering a large rural area offered mop-up clinics in the main city's concert hall on a Saturday afternoon as they believed it would "accommodate more girls, taking into consideration the time they might be up and about, the attraction of shopping and the access for young women who may have had Saturday work in the city" (Central Scotland). 2. Expected versus 'actual' inequalities: Issues included religion and ethnicity, girls not in school, girls with learning difficulties, travellers and 'Looked After Children'. In contrast to the published research, interviews with school nurses stated that in their experiences religion and ethnicity had little effect on HPV vaccination uptake. In many areas there was good uptake in schools with high percentages of religious groups but in other cases some Muslim and Catholic schools decided not to offer the HPV vaccination. In many areas school nurses reported religious leaders had a significant impact on the uptake of the HPV immunisation programme, either in encouraging or rejecting the vaccine. Support from religious leaders was not consistent, even within the same religion. When asked who was likely to miss the HPV vaccine, many school nurses quickly stated they knew who would be difficult to vaccinate - vulnerable girls; "you know the ones that don't attend, we send 5 or 6 letters…For those that did not attend, we keep

	giving them chances" (South Wales). Other vulnerable groups were girls with learning difficulties who needed additional effort to vaccinate. "It also takes longer to get trust and convince girls it is ok" (Central England), "parents think the HPV vaccine is unnecessary as they will not be sexually active" (North East England). Establishing trust and having a flexible attitude was also important when vaccinating travellers and gypsies, a group with poor health and low uptake of childhood vaccines. "Word of mouth worked in my favour" (school nurse who vaccinated 16 travellers in 2009/10). Many school nurses made additional efforts to vaccinate girls held in custody or in the care of social services, describing them as "the most vulnerable girls and (I want to) ensure they get them" (South West Scotland). Girls not in school were also likely to miss HPV vaccination. "We do not currently have a programme for pupils not in school as we are a school-based service" (Central England). "Unless we see them in school it's very difficult" (South London). 3. Accurate and persistent records: the information LEAs provided was frequently wrong or not up to date or slow to be delivered. One school nurse was frustrated with the lists she received from the local education authority, describing them as "three months out of date" (North West England). "We want Year 7 in July but sometimes don't get until girls are already in Year 8" (North West England). In addition, the type of information LEAs offered was inconsistent across the UK. For example, in some areas the LEA provided school nurses with addresses of those not in school but in other areas they would not provide these addresses and instead sent invitation to vaccinate letters on behalf of nurses; leaving school nurses unaware if and/or when letters were sent. Administrative support staff were identified as being valuable members of the immunisation team that helped school nurses maintain accurate records and as a result, minimise inequalities. They also helped chased up girls who had been missed. One school nurse described the reason for their high uptake; "School nurses couldn't meet need alone. Teams go into schools and blitz each school. The school nurse and health care assistant help along with clerical assistance" (South West Scotland). One of the consistent themes that surfaced in the interviews was the repeated number of times girls needed to be contacted and that vulnerable girls needed to be contacted more often. Where health professionals were persistent and offered numerous opportunities to be vaccinated, uptake was higher.

Section	**Question**	**Answer**
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes

Section	Question	Answer
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Yes
Ethical Issues	Have ethical issues been taken into consideration?	Can't tell *(No statement of ethics committee approval)*
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Highly relevant

Evans, 2001

Bibliographic Reference	Evans, M; Stoddart, H; Condon, L; Freeman, E; Grizzell, M; Mullen, R; Parents' perspectives on the MMR immunisation: a focus group study.; The British journal of general practice : the journal of the Royal College of General Practitioners; 2001; vol. 51 (no. 472); 904-10

Study Characteristics

Study design	Focus Groups
Aim of study	To investigate factors that influenced parents' decisions about MMR, with emphasis on the impact of the then recent Wakefield MMR controversy.
Behavioural model used	Grounded theory
Study location	UK
Study setting	Community
Study dates	Not provided

Sources of funding	Not provided
Study methods	6 focus groups were held with parents in Avon and Gloucestershire. Three groups comprised parents who had accepted MMR for their youngest child ('immunisers') and three comprised parents who had refused MMR ('non-immunisers'). Their children had a range of histories for immunisations other than MMR. Sampling was purposeful, so that parents were included from a variety of socioeconomic backgrounds who had either accepted or refused MMR immunisation for their youngest child, aged between 14 months and 3 years at the time of recruitment. Ethical approval was obtained from Bristol, Frenchay, Bath, and Gloucestershire local research ethics committees. Each focus group was facilitated by a moderator and assisted by a different member of the research steering group. The discussions were tape-recorded and fully transcribed. The moderator used a series of open-ended questions about child health, attitudes towards immunisation, the decision-making process, and the effects of the media and other influences on immunisation decisions, but participants were encouraged to explore issues about immunisation that were important to them. The discussions lasted between one and two hours and were held in a convenient location for the parents where a crèche was provided. Data collection and analysis proceeded simultaneously until theoretical saturation was reached, according to the constant comparative method. Transcribed data were analysed using modified grounded theory techniques by the research team. The transcripts were scrutinised, emerging themes and sub-themes were agreed, and an initial coding index was developed. Sections of text were coded and these codes were applied to subsequent transcripts. Further codes were added as new themes emerged. 3 members of the team coded some transcripts independently and a high level of consensus was achieved. Microsoft Word was used to develop individual files for each theme, allowing the text to be sorted and analysed in detail.
Population and perspective	6 focus groups in total having a total of 48 participants (43 female, 5 male)
Inclusion Criteria	Parents of children who had a specified age range Aged 14 months to 3 years
Exclusion criteria	None reported
Relevant themes	4 Themes were identified: 1. Beliefs about the risks and benefits of immunisation compared with the risks associated with contracting measles, mumps or rubella: "You have this doubt in your mind, however small I may feel it may be … autism … Crohn's disease … why put parents through the anxiety of thinking, 'Well did I do it by giving them the immunisation or would it have occurred naturally?'." 2. Responses to information from the media and other sources about vaccine safety: "It was because of the media and the press that I looked into the MMR and decided well whoa, I'm not having that you know, otherwise, before, I didn't just didn't think anything of it." 3. Confidence and trust in the advice given by health professionals and attitudes towards compliance with medical recommendations: "Sometimes the doctors and nurses at the surgery can be too much you know, you must have it, you know? And

	that's what puts a lot of people's backs up doesn't it really really, your choice is gone a bit isn't it?" 4. Views on the importance of individual choice within government policy on immunisation: "They [the government] are making decisions for what they see as society as a whole and we're making decisions for our individual children so we are polarised to start with."

Section	Question	Answer
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Can't tell
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Highly relevant

Hansen, 2017

Bibliographic Reference	Hansen, Caitlin E; Okoloko, Edirin; Ogunbajo, Adedotun; North, Anna; Niccolai, Linda M; Acceptability of School-Based Health Centers for Human Papillomavirus Vaccination Visits: A Mixed-Methods Study.; The Journal of school health; 2017; vol. 87 (no. 9); 705-714

Study Characteristics

Study design	Semi structured interviews

Aim of study	To explore acceptability of and facilitators/barriers to HPV vaccination at of School-Based Health Centres (SBHCs).
Behavioural model used	None stated
Study location	United States
Study setting	Single urban, academic, hospital-based primary care clinic and parents of clinic-enrolled adolescents. This clinic is affiliated with 7 school-based health centres: 3 high schools and 4 middle/elementary school
Study dates	2013 to 2014
Sources of funding	National Institutes of Health grant, the Edith P. Rausch Fund of The Community Foundation for Greater New Haven and Yale CTSA grant.
Study methods	Data collection: Qualitative data were collected through semi-structured interviews with parents and adolescents. A single parent interview was conducted per family, including one or both parents. Enrolment was completed when thematic saturation was achieved. Before commencing data collection, study authors created separate interview guides for patents and adolescents that covered similar topics, which were informed by review of the literature of school-located vaccination. Key domains of the interview guide elicited participants' attitudes towards provision of HPV vaccine at SBHCs (e.g., What would you think about getting HPV vaccine at the SBHC? What about completing the second and third shots there?), helpfulness of HPV vaccination at SBHCs (e.g., How would this help you? Would getting it at the SBHC help you get all 3 doses?), and challenges related to provision of HPV vaccine at SBHCs (e.g., Do you see any challenges or issues with getting HPV vaccine at the SBHC?). If both members of a parent and adolescent pair, for example a mother and her son or daughter, participated, they were interviewed separately so as not to influence each other's responses. The interviews were audio-recorded and transcribed for analysis. Method and process of analysis: A team-based, iterative thematic analytical approach was used. A coding guide was developed which was iteratively revised. Patterns in the data were observed and key themed were identified.
Population and perspective	20 adolescents and 20 parents.
Inclusion Criteria	Age: Adolescents 11–18 years of age because HPV vaccine is typically administered in SBHCs between these ages. Parents: Parents of children aged 11 to 18 years of age
Exclusion criteria	None reported
Relevant themes	The thematic analysis identified 2 key themes concerning fragmentation of care and updating records: 1. Fragmentation of care: included desires to maintain their child's medical records in one location and concerns that records might be inaccurate, and result in receiving an unnecessary, extra dose. "…sometimes they mess things up. Nobody's perfect. I certainly wouldn't want somebody to mess up with my kid. Maybe they are thinking they are giving her the first shot, and it is actually the second shot. No, I don't like it, it is confusing." (Parent, Hansen 2017) 2. Updating records: desires to be notified of vaccination so they could update their records.

	"Well, as far as they notify me they need to get the shot it's no problem…I need to put it down in the records so I make sure they got everything up to date." (Parent, Hansen 2017)

Section	Question	Answer
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Can't tell
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	Yes
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Highly relevant

Jackson, 2016

Bibliographic Reference	Jackson, C.; Dyson, L.; Bedford, H.; Cheater, F.M.; Condon, L.; Crocker, A.; Emslie, C.; Ireland, L.; Kemsley, P.; Kerr, S.; Lewis, H.J.; Mytton, J.; Overend, K.; Redsell, S.; Richardson, Z.; Shepherd, C.; Smith, L.; UNderstanding uptake of immunisations in travelling aNd gypsy communities (UNITING): A qualitative interview study; Health Technology Assessment; 2016; vol. 20 (no. 72)

Study Characteristics

Study design	Semi-structured interviews
Aim of study	(1) Investigate the barriers to and facilitators of acceptability and uptake of immunisations among six Traveller communities across four UK cities; and (2) identify possible interventions to increase uptake of immunisations in these Traveller communities that could be tested in a subsequent feasibility study.
Behavioural model used	Social Ecological Model The Social Ecological Model (SEM) recognises that the determinants of individuals' behaviour are complex, multifaceted and operate at a number of levels (intrapersonal, interpersonal, institutional, community, policy). The researchers used the SEM to ensure that all levels of potential influence on immunisation behaviours were explored. Acknowledging the multi-level influences on immunisation uptake is particularly relevant for

	understanding health behaviours in socially excluded communities such as Travellers and for informing future interventions for both policy and practice.
Study location	UK (Bristol, Glasgow, York and London)
Study setting	Community (travellers) Healthcare (healthcare providers)
Study dates	Recruitment and data collection occurred between December 2013 and April 2015.
Sources of funding	This project was funded by the National Institute for Health Research (NIHR) Health Technology Assessment programme.
Study methods	Phase 1: Gatekeepers who had longstanding relationships with the communities initially spoke with Travellers about the study and distributed printed information sheets that had been developed using community involvement. They identified potential participants. Snowball sampling also occurred. Participants were given a £15 gift voucher to thank them for their time. A mixture of one-to-one and small group interviews, depending on participant preference, with members of the same family/peer group were conducted. Interviews were held in locations known to participants, for example at home or in a community centre. Almost all interviews with the Roma participants were conducted with the assistance of an interpreter. With the consent of participants, interviews were recorded digitally. The discussions were carried out using a topic guide to ensure consistency of data collection although the format was flexible to allow participants to raise additional issues they considered important. The researchers focused primarily on issues arising from the UK childhood immunisation schedule but also explored views on antenatal whooping cough and flu vaccine in pregnancy as well as in older and at risk adults. Throughout the interview participants were prompted to consider the influence of the five levels of the SEM (described to participants as: self, family/friends, community, health professionals, local/national policy makers) on their views, experiences and ideas. A data analysis protocol was developed to ensure consistency across the teams as members were spread across the cities. The interviews were transcribed verbatim and data subjected to thematic analysis using the Framework approach. The stages of Framework analysis were undertaken independently for each Traveller community. Participant based group analysis was used to analyse the group interviews, with the contribution of each individual within the interview being analysed separately. A thematic framework was developed using interview transcripts selected to reflect a mix of participants and refined when necessary. The thematic framework was systematically applied to the interview data from across all four cities. The final step was a thematic cross-community synthesis. The final themes and sub-themes were mapped to the five levels of influence within the SEM. Phase 2: The researchers purposively sampled service providers in each of the four cities to ensure they interviewed a mix of ‘frontline workers’ (e.g. health visitors, practice nurses, community midwives, school nurses, GPs, range of community workers including third sector) and those working in more strategic/commissioning roles (e.g. local decision-makers in health protection/public health/health and wellbeing boards/CCGs). List of relevant service providers (their organisations and roles) were compiled from conversations with gatekeepers and local service

	providers), interviews with Travellers and service providers as well as the researchers own knowledge and professional practice. Interviews with service providers were predominantly one to one, with the exception of a small number of small-group interviews. Similar to phase 1, topic guides were developed and used to help ensure consistency both within and across the six communities, although the format was flexible. Use of the SEM informed the questions and key issues raised in phase 1 were integrated into the topic guide for discussion. Analysis was carried out in a similar manner to phase 1. Phase 3: A series of workshops with a subsample of participants from phases 1 and 2 who had agreed to be re-approached. These workshops are not relevant for this review and, as a result, the details are not presented here. The National Research Ethics Service Committee Yorkshire and The Humber – Leeds East approved the study on 23 August 2013.
Population and perspective	One hundred and seventy-four travellers were interviewed. They included a mix of gender (139 female, 35 male) and generations (83, parents, 38 grandparents, 29 adolescent girls, 5 pregnant women) as intended. There were 19 adults without children. Most participants lived on an authorised caravan, trailer or chalet site or were housed and no participants were currently living on the roadside or on unauthorised encampments. Thirty-nine service providers were interviewed. Twenty-two participants were frontline workers employed across a wide range of roles in the NHS (n = 13), local authorities (n = 5), education (n = 2) and the voluntary sector (n = 2). Seventeen participants were in more strategic roles in the NHS (n = 13 in children's services, primary care and community services, screening and immunisation and health improvement) and local authorities (n = 4).
Inclusion Criteria	Women who are currently pregnant People aged 65 years or older Adolescent girls Eligible for HPV vaccine (given at 12–13 years in school) and for their three in- one booster (diphtheria, tetanus, poliomyelitis, given at 13–18 years). Adolescent boys Eligible for their three in- one booster (diphtheria, tetanus, poliomyelitis, given at 13–18 years) Parents who are part of a specific community Travellers Women Young women planning families Travellers living in extended families across generations The researchers aimed for approximately 1/4 to be men and 3/4 women. Grandparents Adults eligible for the flu vaccine Pregnant women, people over 65 years and those with specified long term conditions
Exclusion criteria	None reported
Relevant themes	There were many common accounts, particularly across the English-speaking communities. Roma communities experienced additional barriers in terms of language

	and moving to a new country. Generally, men and women described similar barriers to and facilitators of immunisation uptake. The study identified many themes: 1. Knowledge: There was widespread understanding among Travellers that immunisation protects against diseases and this appeared sufficient to encourage immunisation. A minority had good understanding and knowledge of specific immunisations was variable, better for childhood than adult vaccines. 2. Sources of information and advice: Health professionals were the key source of written and verbal immunisation information, especially for the current generation of parents. Schools were another source of information for mothers and adolescent girls in the English-speaking communities. Media, social media [particularly Facebook] and the internet were viewed as both positive and negative information sources. Female members of the Scottish Showpeople community focused on negative information about the measles, mumps and rubella (MMR) vaccine. 3. Acceptance of immunisation: Many Travellers believed that the protective benefits of immunisation outweighed the risks, leading them to take up immunisations for themselves and their children. This was expressed by almost all of the Bristol and Glasgow Roma, three-quarters of the Bristol English Gypsy/Irish Traveller communities and Scottish Showpeople and half of the York English Roma and London Irish Traveller communities. Many followed the advice of health professionals and saw it as a normal thing to do; others weighed up the pros and cons and usually went ahead. Service providers, while cautious in expressing a view, believed that most Travellers now accept vaccinations. 4. Concerns about immunisation: A small minority of Travellers were anxious about their children experiencing pain and contamination from needles, but this did not usually deter them. A minority of English-speaking Travellers were concerned about multiple or combined childhood vaccines, particularly MMR, with some paying for single injections and a few completely rejected immunisation. 5. Beliefs about specific vaccines: There was general acceptance of immunisation in pregnancy except in the Bristol English Gypsy/Irish Traveller community, in which views varied, particularly about the whooping cough vaccine. MMR vaccine was a particular concern for Scottish Showpeople, whereas in Bristol, York and London previous measles outbreaks meant that most now accepted MMR vaccination. A few women worried about the safety of human papillomavirus (HPV) vaccine. A minority of mothers, fathers and grandfathers (particularly among the Bristol English Gypsy/Irish Travellers) were concerned that their daughters having HPV vaccine would imply that they were promiscuous. Concern that the adult flu immunisation caused flu was expressed by some English-speaking Travellers. 6. Intergenerational change: Many Travellers and service providers observed that the current generation of parents were more positive about immunisation than previous generations, and this was attributed to greater integration, improved literacy and increased trust in health professionals. This view was not expressed by Scottish Showpeople or their service providers. 7. Interpersonal influence: Experiential knowledge and advice was still passed down through generations, especially among Irish Travellers in Bristol and London. Very few spoke of friends influencing immunisation decisions.

8. Decision-making: Mothers tend to see themselves as the main decision-maker about childhood immunisation and believed this to be the community norm; some jointly make decisions with their partners.

9. Language and literacy: Language and literacy barriers existed for the Bristol and Glasgow Roma communities, leading to a strong reliance on interpreters, who are in short supply. Literacy was also a barrier among the English-speaking communities. There was a widespread preference for simple, written immunisation information with pictures and clear verbal explanations.

10. Discrimination: A small minority in the English-speaking communities described experiencing discrimination from health services. No Roma participants expressed this. Service providers in each city gave examples of discrimination against Travellers by NHS staff, suggesting that this was mainly a result of poor understanding of Traveller culture and inexperience of working with Travellers.

11. Housing: Service providers in Bristol, York and Glasgow suggested that isolation and Traveller families being forced to move home were barriers to immunisation uptake. Glasgow service providers spoke of poor, crowded housing conditions for the Romanian Roma families.

12. Travelling: York English Gypsy and Scottish Showpeople were perceived to be settled, which facilitated uptake of immunisation. Views on the influence of travelling on immunisation were more mixed for the Bristol English Gypsy/Irish Traveller and London Irish Traveller communities. Travelling by the Roma communities was mainly discussed in terms of arrival in the UK.

13. Attendance at school: School attendance was mainly discussed by female Traveller participants and service providers, with a minority commenting that some adolescent girls do not attend secondary school, which is a barrier to receiving immunisations such as HPV. This was not perceived to be an issue for Scottish Showpeople.

14. Poverty: Service providers spoke of the impact of poverty on the Bristol Roma, York English Gypsy and Glasgow Roma (particularly Romanian families), and saw it to be linked to language, employment, benefit systems and housing.

15. Access to health services: A minority of Travellers and service providers described problems accessing health services [e.g. registering with a general practitioner (GP) practice, booking appointments and lack of time with GPs]. This led some to use out-of-hours doctors or the accident and emergency department. Service providers working with Roma communities identified other barriers (e.g. a lack of understanding of how the NHS works when first arriving in the UK).

16. Relationships with health professionals: Trustful relationships and continuity of care were valued. Many Travellers described positive immunisation encounters with health professionals. A minority of the English Gypsy and Irish Traveller communities in Bristol, York and London described a lack of trust in doctors (usually based on a particular incident). Roma participants did not describe any negative experiences with health professionals and the Scottish Showpeople were rarely negative. Service providers acknowledged the time taken to develop good relationships with Travellers and emphasised having the ‘right person’ in specialist roles.

17. Recall and reminders: Most Travellers considered recall letters, reminder texts and telephone calls to be effective. Face-to-face reminders were appreciated, as they provided the opportunity for discussion. Service providers used everyday contact with

	Travellers to prompt them about immunisation. In Bristol and Glasgow, the recall and reminder systems had been adapted for the Roma communities. 18. Attending appointments: A minority of Travellers described their frustration in waiting several weeks for appointments. Suggestions for improving attendance were drop-in sessions and walk-in clinics. Service providers described a flexible approach to providing appointments (e.g. opportunistic immunisation, specific clinics for Roma families). Delivering immunisations on Traveller sites was viewed by most Travellers and service providers as only appropriate for those who cannot attend the GP practice. 19. Record keeping and monitoring: Service providers commonly observed that NHS systems did not routinely record Traveller ethnicity, with the result that uptake of immunisation was unknown, affecting funding and targeting of services. A different challenge was identified by those working with the Glasgow Roma community, namely a lack of records on individuals' immunisation histories. 20. Joined-up working: A common view among service providers was that working in partnership within, and across, organisations is important. Examples were offered within health, between health and education, health and social care/housing, health and local authorities and with the police. 21. Local and national strategies: A small minority of Traveller women spoke of national policy in the context of valuing free immunisations and mandating for childhood immunisation. Service providers working with the Glasgow Roma community spoke extensively of local and national strategies for Roma. Specialist health visitor and community health link roles were unanimously viewed as important. 22. Funding: Many service providers said a lack of/cuts in funding inhibited their general immunisation work, as well as their targeted work with Travellers, including a loss of specialist health visitor posts. Those working with the Roma communities suggested that there was little recognition of the complexity of this work, which impacted on funding. 23. NHS reforms: Service providers described how the 2013 reforms in England challenged the delivery of immunisation and health visiting services, as well as threatening targeted services for Travellers.
Additional information	The 19 adults without children do not fall into the target population for this review which covers all people who are eligible for vaccines on the routine UK immunisation schedule and their families and carers (if appropriate). Where possible the views of these people were not extracted. Themes specific to influenza vaccination were not extracted as this is covered by another guideline and is out of scope for this review

Section	Question	Answer
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes

Section	Question	Answer
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Yes
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Highly relevant *(Although some of participants did not match the population for the review, they were only 11% of the participants. Since the vast majority of participants did match the review protocol the study was not downgraded for relevance. In addition, themes relating to flu vaccination specifically were not extracted.)*

Jackson, 2017a

Bibliographic Reference	Jackson, Cath; Bedford, Helen; Cheater, Francine M; Condon, Louise; Emslie, Carol; Ireland, Lana; Kemsley, Philippa; Kerr, Susan; Lewis, Helen J; Mytton, Julie; Overend, Karen; Redsell, Sarah; Richardson, Zoe; Shepherd, Christine; Smith, Lesley; Dyson, Lisa; Needles, Jabs and Jags: a qualitative exploration of barriers and facilitators to child and adult immunisation uptake among Gypsies, Travellers and Roma.; BMC public health; 2017; vol. 17 (no. 1); 254

Study Characteristics

Secondary publication of an included qualitative study - see the evidence table and risk of bias/ relevance judgements under the main reference	Please refer to UNderstanding uptake of immunisations in travelling aNd gypsy communities (UNITING): a qualitative interview study by Jackson, C.; Dyson, L.; Bedford, H.; Cheater, F.M.; Condon, L.; Crocker, A.; Emslie, C.; Ireland, L.; Kemsley, P.; Kerr, S.; Lewis, H.J.; Mytton, J.; Overend, K.; Redsell, S.; Richardson, Z.; Shepherd, C.; Smith, L. in Health Technology Assessment; 2016; vol. 20 (no. 72).

Kaufman, 2019

Bibliographic Reference	Kaufman, J.; Attwell, K.; Hauck, Y.; Omer, S.B.; Danchin, M.; Vaccine discussions in pregnancy: interviews with midwives to inform design of an intervention to promote uptake of maternal and childhood vaccines; Human Vaccines and Immunotherapeutics; 2019; vol. 15 (no. 11); 2534-2543

Study Characteristics

Study design	Semi-structured interviews
Aim of study	They explored how midwives think and feel about vaccination; its place in their professional practice; their receptivity to delivering behaviour change oriented interventions; and the feasibility of intervention delivery in different antenatal settings.
Behavioural model used	None stated
Study location	Australia
Study setting	They interviewed seven midwives from the Royal Women's Hospital (RWH) in Melbourne, Victoria, and five from King Edward Memorial Hospital (KEMH) in Perth, Australia.
Study dates	Not provided. Study was submitted for publication in 2019.
Sources of funding	The Communicable Disease Control Directorate, Department of Health, Government of Western Australia and the University of Melbourne Bickart Clinician Research Fellowship; University of Melbourne.
Study methods	They recruited midwives working in public antenatal settings within two large tertiary hospitals: King Edward Memorial Hospital (KEMH) in Western Australia and the Royal Women's Hospital (RWH) in Victoria. Studying midwives in two different institutions in two Australian states enabled them to consider the impact of differences in healthcare delivery as dictated by State governments, and hospitals within states, who make independent decisions about funding, policy, and practice. At the RWH, vaccines

	were not available on site and pregnant women needed to make a separate visit to their GP. At KEMH, midwives were trained and authorized to deliver vaccines to pregnant women onsite, either in the clinic rooms or at the hospital immunization clinic. For many shifts, there was also a dedicated immunization midwife who discussed vaccines with pregnant women in the waiting area. In each site, they engaged with clinic managers to develop an understanding of the various clinics, birthing models and care practices. They asked clinic managers to identify potential key informant midwives to interview, representing a range of roles and levels of experience, and distributed the study recruitment flyer. Interested midwives contacted the research team to organise an interview. To recruit additional midwives, clinic managers also disseminated the recruitment flyer through internal staff emails, and participating midwives were asked to share the study details with their peers (snowballing). Midwives were eligible to participate if they were involved in some aspect of antenatal care provision and were able to speak and understand English. All participating midwives were consented, completed a brief anonymous demographic survey, and received a $25 card for their time. Ethics approval was obtained. They conducted semi-structured individual interviews, both telephone and face-to-face, based on scheduling availability and preference of the participant. Interviews generally lasted between 20 and 40 min. All interviews were audio-recorded and professionally transcribed. The two interviewers used a single, open-ended question guide. The questions focused primarily on the participants‘ perceived professional role, with regard to vaccination, and the nature of their current practice and communication about vaccines. They also asked them to describe how they recorded vaccine data. Research team meetings were conducted regularly via telephone so that both interviewers could compare their experiences and incorporate reflections for improving subsequent interviews. Thematic analysis was performed on all interview transcripts, coding them in NVivo. Given that their aim was to understand midwives’ views and roles to inform intervention design, they used template analysis to keep their analysis focused on the applied purpose of the study. Template analysis is a structured yet flexible form of thematic analysis that generally begins with some a priori themes, which are then adapted through initial analysis to form a coding template. They derived a priori themes from the TIDieR (Template for Intervention Description and Replication) checklist, which outlines the key features to be reported when describing complex interventions. While these themes provide overarching categories for interview data related to intervention features, they were not specific or detailed enough to capture the full range of the interview data. Therefore, two authors separately analysed the first interview transcript, using open coding to inductively identify themes emerging from the text. Each author grouped these emerging themes into the template categories where possible, and added or modified categories as necessary. Along with a third author, they discussed and compared their initial analyses and agreed on a single customized coding template fit for our study purpose. One author then coded all transcripts with this template. Further minor additions and modifications to the template were discussed periodically with the full study team.
Population and perspective	12 midwives.
Inclusion Criteria	Registered midwives

Exclusion criteria	None reported
Relevant themes	Seven themes were identified in the results: 1) WHO are midwives? a) Perceived roles and professional values Some saw vaccination as a minor or routine element, while others viewed it as a key feature of their role. There was widespread agreement that delivering and discussing vaccination was a task shared by a number of other health professionals “I think it’s a really important role for us to educate the women about [maternal vaccines]…The other childhood vaccinations, we don’t really discuss as much because that’s generally what the child health nurse and the GP picks up.” b) Previous training Most midwives received little or no training about vaccination or techniques to effectively communicate about vaccines during their degree programs “I think we did a bit at uni [university] for half an afternoon or something” 2) HOW do midwives communicate about and/or deliver vaccines? a) Making recommendations All the midwives said they recommended maternal influenza and pertussis vaccines and infant hepatitis B, but there was considerable variation in the perceived origin of the recommendation. “Sometimes I say the doctors recommend it. I don’t actually say ‘I recommend that you have this.’” b) Message content and framing the midwives all shared the basic information about disease risks, side effects, vaccine benefits, and schedule. Some also said they provided details about vaccine ingredients, government policies, or more physiological details about vaccines in pregnancy. “I usually talk a little bit more about protecting the baby with the whooping cough.” c) Description and perceptions of vaccine delivery and related practices Maternal vaccines are not routinely delivered at the location the midwives work. Some midwives perceived this as a potential barrier, though it wasn’t obvious how it could be addressed. “It would be convenient if we could provide [vaccines], but I also don’t think we’ve got the time.” 3) WHEN and HOW MUCH vaccine information do midwives provide? a) Timing and frequency There is no standardized point in pregnancy to discuss maternal vaccines – it is up to the individual midwives to remember to raise the topic and make time to share information and answer questions. “Usually at booking I would mention [maternal vaccines]…and then I’d often bring it up again after the thirty week mark just to see whether they’ve had it or not” b) Information quantity Most midwives agreed that vaccine discussions were relatively brief – generally 1–5 min long. Some said most women did not need or want more detailed information, others said they lacked information to provide or did not feel confident discussing vaccines in more depth, and some described time constraints. “It’s usually quite a brief conversation probably because there isn’t a lot of actual information that we can access”

	4) WHERE do midwives practice and communicate? Midwives work across different rooms throughout the day, with mixed access to resources. 5) WHAT vaccination resources are available or needed? a) Currently available resources Midwives described utilizing a range of resources to support their vaccination discussions with expectant parents, but there was no single, comprehensive resource available to them “The book that we initially give to women, there’s like a section about this [indicates] long that talks a bit about flu, which again, it’s not really helpful for us.” b) Suggested resources and training The value of a single source of information was highlighted. Several midwives from Victoria also agreed that printed fact sheets would be helpful, and the majority from both hospitals were strongly in favour of online resources, like an educational website or app for parents. “Evidence-based websites, yeah that would be amazing, that would be really helpful” 6) PERCEPTIONS ABOUT PARENTS’ knowledge and attitudes a) Knowledge, gaps, and challenges Some midwives felt women were generally well informed about both maternal influenza and pertussis vaccines, but many thought there were gaps in women’s knowledge. “Women in pregnancy are very focused on the labour and birth…I talk about vaccinations and they glaze over.” b) Attitudes towards maternal and childhood vaccines The midwives agreed that most women seemed relatively accepting of vaccinations, with few questions or concerns. “The flu jab, they’re used to that and it’s, they’re having it, you know. The pertussis is one that, you know, it’s more new than the flu jab” 7) BARRIERS AND ENABLERS to Vaccination delivery and/or implementation of a vaccine promotion intervention Barriers identified were Capacity (psychological and physical ability), Opportunity (physical and social), and Motivation (reflective and automatic).

Section	**Question**	**Answer**
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes
Data collection	Was the data collected in a way that addressed the research issue?	Yes

Section	Question	Answer
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Can't tell
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Highly relevant

Kitayama, 2014

Bibliographic Reference	Kitayama K; Stockwell MS; Vawdrey DK; Peña O; Catallozzi M; Parent perspectives on the design of a personal online pediatric immunization record.; Clinical pediatrics; 2014; vol. 53 (no. 3)

Study Characteristics

Study design	Focus groups
Aim of study	To examine desired characteristics of an online immunisation record for parents from a predominantly Latino, low-income population.
Behavioural model used	None stated
Study location	USA
Study setting	Recruitment was achieved by posting flyers at 4 paediatric community practices and 5 elementary schools.
Study dates	2008 to 2009
Sources of funding	Microsoft Be Well Fund. The authors state that the funder did not influence the study design or analysis.
Study methods	Trained focus group moderators used a bilingual semi-structured guide, and all discussions were recorded and professionally transcribed. The focus group guide covered topics that included type of immunization information that should be included in a personal health record (PHR), when and where to access immunisation information, participants' general comfort with using online resources, and any anxieties or concerns they would have in using this PHR tool. At the end of the discussion, participants were given visual materials representing a prototype of the PHR immunisation record tool to elicit feedback to further its development. Participants received breakfast or lunch and a $25 gift card as incentives for attending the focus group.

	Focus group transcripts were analysed by 2 authors using thematic analysis. After discussion, categories were generated inductively based on participants' comments, and a codebook was created. The 2 authors then independently coded the transcripts, resulting in an intercoder agreement rate of 98%. Coding disagreements were discussed and resolved. Dominant themes were identified using an iterative process in which codes were reviewed for relevance and impact.
Population and perspective	Participants were all parents recruited from Northern Manhattan in a primarily Latino, low-income population. 29 parents participated in 4 focus groups, where 2 groups were led in English and 2 in Spanish. All participants were women and the majority were Latina.
Inclusion Criteria	Parents of children. The ages of the children were not provided.
Exclusion criteria	None
Relevant themes	7 Themes were identified with regards to online immunisation records: 1) Parents said they liked to see what vaccines their children had already had and what vaccines their children should be having (whether they were up to date). They liked the information on the vaccines that was included. 2) Parents said that using an online immunisation record was relatively easy, fast, convenient, and saves time. They liked being able to print out the information so they could show the information to people who needed to know. They liked being able to print out vaccination reminders for themselves. 3) Many parents said they had misgivings about protecting privacy with regards to having details about their children online. 4) Parents suggested safeguards to ensuring confidentiality, including password verification and limited access to the online record. Parents said that many immigrant parents were scared – it should be noted on the online immunisation record that immigration status was confidential. 5) Some parents were interested in extending access to their child's school and doctor's office, whereas others were adamant about exclusive access remaining with the parent. 6) Parents said they would have liked information on what disease(s) each vaccine aimed to prevent. They said that they would have liked the information to be available in a choice of languages – not just English. They would have liked the information to have been presented in a simple, jargon-free way. 7) Parents said that they would have liked face-to-face training or an information guide on how to use the online immunisation record.

Section	Question	Answer
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes

Section	Question	Answer
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Yes
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Relevant *(The ages of the children are not clear. Recruitment of parents occurred at paediatric clinics and at elementary schools. Elementary school age in the USA is 5 to 10 years. Findings presented as for 0-18 to make this uncertainty clear.)*

Mytton, 2020

Bibliographic Reference	Mytton J; Bedford H; Condon L; Jackson C; ; Improving immunization uptake rates among Gypsies, Roma and Travellers: a qualitative study of the views of service providers.; Journal of public health (Oxford, England); 2020

Study Characteristics

Secondary publication of an included qualitative study - see the evidence table and risk of bias/ relevance judgements under the main reference	Please refer to UNderstanding uptake of immunisations in travelling aNd gypsy communities (UNITING): a qualitative interview study by Jackson, C.; Dyson, L.; Bedford, H.; Cheater, F.M.; Condon, L.; Crocker, A.; Emslie, C.; Ireland, L.; Kemsley, P.; Kerr, S.; Lewis, H.J.; Mytton, J.; Overend, K.; Redsell, S.; Richardson, Z.; Shepherd, C.; Smith, L. in Health Technology Assessment; 2016; vol. 20 (no. 72).

New, 1991

Bibliographic Reference	New, S.J.; Senior, M.L.; I don't believe in needles: Qualitative aspects of a study into the uptake of infant immunisation in two English Health Authorities; Social Science and Medicine; 1991; vol. 33 (no. 4); 509-518

Study Characteristics

Study design	Semi-structured interviews
Aim of study	To explore reasons for vaccine hesitancy and parental knowledge of, and attitudes towards, immunisation and the type of advice that parents had received.
Behavioural model used	None stated
Study location	UK
Study setting	Community
Study dates	1988
Sources of funding	Economic and Social Research Council
Study methods	It was decided to examine the experiences of a sample of mothers representing these three groupings within two DHAs in the North West of England, Lancaster and Salford. Lancaster, with a mixture of rural and urban environments within its boundaries, had, at the time of the study (1988), an uptake rate for the primary course of immunisations higher than the national average (73.5% for DTP/Polio uptake against 72% nationally), whilst Salford-which is part of a larger conurbation and has an inner city area-had an uptake rate substantially below the national average (56% for DTP/Polio uptake). With the cooperation of members of the respective DHAs, data from the computerised Child Health System was provided weekly, from June to December 1988, in two forms: (i) immunisation history cards, giving details of children who had recently completed their primary course (‘full’ and ‘partial’ immunisers); and (ii), a routinely produced list for Health Visitors of children who had not attended for two appointments in succession without a reason being given for their non-attendance (‘incomplete’ immunisers). Potential interviewees were chosen at random from these two sources, although the sampling fractions were weighted in favour of incomplete immunisers, as they formed the smallest of the three groups. The nature of the data with which they were provided determined the nature of their research design: a retrospective, unmatched case-control design. Both cross-sectional and cohort designs were ruled out, as very large samples would have been necessary to secure an adequate number of incomplete immunisers. The questionnaire contained a number of sections; the first section asked all the respondents to state all their reasons for non-attendance and explored the notion of specific practical difficulties and constraints. These questions were asked unprompted at the beginning of the interview in order to elicit an answer that would not be influenced by any of the issues discussed in the sections that followed. The middle

	sections invited precise, factual responses amenable to quantitative analysis, whilst the final two sections explored parental knowledge of, and attitudes towards, immunisation and the type of advice that parents had received. Some of the questions in these last two sections were quantifiable, whilst others were more open-ended. In the majority of cases, respondents also freely elaborated on the responses they offered to the more quantifiable questions and were indeed encouraged to do so. Thus, data of a more qualitative nature was contributed by all respondents.
Population and perspective	Overall, attempts were made to contact 634 mothers and interviews were actually secured with 253 women:123 full immunisers, 71 partial immunisers and 48 incomplete immunisers. A further 11 interviews were secured with incomplete immunisers, but proved to be unusable for the purposes of the statistical analysis. In 15 cases, both parents had taken the child to the appointment, whilst only two fathers had had sole responsibility. At 70 addresses in Salford no answer was obtained, even after at least one repeat visit at a different time of the day (and in many cases a third, evening, visit), whilst in 26 cases the address was incorrect. Again in Salford, 42 women declined to be interviewed, 31 of whom were incomplete immunisers. This was the group amongst whom interviews proved most difficult to secure, which raises the question of whether those who declined to be interviewed differed significantly in any characteristics to those incomplete immunisers who agreed to be interviewed; possibly the refusers formed the true ‘hard core’ of incomplete immunisers within Salford, a group which was therefore at best under-represented within the sample.
Inclusion Criteria	Parents of children
Exclusion criteria	None reported
Relevant themes	2 Themes were identified: 1. Health experiences. Partial immunisers had tended to receive more negative advice from family and friends than both full and incomplete immunisers, but many partials said that it was the professionals’ attempts to persuade them that the risks of vaccine-damage were minimal that had actually deterred them: "If he has whooping cough, he catches it and that’s that - but if he had the injection, I’d feel responsible." 2. The impact of the 'gender role constraint'. Transport constraints were not seen to be affecting uptake to any significant extent, whilst illness and the presence of older children-both of which could be interpreted as time-space constraints-were seen to be of some significance.: "I have to take other children along with me and its very hard work."

Section	Question	Answer
Aims of the research	Was there a clear statement of the aims of the research?	No
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes

Section	Question	Answer
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Can't tell
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Can't tell
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Highly relevant *(Although the ages of the children are not clear, the children included in this study easily fit within our 0-5 years of age group because it is about infants and babies.)*

Paterson, 2019

Bibliographic Reference	Paterson P; Mounier-Jack S; Saliba V; Yarwood J; White J; Ramsay M; Chantler T; Strengthening HPV vaccination delivery: findings from a qualitative service evaluation of the adolescent girls' HPV vaccination programme in England.; Journal of public health (Oxford, England); 2019

Study Characteristics

Study design	Semi-structured interviews
Aim of study	To examine whether service-related factors may have contributed to a downward trend in adolescent girls' HPV vaccination coverage and identify best practices from the perspectives of service providers and commissioners.
Behavioural model used	None stated

Study location	UK
Study setting	The offices of the participants who were working at commissioning and service delivery level.
Study dates	2017
Sources of funding	National Institute for Health Research Health Protection Research Unit (NIHR HPRU)
Study methods	This service evaluation was conducted in six local authorities covered by three Screening and Immunization Teams (SIT) in England: South West (Cornwall, North Somerset, Bristol), North Central Midlands (Lincolnshire, Leicester), and South Central Midlands (Luton). The investigators included areas that; (i) delivered either the two doses of vaccine in school Year 8 and areas that delivered the first dose in Year 8 and the second dose in Year 9. (ii) were geographically and socio-demographically diverse, (iii) had a range of HPV coverage rates, and commissioned different types of providers (e.g. school nurses, and immunization teams). They invited individuals working at commissioning and service delivery level to participate by emailing them a study information letter. Respondents who expressed interest in participating were contacted. An initial phone call was arranged for a researcher to explain the study and answer any questions. If the respondent was still interested in participating, a time and place for the interview was arranged. Researchers visited study participants at their place of work, discussed what participation would involve and obtained written informed consent prior to conducting interviews and observations. The consent process included an explanation on how they would protect participants' confidentiality. Data collection involved individual and group interviews and an observation of a school immunization session (documented in field notes). The interviews were conducted by investigators; One focused on the South West and Central Midlands SITs areas and the other on the North Midlands SIT area. A semi-structured interview approach was adopted to enable the interviewer to cover pre-defined topics and allow the exchange to be shaped by interviewees' roles, responsibilities and experiences. The interview topic guides were pre-tested with the support of an immunization provider and a commissioner from a non-participating area. Interviews were mostly conducted face to face, or by telephone. Interviews were audio-recorded and transcribed verbatim.
Population and perspective	Commissioning level Service delivery level: • NHS England Public Health Commissioners • Screening and Immunization Leads • Immunization managers • Immunization coordinators with responsibility for school-aged immunizations Service delivery level: • Service provider organization administrators • Service provider nursing leads • Nurses who provide the vaccines in schools • Service provider data administrators • Child Health Information Service Managers
Inclusion Criteria	See population and perspective above.
Exclusion criteria	None

Relevant themes	1) Many school nurses reported problems with the accuracy of the lists of girls to vaccinate that were provided by the local education authority (or its equivalent). The type of information supplied was also inconsistent making it harder to know who had been offered vaccination or to make contact with the families of girls who were not in school. 2) The movement of girls between schools and areas made it hard to ensure that they received both doses of the HPV vaccination. Providers who used a 1 year delivery model reported less disruption to the vaccination schedule. 3) Real-time database systems helped manage keeping track of the movement of girls between schools and areas, as did troubleshooting meetings between commissioners, Child Health Information Services (CHIS) leads and service providers, and regular communication with General Practice. 4) Inputting and cleaning data in database systems was highlighted as labour intensive, especially the parts of the data management system that are not yet automated. 5) Automated database systems can prevent delays between records appearing on GP or school provider servers by using bulk processing to increase efficiency. They can reduce inaccuracies in data monitoring that could lead to missed or duplicated vaccinations. Data inaccuracies also arise when GPs do not send updated vaccination records to CHIS in a timely fashion.

Section	**Question**	**Answer**
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Yes
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low

Section	Question	Answer
	Relevance	Highly relevant

Thomas, 2018

Bibliographic Reference	Thomas, S.; Cashman, P.; Islam, F.; Baker, L.; Clark, K.; Leask, J.; Butler, R.; Durrheim, D.N.; Tailoring immunisation service delivery in a disadvantaged community in Australia; views of health providers and parents; Vaccine; 2018; vol. 36 (no. 19); 2596-2603

Study Characteristics

Study design	Focus Groups Semi-structured interviews
Aim of study	To gain a deeper understanding of the factors influencing immunisation in order to develop tailored strategies for increasing immunisation coverage.
Behavioural model used	None stated
Study location	Australia
Study setting	Community
Study dates	2016 to 2017
Sources of funding	Not provided. However, the investigators were employees of universities, Population Health or the WHO.
Study methods	Researchers first met with stakeholder groups in Maitland to discuss the planned study and develop a trusting relationship. Stakeholders included 2 community health staff (one manager and one nurse immuniser), the manager of community child health, the manager of the Primary Health Network (PHN) and 3 team members (representing GPs in Maitland), 1 representative of the Maitland City Council (which offers immunisation clinics), 4 public health staff, and the director of the local neighbourhood centre. Purposive sampling was used to recruit stakeholders uniquely positioned to contribute meaningful insights to the research aim. Semi-structured interviews and focus groups were conducted with health service providers invited by email or telephone. A Participant Information Statement was provided and informed consent was obtained in writing prior to the interview. Parents were invited and interviewed individually either by telephone or in person at the neighbourhood centre where services are provided for those experiencing disadvantage. A comprehensive description of the project with assurances of confidentiality and privacy was provided. Consent was obtained verbally and confirmed by participation. Service providers were invited to participate in focus groups to generate narrative data and share experiences in a safe environment. Service managers were

	interviewed individually to capture their views and information regarding immunisation policy and strategic plans. Health service providers were asked about the defining characteristics of children not fully immunised in Maitland, about perceived barriers to achieving full immunisation and what might be done to help parents ensure their children are up to-date. Parents were asked about their experience with immunisation services, what made it difficult to keep up to date with immunisation and what would make it easier. Interviews were recorded with notes taken by a co-facilitator. Their line of inquiry was dynamic, responding to emerging concepts and themes. Further sampling continued until no new insights emerged. Recordings were transcribed verbatim and analysed manually by an investigator and members of the research team. Key concepts were identified and grouped according to the research questions. Ongoing analysis led to the development of themes. These were validated by the research team. Preliminary results were shared with participants to confirm their interpretation and provide opportunity for additional contributions. Ethics approval was obtained from the Hunter New England Human Research Ethics Committee.
Population and perspective	They conducted 34 interviews and 6 focus groups with a total of 59 participants. One service provider and one grandparent declined to participate for reasons not stated. The 59 participants were: 18 parents, 19 community health workers, 13 general practice workers (GPs and nurses), 6 population health, 3 Maitland City Council.
Inclusion Criteria	Practicing healthcare professionals And council staff Parents of children
Exclusion criteria	None reported
Relevant themes	3 Themes were identified: 1. Limited engagement with health services unless the need is urgent. Participants identified children who had fallen behind in immunisation for a variety of reasons, including parents who simply forgot, had several children all requiring immunisation, were waiting for a Medicare card or had recently moved to Maitland and were busy establishing themselves: "Maitland is growing very quickly and for new arrivals, it takes a while to get a GP, getting a job, a house, a school, immunisation falls behind while you're just doing those everyday things. Those people will probably quickly catch up." 2. Parents experience multi-dimension access barriers to immunisation services in Maitland. Many participants agreed that access to services was often difficult for those who were falling behind. Some services were not seen to accommodate the needs of parents who struggled with costs, transportation, location, language barriers or hours of operation: "The council clinics are not central to them [Aboriginal people]; it's too far. . .they don't have transport to get there." 3. A flexible, supportive family centred, primary health care approach, utilising strong partnerships, is most likely to be effective in increasing childhood immunisation rates in Maitland. Some felt that existing immunisation services provided by GPs and the Maitland City Council were working well but that to reach those who were falling through the gap, a more targeted approach was needed: "The only way you'll get that cohort you're focusing on is to have opportunistic immunisation. There's no problem with home visits, having vaccines in the car and saying the child is overdue and asking if they'd like me to do it now. No-one ever says no. It's not a barrier if you can get the vaccine to them."

Additional information	This study also included data from parents. However, this data has not been used because we already had enough UK data from parents.

Section	Question	Answer
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Can't tell
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Can't tell
Ethical Issues	Have ethical issues been taken into consideration?	Yes
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Low
	Relevance	Highly relevant

Webb, 2014

Bibliographic Reference	Webb, Heather; Street, Jackie; Marshall, Helen; Incorporating immunizations into routine obstetric care to facilitate Health Care Practitioners in implementing maternal immunization recommendations.; Human vaccines & immunotherapeutics; 2014; vol. 10 (no. 4); 1114-21

Study Characteristics

Study design	Semi structured interviews
Aim of study	To explore the current practice of HCPs regarding maternal vaccine uptake and the interaction of knowledge, attitudes, beliefs, and practice
Behavioural model used	None stated

Study location	Australia
Study setting	Tertiary maternity hospital
Study dates	Not mentioned
Sources of funding	Partly funded by Immunization Branch, South Australia Health
Study methods	Data collection: Semi-structured interviews were conducted with perinatal health care professionals (HCPs). Open-ended questions were used to explore participants' vaccine management practice, professional vaccine information sources, safety concerns and attitudes and beliefs about vaccinations as well as barriers and facilitators to incorporating vaccine. Data collection and analysis was an iterative process, with collection ceasing with theoretical saturation.
Population and perspective	Participants (n = 15) were 3 GPs, 6 obstetricians, and 6 midwives.
Inclusion Criteria	Participant recruitment Potential participants were identified from respondents to a general email and announcements at 2 midwifery education seminars (antenatal and postnatal) and through targeted recruiting.
Exclusion criteria	None reported
Relevant themes	1 Theme was identified: 1. Barriers to implementing vaccine recommendations: Absence of vaccine references in documentation. This included issues around entry point into documentation. "But there isn't a tick box or something in the handheld record even. So the handheld record could have a box where it could be ticked influenza vaccine as a prompt. Because I might see somebody once in their pregnancy and they could see a different person every time".1 (Midwife, Webb 2014)

Section	Question	Answer
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Yes
Data collection	Was the data collected in a way that addressed the research issue?	No *(No indication of how interviews were conducted and only stated that open-ended questions were used. Data collection methods (questions used or guide) not provided.)*
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Can't tell

Section	Question	Answer
Ethical Issues	Have ethical issues been taken into consideration?	Can't tell
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	Yes
Overall risk of bias and relevance	Overall risk of bias	Moderate *(Issues with data collection)*
	Relevance	Highly relevant (see committee discussion as finding downgraded once)

Wiot, 2019

Bibliographic Reference	Wiot, F.; Shirley, J.; Prugnola, A.; Di Pasquale, A.; Philip, R.; Challenges facing vaccinators in the 21st century: results from a focus group qualitative study; Human Vaccines and Immunotherapeutics; 2019; vol. 15 (no. 12); 2806-2815

Study Characteristics

Study design	Focus Groups
Aim of study	The researchers conducted a qualitative study to investigate perceived gaps between the expectations of healthcare professionals in their role as vaccinators and the reality of the world they operate in.
Behavioural model used	Phenomenological method No further details provided
Study location	United States (US), United Kingdom (UK), Germany and India.
Study setting	Healthcare
Study dates	October and November 2018
Sources of funding	GlaxoSmithKline Biologicals SA
Study methods	The four study countries (US, UK, Germany and India), were selected to provide views from Healthcare professionals (HCPs) working in very different vaccine administration environments. The research was conducted by an independent market research company (Cello Health Insight). Potential participants were contacted by telephone or email from databases of HCPs held by the company and their locally-based suppliers. HCPs were screened to ensure the vaccinators selected from each country were representative of that role in the region, thus able to reflect frontline concerns and challenges. Two hour one-to-one and group discussions were undertaken to gain insights into the understanding HCPs have of their role as vaccinators and to identify the challenges they face in this role. All sessions were facilitated by an experienced researcher from

	the market research company. All participants provided written consent to participate and the study sponsor was not disclosed to participants. Individual and focus group responses were analysed following narrative analysis principles (including word and phrase repetitions). The researchers conducted a detailed local language analysis of the recordings followed by a thematic analysis performed by experienced specialist healthcare researcher through a phenomenological lens. Key themes were identified and discussed to ensure consistency. Data were analysed according to profession-specific and country specific information disclosed through the survey. This was a market research activity and no ethics approval was sought.
Population and perspective	75 nurse and physician vaccinators In the US, 10 paediatricians, 10 general practitioners/ family physicians (GPs) and 8 nurses were divided across six groups, in the UK, 10 GPs and 10 nurses were divided into four groups, in Germany, 9 paediatricians and 8 GPs were divided into four groups, and, in India 10 paediatricians were divided into two groups.
Inclusion Criteria	Practicing healthcare professionals HCPs had to spend 70% of more of their time in direct patient care; have been in practice between 3 and 30 years; have administered and/or recommended/personally discussed measles-mumps-rubella/varicella and diphtheria-tetanus-pertussis-containing paediatric vaccines with patients in the last 3 months and and been involved in the administration/prescribing of vaccines or responsible for discussing vaccine options and making recommendations to adults/adolescents/children. GPs and nurses were additionally required to have recommended/personally discussed at least two adult and/or travel vaccines with patients in the last 3 months.
Exclusion criteria	Participants who were involved in other research Participants could not have participated in vaccination related market research in the last month. Affiliation with any pharmaceutical company, healthcare manufacturer or market research company US specific exclusion criteria HCPs could not participate if they were a government employee or if they were licensed to prescribe medications or practice/work in a medical capacity in Vermont or Minnesota. All US participants had to be board certified or board eligible in their specialty.
Relevant themes	1. The role of HCPs as vaccinators: expectations versus reality: While vaccinators were expected to have meaningful encounters with patients, underwritten by continuity of care and a solid conviction by patients in the benefits of vaccination, the reality was characterized by large administrative loads, constricting influences of regulations, rigid vaccination plans, and extensive time spent educating and convincing parents to accept vaccination associated with a sense of loss of trust. 2. Country-specific findings on the role of HCPs: In the UK, pressure to meet performance targets was highlighted as a key challenge. 3. Challenges faced as a vaccinator by all countries: “vaccination targets and pressure to achieve them”, “devolve vaccination responsibilities from physicians and nurses to pharmacists or non-medically qualified persons”., “little knowledge or misinformation about vaccines by parents/patients”, an expectation that “sufficient time will be available to discuss parent/patient questions and concerns about vaccinations”. 4. Challenges in the UK: “uncertainty surrounding current immunization guidelines”, as well as “frequent, often short notice, changes to the immunization schedule”., “Recurring vaccine stock shortages”, “devolvement/ shared vaccination role with other HCPs”., “rapid provision of up-to-date vaccine information (e.g., new recommendations, schedules, side-effects) to HCPs.”

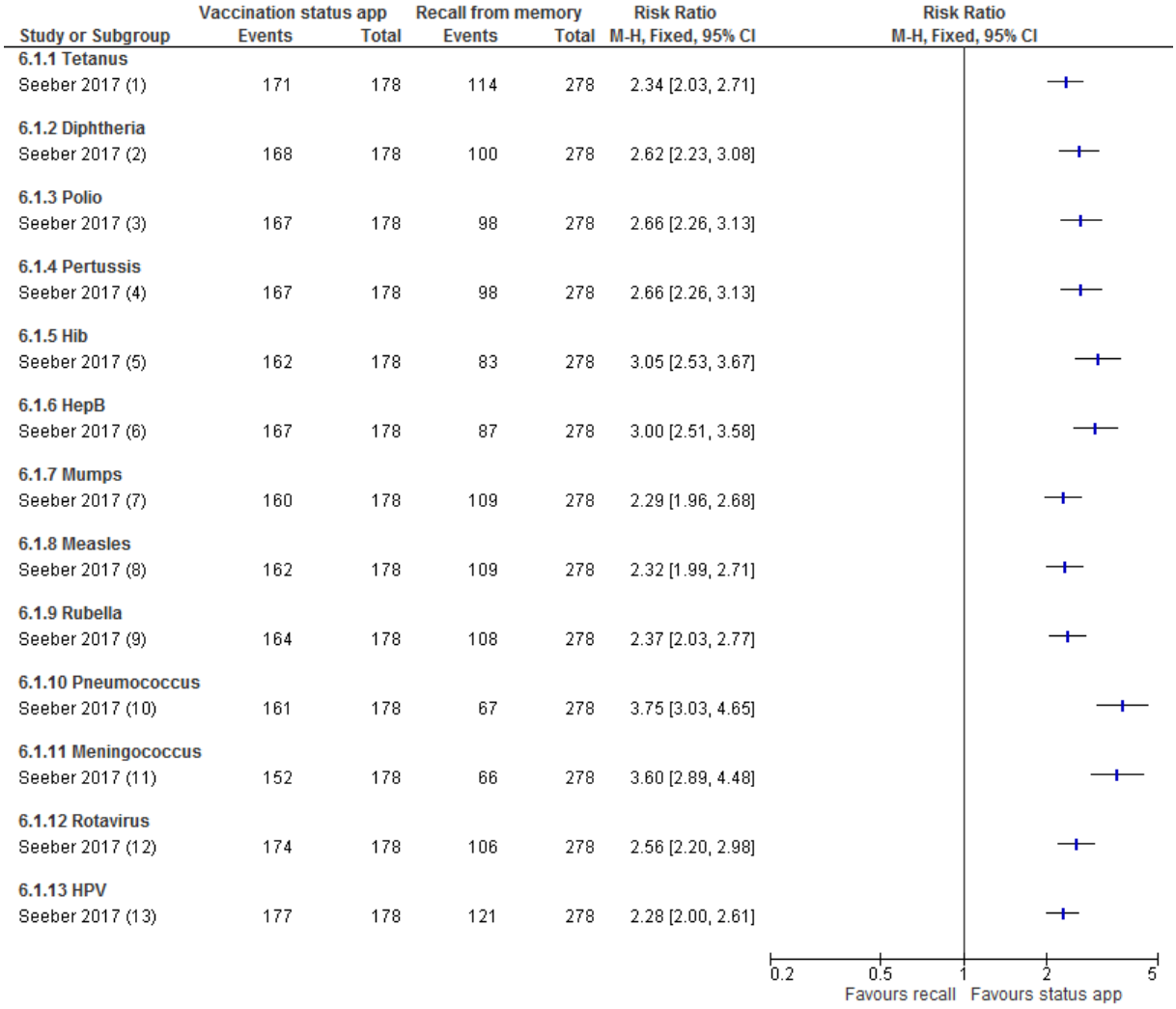
Additional information	This study was used to provide additional evidence on the views of healthcare professionals in the UK, but the data on the USA and Germany were not required and was therefore not extracted. India is not in the OECD and any data referring to India was not extracted.

Section	Question	Answer
Aims of the research	Was there a clear statement of the aims of the research?	Yes
Appropriateness of methodology	Is a qualitative methodology appropriate?	Yes
Research Design	Was the research design appropriate to address the aims of the research?	Yes
Recruitment Strategy	Was the recruitment strategy appropriate to the aims of the research?	Can't tell *(Potential participants were contacted by telephone or email from databases of HCPs held by the company and their locally-based suppliers. It is unclear how these lists were compiled.)*
Data collection	Was the data collected in a way that addressed the research issue?	Yes
Researcher and participant relationship	Has the relationship between researcher and participants been adequately considered?	Can't tell *(Unclear as it was done by an external company and not mentioned in the paper.)*
Ethical Issues	Have ethical issues been taken into consideration?	Yes *(No independent ethics committee approval was required as this counted as market research, but the purpose of the research, and how the participant's contribution will be used was explained.)*
Data analysis	Was the data analysis sufficiently rigorous?	Yes
Findings	Is there a clear statement of findings?	Yes
Research value	How valuable is the research?	The research is valuable
Overall risk of bias and relevance	Overall risk of bias	Moderate *(Due to a lack of information about the sources of participants and lack of information about researcher reflexivity.)*
	Relevance	Highly relevant *(Only UK themes were extracted)*

Appendix E - Forest plots

Interventions aimed at individuals, parents and carers

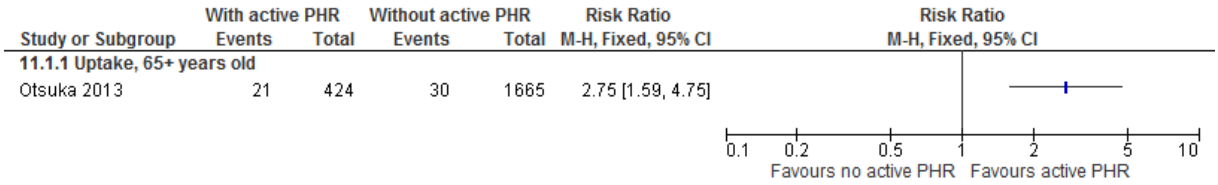
NON-RCT: vaccination status app on a tablet versus recall from memory. Outcome = accuracy of data on vaccination status



Footnotes

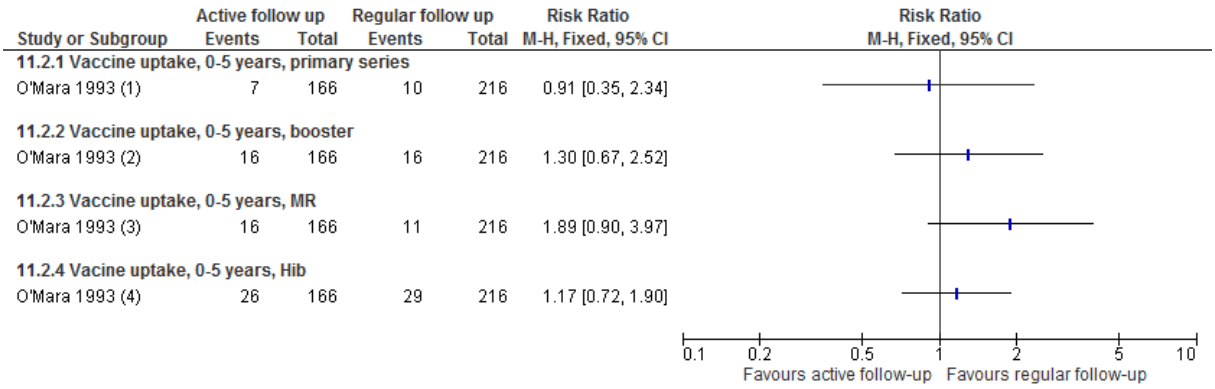
(1) - (13) Non-randomised controlled trial. 0-18 years of age.

NON- RCT: Standard care with active personal health record versus standard care without active personal health record (non-randomised comparison from RCT). Outcome = vaccine uptake.



Footnotes
PHR = personal health record

NON-RCT: Active versus regular nurse follow-up of vaccination status for preschool children attending childcare centres

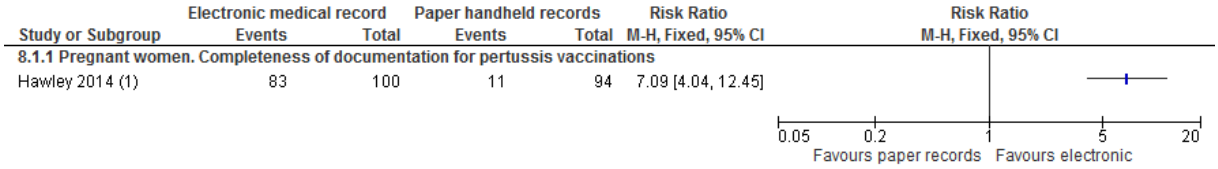


Footnotes

(1) - (4) Cluster non-randomised trial

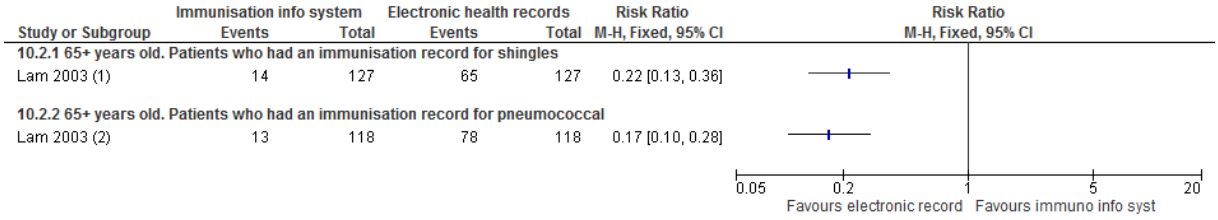
Interventions aimed at healthcare providers

NON-RCT: Paper handheld records (before) versus electronic medical records (after). Outcome = Accuracy and completeness of documentation for pertussis vaccinations



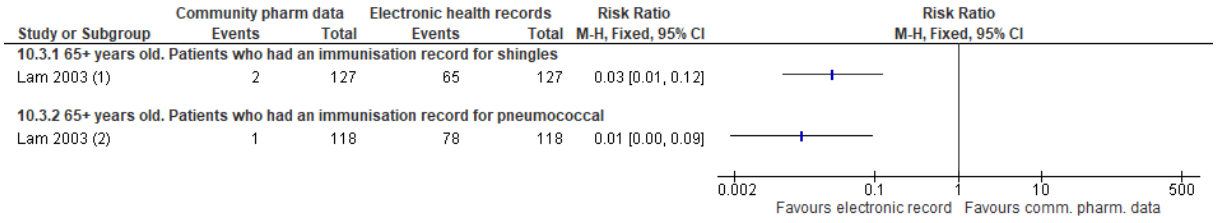
Footnotes
(1) Before-and-after study. There were 94 pregnant women in the paper handheld group because the notes for 6 went missing.

NON-RCT: Regional immunisation information system versus electronic health records. Outcome = Patients who had an immunisation record



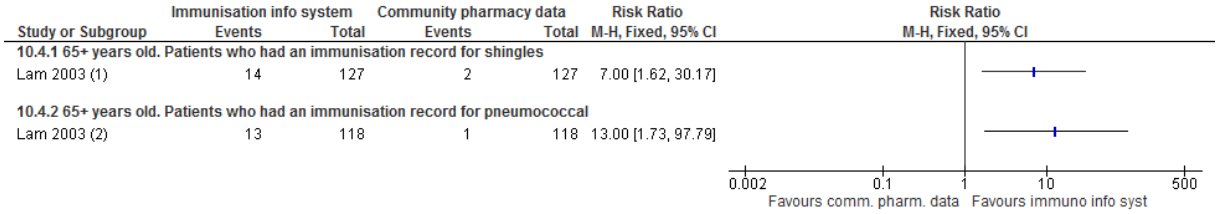
Footnotes
(1) Cohort study. Data could not be pooled because the participants were the same for shingles and pneumococcal immunisation records
(2) Cohort study. Data could not be pooled because the participants were the same for shingles and pneumococcal immunisation records

NON-RCT: Community pharmacy database versus electronic health records. Outcome = Patients who had an immunisation record



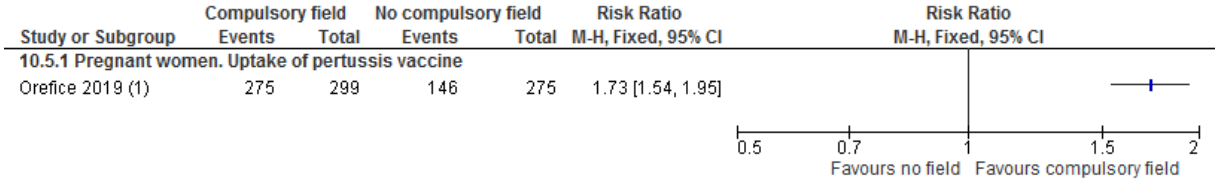
Footnotes
(1) Cohort study. Data could not be pooled because the participants were the same for shingles and pneumococcal immunisation records
(2) Cohort study. Data could not be pooled because the participants were the same for shingles and pneumococcal immunisation records

NON-RCT: Regional immunisation information system versus community pharmacy database. Outcome = Patients who had an immunisation record



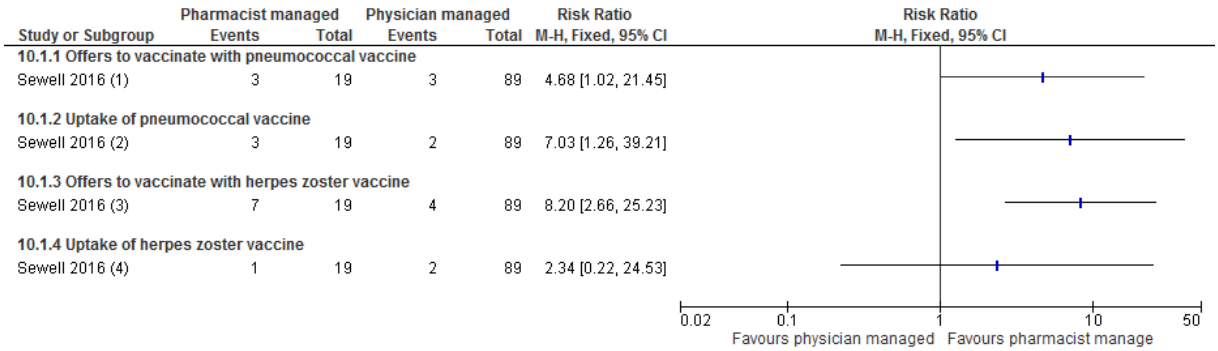
Footnotes
(1) Cohort study. Data could not be pooled because the participants were the same for shingles and pneumococcal immunisation records
(2) Cohort study. Data could not be pooled because the participants were the same for shingles and pneumococcal immunisation records

NON-RCT: Electronic health records with compulsory vaccination status entry field (after) versus electronic health records (before). Outcome = Vaccine uptake



Footnotes
(1) Before-and-after study

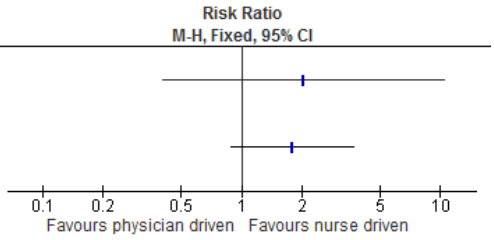
NON-RCT: Pharmacist managed annual wellness visits versus physician managed annual wellness visits



Footnotes
(1) Cohort study, 65+ years of age. Data for pneumococcal 23 serotypes.
(2) Cohort study, 65+ years of age. Data for pneumococcal 23 serotypes.
(3) Cohort study, 65+ years of age
(4) Cohort study, 65+ years of age

NON-RCT: Physician driven (before) versus nurse driven (after) assessment of eligibility of pneumococcal vaccine. Outcome= vaccine uptake

Study or Subgroup	Nurse assessment Events	Total	Physician assessment Events	Total	Risk Ratio M-H, Fixed, 95% CI
10.2.1 65+ years of age, vaccine uptake					
Bakare 2007 (1)	5	168	2	138	2.05 [0.40, 10.42]
10.2.2 65+ years of age, identification of eligibility and status					
Bakare 2007 (2)	22	168	10	138	1.81 [0.89, 3.69]



Footnotes
(1) Before-and-after study
(2) Before-and-after study

Appendix F – GRADE and GRADE-CERQual tables

GRADE tables

Interventions aimed at individuals, parent and carers

Table 11 GRADE table for interventions aimed at individuals, parent and carers

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: control or before	Absolute risk intervention or after (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
NON-RCT: vaccination status app on a tablet versus recall from memory (RR >1 favours vaccination status app) Outcome = accuracy of parental recall of vaccination status										
Tetanus										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.34 (2.03, 2.71)	41 per 100	96 per 100 (83, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Diphtheria										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.62 (2.23, 3.08)	36 per 100	94 per 100 (80, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Polio[4]										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.66 (2.26, 3.13)	35 per 100	94 per 100 (80, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Pertussis[4]										

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: control or before	Absolute risk intervention or after (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.66 (2.26, 3.13)	35 per 100	94 per 100 (80, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Hib										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 3.05 (2.53, 3.67)	30 per 100	91 per 100 (76, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
HepB										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 3.0 (2.51, 3.58)	31 per 100	94 per 100 (79, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Mumps										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.29 (1.96, 2.68)	39 per 100	90 per 100 (77, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Measles										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.32 (1.99, 2.71)	39 per 100	91 per 100 (78, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Rubella										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.37 (2.03, 2.77)	39 per 100	92 per 100 (79, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: control or before	Absolute risk intervention or after (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Pneumococcus										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 3.75 (3.03, 4.65)	24 per 100	90 per 100 (73, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Meningococcus										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 3.6 (2.89, 4.48)	24 per 100	85 per 100 (69, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Rotavirus										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.56 (2.2, 2.98)	38 per 100	98 per 100 (84, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
HPV										
1 (Seeber 2017)	Non-randomised controlled trial	456	RR 2.28 (2.0, 2.61)	44 per 100	99 per 100 (87, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Standard care with active personal health record versus standard care without active personal health record (RR >1 favours active PHR)										
Vaccine uptake, 65+ years old										
1 (Otsuka 2013)[2]	Non-randomised observational finding from an RCT.	2089	RR 2.78 (1.59, 4.68)	2 per 100	5 per 100 (3, 8)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Active verses regular nurse follow-up of vaccination status for preschool children attending childcare centres (RR >1 favours active follow-up)										
Vaccine uptake, 0-5 years, primary series (general vaccinations)										

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: control or before	Absolute risk intervention or after (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (O'Mara 2013)	Cluster NRT	514	RR 0.91 (0.35, 2.34)	5 per 100	4 per 100 (2, 11)	Very serious[1]	Not serious	N/A[5]	Serious[3]	Very low
Vaccine uptake, 0-5 years, booster (general vaccinations)										
1 (O'Mara 2013)	Cluster NRT	514	RR 1.30 (0.67, 2.52)	7 per 100	10 per 100 (5, 19)	Very serious[1]	Not serious	N/A[5]	Serious[3]	Very low
Vaccine uptake, 0-5 years, MMR										
1 (O'Mara 2013)	Cluster NRT	514	RR 1.89 (0.90, 3.97)	5 per 100	10 per 100 (5, 20)	Very serious[1]	Not serious	N/A[5]	Serious[3]	Very low
Vaccine uptake, 0-5 years, Hib										
1 (O'Mara 2013)	Cluster NRT	514	RR 1.17 (0.72, 1.90)	13 per 100	16 per 100 (10, 26)	Very serious[1]	Not serious	N/A[5]	Serious[3]	Very low

1. Downgraded twice: greater than 33.3% of the weight of the meta-analysis came from studies at high risk of bias.
2. The study included 4 arms; electronic message with active PHR, standard care with active PHR, postal message without PHR and standard care without PHR, but was randomised as 2 blocks (+/- PHR).
3. Downgraded once for imprecision: the 95% confidence interval for the effect size crossed the line of no effect
4. The data for polio and pertussis vaccination was identical in the paper.
5. Single study. Inconsistency not applicable.

Interventions aimed at healthcare providers

Table 12 GRADE table for interventions aimed at healthcare providers

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: before or 2nd intervention	Absolute risk: after or 1st intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
NON-RCT: Electronic records (after) versus paper handheld records (before) for pregnant women attending maternity unit (RR >1 favours electronic records)										
Pregnant women. Outcome – Accuracy and completeness of documentation for pertussis vaccinations										
1 (Hawley 2014)*	Before and after study	100	RR 7.09 (4.04, 12.45)	12 per 100	83 per 100 (47, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
NON-RCT: Regional immunisation information system versus electronic health records (RR >1 favours immunisation information system)										
65+ years old. Outcome – Patients who had an immunisation record for shingles										
1 (Lam 2019)	Cohort study	127	RR 0.22 (0.13, 0.28)	51 per 100	11 per 100 (7, 18)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
65+ years old. Outcome – Patients who had an immunisation record for pneumococcal										
1 (Lam 2019)	Cohort study	118	RR 0.17 (0.10, 0.28)	66 per 100	11 per 100 (7, 19)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
NON-RCT: Community pharmacy database versus electronic health records (RR >1 favours community pharmacy database)										
65+ years old. Outcome – Patients who had an immunisation record for shingles										
1 (Lam 2019)	Cohort study	127	RR 0.03 (0.01, 0.12)	51 per 100	2 per 100 (1, 6)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
65+ years old. Outcome – Patients who had an immunisation record for pneumococcal										
1 (Lam 2019)	Cohort study	118	RR 0.01 (0.00, 0.09)	66 per 100	1 per 100 (0, 6)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
NON-RCT: Regional immunisation information system versus community pharmacy database (RR >1 favours immunisation information system)										
65+ years old. Outcome – Patients who had an immunisation record for shingles										
1 (Lam 2019)	Cohort study	127	RR 7.00 (1.62, 30.17)	2 per 100	11 per 100 (3, 48)	Very serious[1]	Not serious	N/A[5]	Not serious	Low

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: before or 2nd intervention	Absolute risk: after or 1st intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
65+ years old. Outcome – Patients who had an immunisation record for pneumococcal										
1 (Lam 2019)	Cohort study	118	RR 13.00 (1.73, 97.79)	1 per 100	11 per 100 (1, 83)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
NON-RCT: Electronic health records with a compulsory vaccination status entry field (after) versus electronic health records (before) (RR >1 favours electronic health records with a compulsory vaccination status entry field)										
Pregnant women. Outcome – Uptake of pertussis vaccine										
1 (Orefice 2019)	Before-and-after	574	RR 1.73 (1.54, 1.95)	53 per 100	92 per 100 (82, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
NON-RCT: Pharmacist managed annual wellness visits versus physician managed annual wellness visits (RR >1 favours pharmacist managed)										
Offers to vaccinate with pneumococcal vaccine										
1 (Sewell 2016)	Cohort study	108	RR 4.68 (1.02, 21.45)	3 per 100	16 per 100 (3, 72)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Uptake of pneumococcal vaccine										
1 (Sewell 2016)	Cohort study	108	RR 7.03 (1.26, 39.21)	2 per 100	16 per 100 (3, 88)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Offers to vaccinate with herpes zoster vaccine										
1 (Sewell 2016)	Cohort study	108	RR 8.2 (2.66, 25.23)	4 per 100	12 per 100 (12, 100)	Very serious[1]	Not serious	N/A[5]	Not serious	Low
Uptake of herpes zoster vaccine										
1 (Sewell 2016)	Cohort study	108	RR 2.34 (0.22, 24.53)	2 per 100	5 per 100 (0, 55)	Very serious[1]	Not serious	N/A[5]	Very serious[2]	Very low
NON-RCT: Nurse driven (after) versus physician driven (before) assessment of eligibility for pneumococcal vaccine (RR > favours nurse driven assessment)										
Outcome – Change in vaccine uptake										

No. of studies	Study design	Sample size	Effect size* (95% CI)	Absolute risk: before or 2nd intervention	Absolute risk: after or 1st intervention (95% CI)	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
1 (Bakare 2007)	Before and after study	306	RR 2.05 (0.40, 10.42)	1 per 100	3 per 100 (1, 15)	Very serious[1]	Serious[4]	N/A[5]	Serious[3]	Very low
Outcome – Identification of vaccine eligibility and status										
1 (Bakare 2007)	Before and after study	306	RR 1.93 (0.88, 4.23)	7 per 100	14 per 100 (6, 31)	Very serious[1]	Serious[4]	N/A[5]	Serious[3]	Very low

1. Downgraded twice: greater than 33.3% of the weight of the meta-analysis came from studies at high risk of bias.
2. Downgraded twice for imprecision: the 95% confidence interval for the effect size crossed the line of no effect and the total number of participants was <200.
3. Downgraded once for imprecision: the 95% confidence interval for the effect size crossed the line of no effect.
4. Downgraded once for indirectness because the study population included people aged under 65 years old. However, greater than 50% of people in each arm were 65 and over and greater than 70% were 50 and over.
5. Single study. Inconsistency not applicable.

* Data were reported graphically as % of records only. Data were extracted by the NICE team and converted to numerical values using digitising software.

GRADE-CERQual tables

Pregnancy

Table 13 Barriers to and facilitators for the identification and recording of vaccination status of pregnant women

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
No designated place in electronic medical records to document vaccinations							
1 (Webb 2014)	Semi-structured interviews	Healthcare practitioners agreed that there was no designated place in the electronic medical record to mention pertussis vaccines. Maternal vaccines were not included as a discussion point in the South Australian Pregnancy Record (SAPR). In those cases where vaccination was recommended, there was no mechanism for documenting the response or following up.	Serious[1]	Moderate[3]	High	Low[2]	Very low
Identification of eligible women and recording of vaccination							
1 (Kaufman)	Semi-structured interviews	Midwives said that they would have liked to have had a sticker in the pregnant women's medical records that prompted aspects of discussion and recorded whether the vaccination was done.	Not serious	High	High	Moderate[4]	Moderate
1 (Kaufman)	Semi-structured interviews	Midwives said that they were proactive in identifying suitable pregnant women who should have been vaccinated and discussed vaccines with them.	Not serious	High	High	Moderate[4]	Moderate

1. Finding was downgraded once because it was only identified in studies at moderate or high risk of bias.
2. Finding was downgraded twice for adequacy because it was reported in a single study that was not particularly detailed or rich in the results that fed into this finding.
3. The finding was downgraded once for relevance based on committee discussions because it was not completely applicable to the UK.
4. Finding was downgraded once for adequacy because it was reported in a single study that provided some detail in the results that fed into this finding.

Babies and children aged 0-5 years old

Table 14 Barriers to and facilitators for the identification and recording of vaccination status of babies and children aged 0-5 years old

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Missing medical records							
3 (Evans 2001, New 1991, Thomas 2018)	Semi-structured interviews, focus groups	Parents and staff working in obstetrics and gynaecology departments said that missing vaccination histories, missing medical records and illegible entries can waste time and resources. For example, children can be given too many doses of vaccine.	Not serious	High	High	Moderate[1]	Moderate

1. Finding was downgraded twice for adequacy because it was reported in a small number of studies that were not particularly detailed or rich in the results that fed into this finding.

Young people aged 11-18 years old

Table 15 Barriers to and facilitators for the identification and recording of vaccination status of young people aged 11-18 years old

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Fragmentation of care impacting record accuracy							
1 (Hansen 2017)	Semi-structured interviews	Some parents expressed desires to maintain their child's medical records in one location and feared that receiving vaccines at multiple locations, such as both the primary care provider's office and school-based health centres (SBHCs), would disrupt record keeping.	Not serious	High	High	Low[1]	Low

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
		Parent concerns about completing the 3-dose HPV vaccine series as records might be inaccurate, and result in daughter receiving an unnecessary, extra dose.					
Problems with databases							
2 (Boyce 2012, Paterson 2019)	Semi-structured interviews	Many school nurses reported problems with the accuracy of the lists of girls to vaccinate that were provided by the local education authority (or its equivalent). The type of information supplied was also inconsistent making it harder to know who had been offered vaccination or to contact the families of girls who were not in school.	Not serious	High	High	Low[1]	Low
1 (Paterson 2019)	Semi-structured interviews	The movement of girls between schools and areas made it hard to ensure that they received both doses of the HPV vaccination. Providers who used a 1-year delivery model reported less disruption to the vaccination schedule.	Not serious	High	High	Low[1]	Low
1 (Paterson 2019)	Semi-structured interviews	Inputting and cleaning data in database systems was highlighted as labour intensive, especially the parts of the data management system that are not yet automated.	Not serious	High	High	Low[1]	Low
Automated databases and communication							
1 (Paterson 2019)	Semi-structured interviews	Automated database systems prevented delays between records appearing on GP or school provider servers by using bulk processing to increase efficiency. They reduced inaccuracies in data monitoring that could lead to missed or duplicated vaccinations. Data inaccuracies also arose when GPs did not send updated	Not serious	High	High	Low[1]	Low

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
		vaccination records to CHIS in a timely fashion.					
1 (Paterson 2019)	Semi-structured interviews	Real-time database systems helped manage keeping track of the movement of girls between schools and areas, as did troubleshooting meetings between commissioners, Child Health Information Services (CHIS) leads and service providers, and regular communication with General Practice.	Not serious	High	High	Low[1]	Low
Updating records							
1 (Hansen 2017)	Semi-structured interviews	Parents expressed desires to be notified of vaccination so they could update their records.	Not serious	High	High	Low[1]	Low

1. Finding was downgraded twice for adequacy because it was reported in a small number of studies that were not particularly detailed or rich in the results that fed into this finding.

Studies spanning multiple age/ life categories

Table 16 Barriers to and facilitators for the identification and recording of vaccination status identified from studies spanning multiple age/ life categories

In the following table Gypsy, Roma and Travellers have been abbreviated to GRT to simplify the findings, however these apply to all 3 groups unless otherwise specified.

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Recording vaccinations takes time							
1 (Wiot 2019)	Focus groups	Health care practitioners noted that vaccination recording was a complicated process that could take longer than the vaccination itself. Reducing the logistical burden of recording and improved sharing	Not serious	High	High	Low[1]	Low

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
		of patient information would help make vaccinations easier for staff to carry out.					
What parents of children aged 0-18 years thought about online immunisation records							
1 (Kitayama 2014)	Focus groups	Parents said they liked to see what vaccines their children had already had and what vaccines their children should be having (whether they were up to date). They liked the information on the vaccines that was included.	Not serious	Serious[2]	High	Low[1]	Very low
1 (Kitayama 2014)	Focus groups	Parents said that using an online immunisation record was relatively easy, fast, convenient, and saves time. They liked being able to print out the information so they could show the information to people who needed to know. They liked being able to print out vaccination reminders for themselves.	Not serious	Serious[2]	High	Low[1]	Very low
1 (Kitayama 2014)	Focus groups	Many parents said they had misgivings about protecting privacy with regards to having details about their children online.	Not serious	Serious[2]	High	Low[1]	Very low
What further features parents of children aged 0-18 years wanted to see for online immunisation records							
1 (Kitayama 2014)	Focus groups	Parents suggested safeguards to ensuring confidentiality, including password verification and limited access to the online record. Parents said that many immigrant parents were scared – it should be noted on the online immunisation record that immigration status was confidential.	Not serious	Serious[2]	High	Low[1]	Very low
1 (Kitayama 2014)	Focus groups	Some parents were interested in extending access to their child's school and doctor's office, whereas others were adamant about exclusive access remaining with the parent.	Not serious	Serious[2]	High	Low[1]	Very low

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
1 (Kitayama 2014)	Focus groups	Parents said they would have liked information on what disease(s) each vaccine aimed to prevent. They said that they would have liked the information to be available in a choice of languages – not just English. They would have liked the information to have been presented in a simple, jargon-free way.	Not serious	Serious[2]	High	Low[1]	Very low
1 (Kitayama 2014)	Focus groups	Parents said that they would have liked face-to-face training or an information guide on how to use the online immunisation record.	Not serious	Serious[2]	High	Low[1]	Very low
Lack of documentation, including for migrants and Gypsy, Roma and Travellers							
2 (Jackson 2016[a], Bell 2019)	Semi-structured interviews	Inaccurate or undocumented vaccination history may be barrier to accurate record keeping and identification of eligible people. Health care practitioners noted that families coming to the UK with children may not bring vaccination records from their home countries. In addition, Polish and Romanian immigrants may go home for vaccinations and do not necessarily provide this information to UK health services on their return.	Not serious	High	High	Moderate[3]	Moderate
Gypsy, Roma and Traveller specific issues							
2 (Jackson 2016[a], Wiot 2019)	Semi-structured interviews, focus groups	The lack of centralised records was seen to be a problem because vaccinations in one setting are not necessarily accessible to staff in other places and the GP practice may not be informed. This was raised by a staff concerning vaccination of GRT. In addition, other health care practitioners thought that the lack of centralized record system was also	Not serious	High	High	Moderate[3]	Moderate

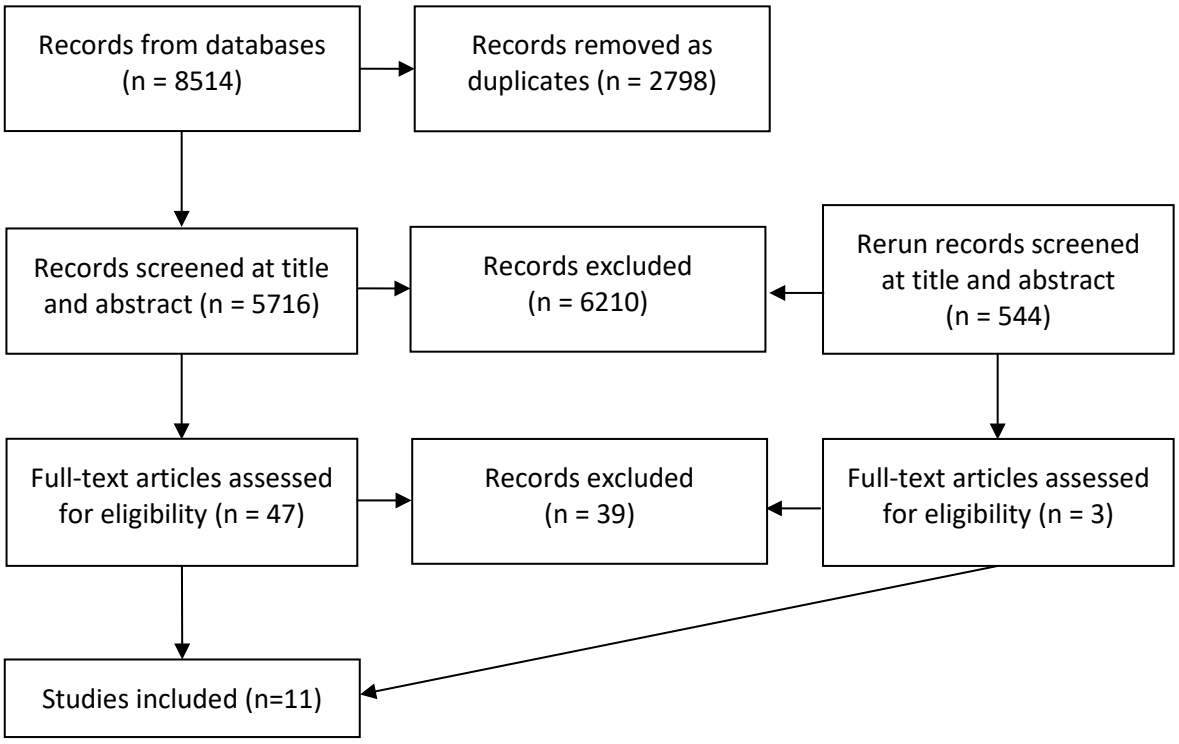
Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
		problematic when people moved within the UK and that obtaining a vaccination history in this situation is an unnecessary waste of consultation time.					
1 (Jackson 2016[a])	Semi-structured interviews	Collaboration between health providers, schools and Initiatives such as GRT Education Services were raised by healthcare providers as being helpful in enabling them to identify children and young people who have missed their vaccinations and follow up with their families, however this service is no longer funded in some areas.	Not serious	High	High	Moderate[3]	Moderate
1 (Jackson 2016[a])	Semi-structured interviews	A number of strategies were used to identify GRT eligible for vaccination. These included: using the postcodes of GRT sites and common Roma surnames to try to identify people in GP records; using CHIS across regions to check vaccination status; verbal handovers between health practitioners to keep track of families and using flags on Roma GP records to help identify them.	Not serious	High	High	Moderate[3]	Moderate
1 (Jackson 2016[a])	Semi-structured interviews	Delays in recording vaccinations carried out in different settings in CHIS and GP records made it hard to maintain accurate immunisation uptake data for Travellers. The time lag from administering an immunisation in a GP practice or school and it being recorded on the CHIS system, or in informing GP practices of immunisations given in hospital could be a problem for GRT who may have moved on before records are updated.	Not serious	High	High	Moderate[3]	Moderate

Studies	Study design	Finding	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
1 (Jackson 2016[a])	Semi-structured interviews	The lack of accurate, consistent methods of recording GRT identity in medical records makes it hard to assess uptake in these communities and target funding and services appropriately. Some staff also worry that recording this information could be seen to be discriminatory.	Not serious	High	High	Moderate[3]	Moderate
2 (Jackson 2016[a], Wiot 2019)	Semi-structured interviews, focus groups	Opportunistic identification of eligibility and discussions of vaccinations when attending other appointments for long term health conditions or general healthcare were viewed favourably by GRT and could facilitate vaccine uptake for their community and others. However, nurse vaccinators were concerned that other providers (such as pharmacists) would not adhere to the same care practices nor engage in appropriate clinically relevant discussions with patients. They were also concerned about the logistics of managing vaccination targets if vaccine responsibilities were shared.	Not serious	High	High	Moderate[3]	Moderate

a. Jackson 2016 encompasses 3 studies (Jackson 2016, Jackson 2017a, Mytton 2020), which we have called “Jackson 2016” for convenience.
1. Finding was downgraded twice for adequacy because it was reported in a single study that was not particularly detailed or rich in the results that fed into this finding.
2. Finding was downgraded once for relevance because it was reported by a study that was partially relevant.
3. Finding was downgraded once for adequacy because it was reported in a small number of studies that provided some detail in the results that fed into this finding.

Appendix G – Economic evidence study selection

The diagram below summarises the search results across all of the reviews. None of the 11 studies identified in the full text review were relevant to interventions for identification and recording of vaccination eligibility and status.



Appendix H – Economic evidence tables

No economic evidence was identified for this review question.

Appendix I – Health economic model

No economic model was created for this review.

Appendix J – Excluded studies

J.1 Initial search

J.1.1 Quantitative studies

Study	Exclusion reason
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	- Not a relevant study design *Not an intervention study- study compares 2 methods of reporting for accuracy.*
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	- Study does not contain a relevant intervention *The documentation intervention is not clearly defined*
Beck A, Scott J, Williams P et al. (1997) A randomized trial of group outpatient visits for chronically ill older HMO members: the Cooperative Health Care Clinic. Journal of the American Geriatrics Society 45(5): 543-549	- Study does not contain a relevant intervention *About management of chronic illness*
Berry, J.G., Gold, M.S., Ryan, P. et al. (2012) Public perspectives on consent for the linkage of data to evaluate vaccine safety. Vaccine 30(28): 4167-4174	- Not a relevant study design *This study is a survey, there is no intervention.*
Botham, Susan J, Poulos, Roslyn G, McFarland, Karen J et al. (2004) Getting it right--the Australian Childhood Immunisation Register and immunisation rates in south-eastern Sydney. Australian and New Zealand journal of public health 28(1): 68-71	- Not a relevant study design *Survey, non-interventional study*
Callahan, J.M., Reed, D., Meguid, V. et al. (2004) Utility of an immunization registry in a pediatric emergency department. Pediatric Emergency Care 20(5): 297-301	- Study does not contain a relevant intervention
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

Study	Exclusion reason
Edwards, T. and Hooper, G.L. (2019) A School-Based Intervention to Increase HPV Vaccination Rates. Journal of Doctoral Nursing Practice 12(2): 196-201	- Study does not contain a relevant intervention *This is a before-and-after study and the intervention is parental reminder and education.*
Fierman, A H, Rosen, C M, Legano, L A et al. (1996) Immunization status as determined by patients' hand-held cards vs medical records. Archives of pediatrics & adolescent medicine 150(8): 863-6	- Not a relevant study design *Not an intervention study- study compares 2 types of medical record for accuracy* - Study does not contain a relevant intervention *Study does not contain any interventions*
Frimpong, J.A.; Rivers, P.A.; Bae, S. (2008) Vaccination coverage among kindergarten children in Phoenix, Arizona. Health Education Journal 67(1): 56-63	- Not a relevant study design *non-interventional, sampling study to determine vaccination coverage*
Hirth, Jacqueline, Kuo, Yong-Fang, Laz, Tabassum Haque et al. (2016) Concordance of adolescent human papillomavirus vaccination parental report with provider report in the National Immunization Survey-Teen (2008-2013). Vaccine 34(37): 4415-21	- Not a relevant study design *Survey, non-interventional study*
Jessop, L, Lotya, J, Murrin, C et al. (2011) Relationship between parent held child records for immunisations, parental recall and health service. Irish medical journal 104(3): 73-6	- Not a relevant study design *Not an intervention study- study compares 2 types of medical record for accuracy*
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	- Study does not include a relevant population *Population requiring selective immunisation programme.*
Lehman, Nicholas, Koenigsfeld, Carrie F, Wall, Geoffrey C et al. (2018) A collaborative program to increase adult pneumococcal vaccination rates among a high-risk patient population receiving care at urgent care clinics. American journal of infection control 46(8): 952-953	- Study does not contain a relevant intervention
Ojha, Rohit P, Tota, Joseph E, Offutt-Powell, Tabatha N et al. (2013) The accuracy of human papillomavirus vaccination status based on adult proxy recall or household immunization records for adolescent females in the United States:	- Not a relevant study design *Data derived from survey, not eligible study design*

Study	Exclusion reason
results from the National Immunization Survey-Teen. Annals of epidemiology 23(5): 281-5	
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	- Not a relevant study design
Petroll, Andrew E; Phelps, Jenise K; Fletcher, Kathlyn E (2014) Implementation of an electronic medical record does not change delivery of preventive care for HIV-positive patients. International journal of medical informatics 83(4): 273-7	- The context of vaccination in the study is not on the routine UK vaccination schedule *Selective Hep B vaccination in at risk group - HIV*
Pollack AH, Kronman MP, Zhou C et al. (2014) Automated Screening of Hospitalized Children for Influenza Vaccination. Journal of the Pediatric Infectious Diseases Society 3(1): 7-14	- Study looked at high risk patients and committee decided this was not generalisable to routine vaccinations
Rolnick, S J, Parker, E D, Nordin, J D et al. (2013) Self-report compared to electronic medical record across eight adult vaccines: do results vary by demographic factors?. Vaccine 31(37): 3928-35	- Not a relevant study design *Survey data combined with retrospective record review - ineligible study design* - Study does not contain a relevant intervention *No intervention defined*
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(3 Suppl): 14-20	- The intervention is not clearly defined *The interventions employed by the community-based organisations were not consistent within or between each group. There was no clearly defined comparison.*
Skull, Susan A, Andrews, Ross M, Byrnes, Graham B et al. (2007) Validity of self-reported influenza and pneumococcal vaccination status among a cohort of hospitalized elderly inpatients. Vaccine 25(25): 4775-83	- Study does not contain a relevant intervention *No defined intervention*
Stetson, R.C., Fang, J.L., Colby, C.E. et al. (2019) Improving infant vaccination status in a Level IV neonatal intensive care unit. Pediatrics 144(5): e20190337	- Education and reminders non-RCT. Excluded because there was sufficient RCT evidence for this review

Study	Exclusion reason
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	- The context of vaccination in the study is not on the routine UK vaccination schedule *Selective vaccinations to postpartum women. Not treated as part of routine immunisation schedule.*
Vandermeulen, Corinne, Roelants, Mathieu, Theeten, Heidi et al. (2008) Vaccination coverage in 14-year-old adolescents: documentation, timeliness, and sociodemographic determinants. Pediatrics 121(3): e428-34	- Abstract - Study does not contain a relevant intervention
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	- Study does not contain a relevant intervention *Chart reminder intervention.*
Warner, EA and Seleznick, MJ (2004) Using medical record reminders to improve pneumococcal vaccination rates. Joint commission journal on quality and safety 30(6): 331-334	- Study does not contain a relevant intervention *Focus of intervention is on use of reminders to increase uptake, not on identifying eligibility*
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	- The context of vaccination in the study is not on the routine UK vaccination schedule *Adults at high risk for hepatitis B - not treated as part of a routine immunisation schedule*
Wilkinson, T.A., Dixon, B.E., Xiao, S. 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 does not contain a relevant intervention *This study has been included in the reminders evidence review because the focus is on physician reminders, not on identifying eligibility, which was done before randomisation via the child health IT system.*
Zweigoron, R.T., Roberts, J.R., Levin, M. et al. (2017) Influence of Office Systems on Pediatric Vaccination Rates. Clinical Pediatrics 56(3): 231-237	- Not a relevant study design *This study is a survey that looks for 'risk factors' for vaccine uptake.*

J.1.2 Qualitative studies

Study	Exclusion reason
Cohen, N.J., Lauderdale, D.S., Shete, P.B. et al. (2003) Physician knowledge of catch-up	- Not a relevant study design

Study	Exclusion reason
regimens and contraindications for childhood immunizations. Pediatrics 111(5i): 925-932	Survey, non-interventional study
McKinney, P A, Alexander, F E, Nicholson, C et al. (1991) Mothers' reports of childhood vaccinations and infections and their concordance with general practitioner records. Journal of public health medicine 13(1): 13-22	- Study does not report any of the factors of interest specified in the protocol Identification and recording of vaccine status not examined

J.2 Search reruns- quantitative and qualitative pooled

Study	Reason
Bach, Albert T. and Goad, Jeffery A. (2019) Using community pharmacy immunization screening forms to identify potential immunization opportunities. Pharmacy 7(4): 160	- The study does not have a relevant population *With regards to pneumococcal vaccine, the aim was to increase uptake for people who had chronic conditions rather than have an age of 65 years and over.*
Brewer, Sarah E, Barnard, Juliana, Pyrzanowski, Jennifer et al. (2019) Use of Electronic Health Records to Improve Maternal Vaccination. Women's health issues : official publication of the Jacobs Institute of Women's Health 29(4): 341-348	- This study has already been considered elsewhere in the reviews *This study has already been considered in the multicomponent review.*
Bunko, Andrean, Wilton, Andrew S., Young, Jacqueline et al. (2020) Assessing the completeness of infant and childhood immunizations within a provincial registry populated by parental reporting: A study using linked databases in Ontario, Canada. Vaccine 38(33): 5223-5230	- Study does not contain a relevant intervention *Although this study compares the accuracy of 2 medical record systems, it does not have an intervention that encourages recording or identification of vaccine eligibility.*
Nagykaldi, Zsolt, Scheid, Dewey, Zhao, Yan 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	- The study does not have a relevant population *This study includes varicella and pneumococcal vaccination but the mean age of the participants was 45.7 years (SD 23.5) and the median age was 46 years. The relevant age for these vaccinations in the UK is 65 years or older.*
NCT00589173 (2007) An Interactive Preventive Health Record (IPHR) to Promote Patient-Centered Preventive Care. https://clinicaltrials.gov/show/NCT00589173	- The study does not have a relevant population *The study is published as Krist 2012 and measures uptake of pneumococcal vaccine but only 20% of the participants were over 65 years of age. 60% of the participants were 35 to 64 years of age, and 20% were aged 18 to 34 years.*

Study	Reason
NCT03180138 (2017) Enhancing Health Care Access With Cellular Technology. https://clinicaltrials.gov/show/NCT03180138	- Study took place in a non-OECD country *This study was published as Seth 2018 and took place in India.*

J.3 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	- Study did not consider increasing uptake

diphtheria toxoid, and acellular pertussis vaccine (Tdap). Vaccine 31(22): 2558-64	
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, and cocooning vaccination strategies. Vaccine 31(46): 5392-7	- Study did not consider increasing uptake
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	- Vaccine not routine in the UK

up program on the incidence of varicella complications in France. Value in Health 13(7): a430	
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 vaccination to prevent whooping cough cost-effective in Australia?. Human vaccines & immunotherapeutics 14(9): 2263-2273	- Study did not consider increasing uptake
van Hoek, Albert Jan, Campbell, Helen, Amirthalingam, Gayatri et al. (2016) Cost-effectiveness and programmatic benefits of 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	- Study did not consider increasing uptake

against pertussis for The Netherlands. Value in Health 12(7): a425-a426	
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

Appendix K – Evidence for adapted recommendations

Recommendation (bullets adapted from the flu recommendation are highlighted in yellow)	Original Recommendation from NG103	Supporting evidence from NG103 (taken from the evidence discussion section reported within the guideline itself)	Vaccines committee's discussion – rationale
Identification of eligible groups			
Use every opportunity to identify people eligible for vaccination. This could include.: • At registration in general practice. • During Health and developmental reviews as part of the healthy child programme and health visitor and school nursing targeted contacts. • during the annual learning disability health check for people with learning disabilities • when making contact with people in healthcare settings, community health clinics, sexual health services or drug and alcohol services (including hospitals, emergency departments, inpatient services,	1.3.1 Use every opportunity throughout the flu vaccination season to identify people in eligible groups and offer them the flu vaccination. This could include when: • People register in general practice. • Women have a newly confirmed pregnancy. • People are newly diagnosed with a condition that may place them in a clinical risk group, or have a BMI of 40 or over. • People attend outpatient and antenatal clinics or drug and alcohol services. • People (including children aged 6 months to 17 years) who are in a clinical risk group attend routine GP or outpatient clinic appointments,	From the section on the quality of the evidence for recommendations 1.3.1 to 1.3.6: "Expert testimony highlighted the importance of using both opportunistic and systematic approaches to case-finding as a means of increasing opportunities to offer flu vaccination. Face-to face interactions in primary care (including community pharmacy) provide opportunities to identify and offer vaccination to eligible people. Periodic searches of computer records can be undertaken in general practice to identify unvaccinated new patients or people who have recently become eligible (for example, people who are recently diagnosed with a condition that places them in a clinical risk group, or women with a newly confirmed pregnancy) [EP6].	In the absence of specific evidence about how and where to opportunistically identify people eligible for routine vaccinations, the committee based their recommendation on a recommendation in the NICE guideline on flu vaccination: increasing uptake (2018) (recommendation 1.3.1).The committee agreed with the flu guideline committee that it is important to seize every opportunity to identify people who could be eligible for vaccination to help improve vaccination uptake. They adapted the wording to remove any references to flu or to flu specific target populations because flu is not included in the scope of this guideline. The committee added several settings, including those outside the healthcare system, and points

rehabilitation services and general practice) • when contact is made with women who are trying to conceive, have a newly confirmed pregnancy and at antenatal and postnatal reviews. • on admission to day care, nurseries, schools, special schools, pupil referral units, and further and higher education. • on admission to care homes and supported living settings. • when people visit community pharmacies for health advice, a medication review or a New Medicine Service, or to collect prescriptions. • home visits for healthcare or social care • any health service contact with people who are homeless. • when new migrants, including asylum seekers arrive in the country. • within 7 days of arrival in prisons and young offender institutions, during any contact with healthcare services in these places, and when people leave.	or for other vaccination services. • People visit community pharmacies for health advice, a Medicines Use Review or a New Medicine Service, or to collect prescriptions (check whether the person taking the medicine or their carer is eligible, while taking into account confidentiality). • People in clinical risk groups are staying in hospital. • People who are eligible are having home visits for healthcare.	Other strategies for case-finding should be considered for eligible people who may not be identifiable using existing general practice systems. The committee noted that carers are a difficult group to identify because their carer status may not be routinely recorded in GP records [EP1]. Other expert testimony highlighted that chronic liver disease is associated with the highest risk of flu-related mortality but lowest rates of vaccination uptake across all clinical risk groups specified in the Green Book. Prevalence of chronic liver disease is high among people who abuse drugs and alcohol, who may be in more regular contact with specialist services and pharmacies than with GPs [EP2]. People sleeping rough have a high prevalence of chronic respiratory illness and are usually not in regular contact with statutory healthcare services [EP3]. The committee was keen to promote links between vaccination providers and other local organisations, such as those assessing and supporting carers, specialist drug and alcohol services, community pharmacies and voluntary groups working with	of contact with the healthcare system where they agreed that people eligible for vaccination could be identified. They also included some specific groups who may need more specific approaches (such as people who misuse alcohol, are homeless, use drugs, are asylum seekers or in prisons). Because these people may not be in routine contact with the healthcare system, special consideration is needed to assess their eligibility for vaccination. The committee also noted that looked-after children and young people and those who are home educated or outside mainstream schooling are particularly at risk of missing vaccinations. The list is not intended to be exhaustive.

• as part of the looked after child or young person's health plan, and during initial health assessments, and annual and statutory reviews (see also NICE's guideline on looked-after children and young people). • any contact with home educated children. • during occupational health checks for everyone who works in a clinical or social care setting even if their role is not healthcare related.		carers or people who are homeless to identify eligible people and offer (or signpost them to) vaccination services." "the committee noted that people of working age in clinical risk groups who are relatively well but need regular prescription medication, and carers in particular, may be more likely to use community pharmacies as a convenient alternative to GP vaccination services. This was confirmed by expert testimony relating to carers [EP1]. The committee concluded that increasing identification of eligible people and providing sufficient routes of access to meet the needs of different groups (including out-of-hours opportunities for people with work commitments) are key to increasing vaccination uptake,…"	