National Institute for Health and Care Excellence

Draft for consultation

Flu vaccination: increasing uptake

Evidence reviews for RQ1-3 Increasing Uptake in Children

NICE guideline <number>

Evidence reviews

[June, 2017]

Draft for Consultation

These evidence reviews were developed by Public Health – Internal Guideline Development team

Disclaimer

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

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

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 All NICE guidance is subject to regular review and may be updated or withdrawn.

Copyright

ISBN:

Contents

Increasing flu vaccination uptake in children (aged 2-17 years)

Review question(s)

Review question 1a (RQ 1a): What interventions to promote information about, and acceptability of, flu vaccination are the most effective for increasing acceptability and uptake of seasonal flu vaccination among children?

Review question 1b (RQ 1b) : What interventions to promote information about, and acceptability of, flu vaccination are cost effective for increasing acceptability and uptake of seasonal flu vaccination among children?

Review question 2a (RQ 2a): What interventions to increase access to seasonal flu vaccine are the most effective in increasing uptake of seasonal flu vaccine among children?

Review question 2b (RQ 2b): What interventions to increase access to seasonal flu vaccine are cost effective in increasing uptake of seasonal flu vaccine among children?

Review question 3a (RQ 3a): Which provider-based systems and processes for identifying, contacting and inviting children for seasonal flu vaccination are most effective in increasing uptake of among this population group?

Review question 3b (RQ 3b): Which provider-based systems and processes for identifying, contacting and inviting children for seasonal flu vaccination are cost-effective in increasing uptake among this group?

Introduction

Each winter hundreds of thousands of people see their GP and tens of thousands are hospitalised because of flu.

The Joint Committee on Vaccination and Immunisation has recommended offering flu vaccination with live attenuated intranasal vaccine to all children aged 2 to 17 years who are not in a clinical risk group in order to reduce transmission in the community and reduce the number of cases of flu-related illness and death among older adults. This programme is being implemented in a phased roll-out, starting with the youngest first. At the time of publication (January 2018), the universal vaccination programme is available for children aged 2 to 9 years (up to school Year 4). Preschool children (aged 2 to 4) should be vaccinated in general practice. Older children (from reception age) are being vaccinated by local healthcare teams working with schools. Once the programme has been rolled out to all primary school-aged children it will be reviewed to assess whether to continue the extension into secondary schools. Decisions about further roll-out to include older year groups will be notified in the annual flu plan.

The most recent statistics show that uptake among younger children eligible to be vaccinated at their general practice was 39% for 2 year olds, 42% for 3 year olds and 34% for 4 year olds (Seasonal flu vaccine uptake in GP patients in England: winter 2016/17).

NHS England is responsible for commissioning the seasonal flu vaccination programme for at-risk people in the community including children. It is also responsible for extending the programme to school age children (see section 7A of the NHS public health functions agreement 2017-18, Department of Health).

The aim of this review was to examine interventions that can be delivered in the community to increase the uptake of influenza vaccination in all children aged 2-17 years to support the roll-out of the seasonal flu vaccination to all children.

The review focused on identifying studies that fulfilled the criteria specified in Table 1. For full details of the review protocol, see Appendix A.

PICO table

Table 1: PICO inclusion criteria for the review questions on increasing uptake in children aged 2-17 years (who are not in a clinical risk group[a])

Population	Children aged 2–17 years
Interventions RQ1	Information campaigns: o targeted o community based, including local radio campaigns o settings based o online campaigns, including social media and apps Education: o educational tools o peer education (carried out by a community member who shares similar life experiences to the community they are working with) o lay education (carried out by community members working in a non-professional capacity) Tailored information and advice delivered: o during home visits o during consultation with health and social care workers o at support group meetings for patients and other people who use services. Flu vaccination 'champion' : o practitioner o peer Recommendations from a respected person: o health or social care worker o carer o peer o volunteer o family member
Interventions RQ2	Vaccination clinics in community settings: o community pharmacies o antenatal clinics o specialist clinics e.g. drug and alcohol services, mental health services o community venues e.g. libraries, children's centres Dedicated flu vaccination clinics Mass vaccination clinics in community or other settings Walk in or open access immunisation clinics Extended hours clinics: o weekends o evenings (after 6 pm) o early mornings (before 8 am) o 24 hour access. Outreach or mobile services: o home or domiciliary or day centre visits o support group meeting visits o residential or care home visits

[a] Studies in children in a clinical risk group are included in the review on increasing flu vaccination among people in clinical risk groups (Evidence Review 3)

	○ special schools visits ○ inpatient visits ○ custodial visits ○ immigration settings ○ mobile clinics e.g. in community Parallel clinics: ○ Offer flu vaccination in parallel with regular appointments e.g. with midwives, clinicians, inpatient and outpatient clinics, long stay wards, etc. ○ coordinated timing of other programmes e.g. retinal screening for diabetic patients within flu season Opportunistic vaccination e.g. visits to GP, practice nurse or consultant for other medical conditions Flu vaccination vouchers to enable eligible groups to receive flu vaccination from community providers
Interventions RQ3	Local programme ○ assigned lead for an annual flu programme ○ local approach ○ systems and processes in working with the community ○ practice approach Programmes to modify standard searches of patient databases to identify eligible patients. Reminder and recall systems (for providers) ○ clinical alerts and prompts Personal invitation ○ GP ○ community pharmacist ○ health or social care worker ○ from several professionals Booking systems ○ dedicated flu lines or online systems Payment systems (fiscal arrangements) ○ outside primary care Reminders (to eligible groups) ○ text messages ○ emails ○ postcards ○ posters ○ telephone call Approaches to follow-up ○ phoning patients Personal health record (so eligible people can see if their vaccination is due) Shared health records for providers. ○ Integration of primary and secondary care health records ○ Centralised uptake record Audit and feedback on uptake rates ○ weekly statistics ○ content and delivery of feedback ○ practical relevance (e.g. how many more people need to be vaccinated to achieve target number) ○ comparison data e.g. between GP practices Incentives (for eligible groups)

	○ voucher schemes Incentive schemes (for providers) ○ targets ○ quality and outcomes framework ○ voucher schemes
Comparators RQ1-3	• Other intervention • Status quo/do nothing/control • Time (before and after)
Outcomes RQ1-3	• Uptake (Critical) • Acceptability (Critical) • Knowledge (Important) • Attitudes (Important) • Beliefs (Important) • Intentions (Important) • Adverse outcomes [any] (Important)
Economic Outcomes RQ1-3	• Economic evaluations • Cost-utility (cost per QALY) • Cost benefit (i.e. Net benefit) • Cost-effectiveness (Cost per unit of effect) • Cost minimisation • Cost-consequence

Public Health evidence

Included studies

Studies were included if they met the PICO and were:

- Randomised controlled trials (RCT) including cluster trial designs (cRCT), non-randomised controlled trials (nRCT), randomised pragmatic trials (RPT), controlled before and after studies, before and after studies.
- Observational studies were included only if they provided evidence on approaches where there was no experimental study design and they included a comparison group (i.e. comparative case control and cohort studies).
- Systematic reviews of effectiveness studies that directly answered the questions and reported critical or important outcomes were included. If they did not directly answer the questions they were citation chased for relevant studies.
- Qualitative studies (interviews and focus groups) that assessed the views and opinions of children or parents on any of the interventions listed in table 1.
- Economic studies which included costs and benefits of any (or a combination) of the interventions listed in table 1.

See table 2 (effectiveness and observational studies), and table 3 (qualitative studies) for a summary of included studies.

Excluded studies

Studies were excluded if they were:

- Narrative reviews, case studies/reports, case series, non-comparative studies (unless they were qualitative studies meeting the inclusion criteria)

- Cross-sectional surveys, epidemiological studies, correlation studies and studies to assess coverage rates
- Economic studies that included only costs, burden of disease and cost of illness
- Cost-effectiveness studies of the flu vaccination itself
- Animal studies
- Not published in the English language.

For the list of studies that were excluded after full-text review, with reasons for their exclusion, see Appendix L.

Evidence Review

In total, 6048 references were found for these review questions, and full-text versions of 162 citations that seemed potentially relevant to this topic were retrieved. In total 14 studies are included in the effectiveness section of the review and 10 studies are included in the qualitative evidence review. Overall there are 21 unique studies as 3 of the identified studies are included in both the review of quantitative and qualitative evidence. No cost effectiveness studies were identified for this review (see PRISMA diagram in Appendix M).

Summary of studies included in the effectiveness evidence review

Table 2: Included effectiveness or observational studies for each review question (RQ1-3)

RQ1: Information, education, tailoring, flu champions and recommendation by a respected person					
First author, year	**Design**	**Country**	**Setting**	**Population**	**Intervention**
Gargano 2011	nRCT	US	Community clinics	Adolescents (11 to18 yrs)	Education (parents and adolescents via a brochure plus, school presentation by peers) Free vaccination
Joshi 2009	Before and after	US	Emergency department & paediatric clinic	Children (6 to 59 mths)	Education (interactive computer program including animations, audio, text and images)
Suryadevara 2013	Before and after	US	Community setting (opportunistic enrolment during registration for another program)	Children from low income households (6 mths-18 yrs)	Education of parents (addressing vaccine concerns and importance/ safety of vaccination)
Witteman 2015	RCT	US	Online	Children (6mths to 18 yrs)	Education (risk communication and value clarification)
RQ2: Flexible, walk-in/open access, outreach and parallel clinics or other opportunistic approach					
First author, year	**Design**	**Country**	**Setting**	**Population**	**Intervention**
No included studies met the intervention inclusion criteria for this question alone.					
RQ3: Local leadership, reminder-recall, provider prompts, incentives, audit and feedback					
First author, year	**Design**	**Country**	**Setting**	**Population**	**Intervention**
Reminders to parents					

Hofstetter, 2015	RCT	US	Providers (Paediatric clinics)	Children (6 mths to17 yrs)	short-message service (SMS) interventions delivered to parents
Stockwell, 2012	RCT	US	Providers (Community clinics)	Children (6 mths to 18 yrs)	short-message service (SMS) interventions delivered to parents
Stockwell, 2015b	RCT	US	Providers (Community clinics)	Children (6 mths to 8 yrs)	short-message service (SMS) interventions delivered to parents
Reminders to providers (provider prompts)					
Ly 2015	Controlled before and after	US	Paediatric clinics	Children (6 months to 5yrs)	Provider prompts (chart reminders, reminders and recalls, electronic medical record reminder, standing orders)
Pollack 2014	Retrospecti ve cohort study	US	Hospital	Children (6 months to 17 yrs)	Automated vaccination programme using the electronic medical record
Stockwell 2015a	RCT	US	Providers (Paediatric clinics)	Children (6 mths to 17 yrs)	Provider prompts (Electronic health record)
Szilagyi, 2015	RCT	US	Paediatric and family medicine clinics	Children (11 to 17 yrs)	Provider prompts (Electronic health record and nurse/staff)
RQ1-3: Multi-component interventions crossing over review questions					
First author, year	**Design**	**Country**	**Setting**	**Population**	**Intervention**
Awareness raising (RQ1), accessibility (RQ2) and SMS (RQ3)					
Meredith 2016	Before and after	UK	General Practice	Children (2 to 4 yrs)	Awareness raising, or accessibility or both. Also includes SMS approaches in some practices
Access (RQ 2), Local programme with an assigned lead and provider system changes (RQ3)					
Kempe, 2015	RPT	USA	Paediatric and family medicine clinics	Children (6 months to 18 yrs)	Primary care-public health collaboration
Education and vaccination champion (RQ1), accessibility (RQ2), leadership and enhanced office systems (RQ3)					
Zimmerman, 2014	RCT	US	Paediatric and family medicine clinics	Children (6 months to 18 yrs)	Multi-component 4 Pillars toolkit (convenient vaccination services, patient information, office systems, immunisation champion), provider education and vaccine supply interventions

1 See appendix Gi for full evidence tables for included effectiveness studies and appendix Gii for
2 observational studies.

Synthesis and quality assessment of the effectiveness evidence

Studies included in this review were a mix of experimental and observational study designs. Studies with a control group were assessed for risk of bias using the Cochrane Effective Practice and Organisation of Care (EPOC) checklist as referenced in Appendix H of the NICE methods manual. The Effective Public Health Practice Project (EPHPP) QA Checklist was applied to assess risk of bias in uncontrolled before-and-after studies.

Data analyses were undertaken in Review Manager (version 5.3). Where data from more than one study were pooled in a meta-analysis, a random effects model was used to account for the different effects anticipated across different study populations and types of intervention. A fixed effects model was used only where it was clear that an intervention with identical content and mode of delivery was examined in different studies undertaken in the same population subgroup (for example, children with asthma).

A general approach was taken to pool data from RCTs with data from observational studies where the same outcome was being investigated under conditions that were considered sufficiently similar. This is because although observational studies may introduce more bias than RCTs, it has been suggested that this issue might be outweighed by the potential benefits of including data from observational studies to improve inferences from RCT trials, particularly where RCT evidence is limited, as the increased sample size may provide additional evidence to choose a correct intervention for a condition (Shrier et al 2007)[b]. In this review, the pooling of experimental and observational data was undertaken for one analysis (see GRADE profile 1; forest plot figure 1; ES1.1). A sensitivity analysis found there was no impact of study design on the pooled result.

GRADE methodology was used to appraise the evidence across five potential sources of uncertainty: risk of bias, indirectness, inconsistency, imprecision and other issues. Overall ratings start at 'High' where the evidence comes from RCTs, and 'Low' for evidence derived from observational studies. Where RCT and observational studies remained pooled in analyses, a decision was made to start GRADE from 'Low'. Details of how the evidence for each outcome was appraised across each of the quality domains is given below.

Quality domain	Description
Risk of bias	Limitations in study design and implementation may bias the estimates of the treatment effect. Major limitations in studies decrease the confidence in the estimate of the effect. Examples of such limitations are selection bias (often due to poor allocation concealment), performance and detection bias (often due to a lack of blinding of the patient, healthcare professional or assessor) and attrition bias (due to missing data causing systematic bias in the analysis). Where there are no study limitations, evidence is assessed as having 'no serious' risk of bias. Alternatively, evidence may be downgraded one level ('serious' risk of bias) or two levels ('very serious' risk of bias).
Indirectness	Indirectness refers to differences in study population, intervention, comparator and outcomes between the available evidence and the review question. Where the evidence is directly applicable to the PICO, it is assessed as having 'no serious' risk of indirectness. Alternatively, evidence may be downgraded one level ('serious' risk of indirectness) or two levels ('very serious' risk of indirectness).
Inconsistency	Inconsistency refers to an unexplained heterogeneity of effect estimates between studies pooled in the same meta-analysis. The I2 statistic describes the percentage of the variability in effect estimates that is due to heterogeneity rather than sampling error (chance).

[b] Shrier, I., Boivin, J., Steele, R. J. et al. 2007. Should Meta-Analyses of Interventions Include Observational Studies in Addition to Randomized Controlled Trials? A Critical Examination of Underlying Principles. *American Journal of Epidemiology,* 166 (10); 1203-1209.

Quality domain	Description
	For the purposes of this review, the committee agreed that a large amount of clinical and methodological diversity would be expected from pooled analyses of studies in this area. Heterogeneity could be explained by differences in study design, content of interventions and comparators, or differences in clinical risk factors between study populations. A decision was therefore made to downgrade pooled analyses by 1 level (indicating 'serious' inconsistency) only when the I2 statistic was ≥75%. If the I2 statistic for a pooled analysis was less than 75%, the evidence was not downgraded for inconsistency.
Imprecision	Results are imprecise when studies include relatively few patients and few events (or highly variable measures) and thus have wide confidence intervals around the estimate of the effect relative to clinically important thresholds. 95% confidence intervals denote the possible range of locations of the true population effect at a 95% probability, and so wide confidence intervals may denote a result that is consistent with conflicting interpretations (for example a result may be consistent with both public health benefit AND public health harm) and thus be imprecise. For the purpose of this review, the committee agreed that a relative increase in vaccination uptake of 5% would be clinically important for all target populations. Imprecision was therefore assessed with reference to minimally important difference (MID) thresholds of RR 0.95 and RR 1.05. It was decided that the point measure would be used to decide whether or not the result was clinically important, and that the 95% confidence intervals would indicate certainty of this importance. Uncertainty is introduced where confidence intervals crossed the MID threshold. If the confidence interval crosses either the lower (RR 0.95) or upper MID threshold (RR 1.05), this indicates 'serious' risk of imprecision. Crossing both MID thresholds indicates 'very serious' risk of imprecision in the effect estimate. Where the 95%CI does not cross either MID threshold, the evidence is assessed as having 'no serious' risk of imprecision unless the effect estimate is derived on the basis of few events and a small study sample (that is, less than 300 'vaccination events' across both intervention and comparator groups). In that case the results were downgraded one level for 'serious' imprecision to reflect uncertainty in the effect estimate.
Other issues	Publication bias is a systematic underestimate or overestimate of the underlying beneficial or harmful effect due to the selective publication of studies. A closely related phenomenon is where some papers fail to report an outcome that is inconclusive, thus leading to an overestimate of the effectiveness of that outcome. Sometimes randomisation may not adequately lead to group equivalence of confounders, and if so this may lead to bias, which should be taken into account. Potential conflicts of interest, often caused by excessive pharmaceutical company involvement in the publication of a study, should also be noted. A decision to upgrade was made where there was evidence of a dose-response relationship, or evidence from 2 or more observational studies consistently indicated a large effect size (RR of 2 or more).

1

2

3

Details of how the 4 main quality elements (risk of bias, indirectness, inconsistency and imprecision) were appraised for each outcome are given below in the GRADE tables. Publication or other bias was only taken into consideration in the quality assessment if it was apparent.

GRADE rating	Description
High	Further research is very unlikely to change our confidence in the estimate of effect.
Moderate	Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate.
Low	Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate.
Very Low	Any estimate of effect is very uncertain.

See Appendix I: for full GRADE tables by outcome.

The GRADE tables and forest plots (Appendix K) are used to generate the quality rating and, where applicable, the pooled results that are summarised in the evidence statements below. Each GRADE table and forest plot (where applicable) includes a cross reference to the associated evidence statement.

Effectiveness evidence statements

Each evidence statement is associated with the relevant review question, for example ES 3.1 corresponds to evidence statement 1 for review question 3. ES123.1 relates to a study that is multicomponent and crosses review questions where the data cannot be disaggregated for separate review questions.

Education

ES 1.1 Very low quality evidence from a pooled analysis of 1 before-and-after study and 1 non-randomised controlled trial, with a total of 4,970 participants, showed that educational interventions increase uptake of seasonal flu vaccination compared with usual practice (RR 1.73; 95%CI 1.19 to 2.51). However, very low quality evidence from 1 RCT with 116 participants found an educational intervention that combined risk communication and values clarification did not significantly increase uptake compared with providing standard risk information (RR: 0.86, 95%CI: 0.54 to 1.39) [GRADE profile 1]

ES 1.2 Low and very low quality evidence from 2 studies (1 RCT with 407 participants and 1 before and after study with 90 participants) indicates that educational interventions may increase parental intention to vaccinate. The RCT found that combining risk communication and values clarification may increase intention to vaccinate a child compared with either intervention alone, or with standard risk information. However, previous vaccination behaviour or baseline intention moderates the effect of educational interventions. The before and after study found that a computer-based educational intervention (based on 3 learning theories) increased intention to vaccinate children by 2.2%. However the magnitude of effect may have been moderated by high levels of planned vaccination at baseline (89% already planned to get their child vaccinated) [GRADE profile 2]

Access

No studies were identified of interventions for increasing access to improve uptake of seasonal flu vaccination in children.

SMS messages

ES 3.1 Moderate quality evidence from 3 RCTs with a total of 13,533 participants showed that provider short-message service (SMS) interventions to parents increased uptake of seasonal flu vaccination among children aged 6 months to 17 years compared with usual care, but there is some uncertainty in the importance of the effect (RR 1.12, 95% 95%CI 1.04 to1.19) [GRADE profile 3].

ES 3.2 Moderate quality evidence from 2 RCTs with a total of 3,981 participants showed that more complex multicomponent SMS interventions to parents were more effective than single component SMS in increasing uptake of seasonal flu vaccination among children aged 6 months to 17 years, but there is some uncertainty in the importance of the effect (RR 1.09, 95%CI 1.02 to 1.17). Similarly, high quality evidence from 3 RCTs (with a total of 13,313 participants) found that SMS interventions with an educational component were more effective than usual care (a reminder to attend for flu vaccination with information on clinic times and how to book an appointment), again with some uncertainty in the importance of the effect (RR 1.09, 95%CI 1.03 to 1.19) [GRADE profile 3].

ES 3.3 A subgroup analysis of moderate quality evidence from 2 RCTs (with a total of 4,875 participants aged 23-59 months and 5,146 participants aged 5-17 years) found that provider SMS interventions targeting parents were more effective than usual care in increasing uptake of seasonal flu vaccination among children in both age groups, but with some uncertainty in the importance of these effects (age: 23-59 months: RR 1.08; 95%CI 1.01 to 1.6; age 5-17 years: RR 1.10; 95%CI 1.00-1.20) [GRADE profile 3].

Provider Prompts

ES 3.4. Low quality evidence from 2 RCTs with 10,113 participants showed that a provider prompt intervention (using electronic medical records) activated throughout the flu season increased uptake of seasonal flu vaccination among children aged 6 months to 17 years compared with not having the prompt active, but there is some uncertainty in the importance of the effect (RR 1.03; 95%CI 1.01 to 1.0). The timing of provider prompts moderated their effect on vaccination uptake. There were no significant difference in the proportion of children who remained unvaccinated when the provider prompt was on versus off during autumn (Oct-Dec 2011; unvaccinated RR 0.99, 95%CI 0.89 to1.09). However the intervention was effective during the winter compared with no provider prompts (Jan-Feb 2012; unvaccinated RR 0.85; 95%CI 0.76 to 0.95).

Very low quality evidence from 1 controlled before and after study with 788 participants found that practices using a provider prompt intervention (based on academic detailing) significantly increased uptake of flu vaccination in children aged 6 months to 5 years compared with pre-intervention baseline rates (OR 1.40; 95% CI 1.04 to 1.89), while there was no significant increase in control practices (OR 1.30; 95% CI 0.93 to 1.82).

Moderate quality evidence from a retrospective cohort study with 43,022 participants found that a hospital based provider prompt associated with the medical record significantly increased in-hospital rates of flu vaccination among inpatients aged 6 months to 17 years from 2.1% pre-intervention to 8% post-intervention (RR 3.81 95%CI 3.45 to 4.21) [GRADE profile 3]

Multicomponent

ES 123.1 Low quality evidence from 1 cluster randomised controlled trial with 41,500 participants showed that collaborative local programmes with an organisational lead and using provider-based systems significantly increased uptake of seasonal flu vaccination among children compared with usual care (RR 1.09 95% CI 1.06 to1.11). There was a 9.2% change in uptake from baseline (pre-intervention) in paediatric and family medicine clinics collaborating with a lead public health department, which offered joint community clinics and public health nurses to aid in delivery of flu vaccine, compared with a 3.2 % change in uptake in control group clinics (no public health involvement). A sub-group analysis found very low quality evidence that the largest increase in uptake was among school-aged children aged 6 to 12 years l(11.9% increase compared with 2.8% in the control, X^2=80.92; p<0.0001). A significant but smaller increase in uptake was observed among adolescents aged 13 to18 years (9.8% increase compared with 5.4% in the control, X^2=21.29; p<0.0001) There was no significant subgroup effect among children aged 6 months to 5-years. [GRADE profile 3]

ES 123.2 Very low quality evidence from a before and after study in 77 GP practices indicates that interventions to improve access to flu vaccinations by increasing the number and flexible timing of vaccination clinics, either alone or in combination with awareness-raising activities and/or SMS messaging, did not consistently increase uptake of flu vaccination among children (12/35 practices (34%) observed increased uptake; across the 35 practices, change in % uptake ranged from -35.3% to 48.5%). Awareness-raising interventions only (with no change in accessibility) increased uptake in 18/32 practices (56%), with change in % uptake ranging across the practice sample from -27.2% to 30.7%. Those practices also using SMS interventions saw an overall decrease in percentage uptake in the majority of cases (7/8 practices) with percentage change ranging from -22% to19.7%. Overall, 38% of participating practices observed an increase in uptake of flu vaccination among children; however, similar initiatives did not exhibit similar impact across practices. There was considerable inconsistency in the reported results and intervention components [GRADE profile 3].

ES123.3 Low quality evidence from 1 RCT with 81,599 participants found use of a multicomponent local programme incorporating education, a vaccination champion, improved accessibility and an assigned organisational lead increased uptake of seasonal flu vaccination among children compared with usual care but with uncertainty in the importance of the effect (RR 1.23; 95%CI 1.01 to 1.50). The study found a 7.9% increase in uptake of seasonal flu vaccine in paediatric and family medicine clinics assigned to receive the intervention (a toolkit of evidence-based strategies; provider education and vaccine supply interventions) compared with 4.4 % in control group clinics (operating usual practice). No significant effect was observed in clinics with pre-intervention vaccination rates >58% [GRADE profile 3].

ES 123.4 Moderate quality evidence from 1 cluster randomised controlled trial with 28,049 participants found that in paediatric and family medicine clinics collaborating with a lead public health department to offer joint community clinics with public health nurses to aid in delivery of flu vaccine, there were significantly fewer missed opportunities to vaccinate children against flu than in control group clinics (with no public health involvement) 2 years post-intervention (RR 0.80; 95%CI 0.78 to 0.82) [GRADE profile 4]

Qualitative evidence review

To consider acceptability of flu vaccination and interventions to increase uptake, the views and experiences of parents of children and of vaccination providers were assessed from the qualitative literature. The quality of included studies was appraised based on a checklist adapted from the Quality in qualitative evaluation framework (see Appendix H of the NICE methods manual). A summary of included studies and their final quality rating is included in Table 3 below. The quality ratings used were:

> ++ All or most of the checklist criteria have been fulfilled, and where they have not been fulfilled the conclusions are very unlikely to alter.
>
> + Some of the checklist criteria have been fulfilled, and where they have not been fulfilled, or are not adequately described, the conclusions are unlikely to alter.
>
> – Few or no checklist criteria have been fulfilled and the conclusions are likely or very likely to alter.

Included qualitative studies

See Appendix G for full evidence tables for the included qualitative studies.

Table 3: Included qualitative studies for each review question (RQ1-3) in children age 2-17 years

First author, year	Design & analysis	Country	Setting	Population	Subject	Quality rating
(RQ1 – attitudes, beliefs and knowledge relevant to information or educational content)						
Bhat-Schelbert 2012	Focus groups; Thematic analysis	US	Paediatric healthcare clinics in Pittsburg	Parents, teens, paediatric healthcare staff and providers, immunization and marketing experts	Barriers to and facilitators of child vaccination	+
Bond 2011	Interviews Thematic analysis	AUS	Metropolitan areas in Melbourne	Mothers	Risk perception of vaccination	+
Dyson 2015	Focus groups; Thematic analysis	UK	Playgroups South east Wales	Parents	Awareness, experience and opinion of vaccine	-

First author, year	Design & analysis	Country	Setting	Population	Subject	Quality rating
Flood 2011	Interviews; Thematic analysis	US	Metropolitan areas in Washington DC	Children	Perceptions and preferences for flu vaccination	++
Gazmararian 2010	Focus groups; Thematic analysis	US	Metropolitan areas in Atlanta	Mothers/ step-mother /female guardian	Learning preference and suggested content of educational campaigns	++
Witteman 2015	Open ended questionnaires; Thematic analysis	US	Online	Parent or guardian	Risk communication, values clarification and vaccination decisions	+
(RQ3 – perceived benefits, barriers, concerns and desired characteristics of provider prompts in electronic health records)						
Birmingham 2011	Focus groups and interviews; Thematic analysis	US	Paediatric ambulatory care clinic	Providers and practice leaders	Desired characteristics and concerns about computerized flu alerts	+
Szilagyi 2015	Interviews; Thematic analysis	US	Greater Rochester area	Practitioners at intervention practice	Feasibility, acceptability and sustainability of electronic health record provider prompts	+
(RQ3 – provider perceptions of collaboration with public health department)						
Kempe 2014	Focus group; Thematic analysis	US	Denver metropolitan area	Paediatric family private practices practitioners and a public health department representative	Understanding and interpretation to evaluate effectiveness and sustainability of collaborative approach	++
(RQ3 – call-recall approaches)						
Crocker 2014	Open ended questionnaires; Thematic analysis	UK	Wales	GP practices and child vaccination	To explore aspects of GP Practice flu vaccination campaigns	-

1

2 **Summary of included qualitative evidence**

3

4 **Bhat-Schelbert (2012 [+])** completed 8 focus groups with 91 participants (Parent = 21, Adolescent
5 = 22, Health and immunization professionals = 39, marketing professionals = 9) to explore the
6 perspectives of these groups on flu vaccination. Key themes identified include informed choice,

mixed messages, adverse outcomes, misconceptions, safety, necessity and the mandatory vaccination in schools.

Bond (2011 [+]) undertook 45 semi-structured interviews with mothers of children aged 3-30months who were a mix of first time and experienced mothers to explore the utility of risk perception and decision making theories for understanding immunisers and non-immunisers health beliefs and behaviours. Key themes identified include informed choice and information, trust, adverse outcomes and risk perceptions.

Dyson (2015 [-]) undertook 3 focus groups (19 participants) with parents of 2 or 3 year old children to explore their awareness, experience and opinion about the vaccine. Key themes include vaccination delivery mode, information content,

Flood (2011 [++]) undertook 28 semi-structured interviews with children aged 6-12 years to explore children's knowledge and perception of influenza vaccination. Key themes identified include risk perceptions, adverse outcomes, necessity, vaccination delivery mode preference and moderation of that.

Gazmararian (2010 [++]) completed 9 focus groups with 54 mothers of children aged 5 to12 years to explore knowledge, concerns, attitudes and communication preferences for influenza vaccination of primary or joint decision makers for their child/children. Key themes include risk perception, knowledge, perceived benefit, mandatory vaccination in schools, access and trust.

Witteman (2015[+])undertook semi structured online questionnaires with parents and guardians who make medical decisions for at least one child aged 6months to18 years, to explore vaccination intention before an intervention on risk-benefit trade-offs to enable informed choice (n=407) and at 7 months post intervention to assess children's vaccination status (n=107). Key themes include risk perceptions, adverse outcomes, misconceptions, necessity and logistical/access issues.

Birmingham (2011 [+]) completed 4 focus groups and 5 individual interviews. Twenty-one paediatric providers participated in the focus groups and 5 practice leaders participated in the interviews to evaluate a computerised flu alert associated with the electronic health record (EHC) to assess perceived barriers and desired characteristics. Key themes include risk perception, prompt errors/EHC accuracy, potential to ignore the prompt and resource impact concerns.

Szilagyi (2015 [+]) completed 1 telephone interview with a practitioner of each intervention practice to assess feasibility and sustainability of EHC or nurse initiated provider prompts. Key themes include prompt errors/EHC accuracy, resource impact concerns, acceptance and possibility of ignoring the prompt.

Kempe (2014 [++]) completed 1 focus group with a representative from each intervention practice and public health departments representative (5 participants) to explore perceived effectiveness and sustainability of a collaboration between providers and the public health department to increase flu vaccination uptake. Key themes include EHC accuracy, logistics and planning (vaccine supply) and access/clinic hours.

Crocker (2016 [-]) completed 108 questionnaires with open ended questions exploring the staffs experiences and perceived difficulties of or barriers to GP practice based flu campaigns using call-recall approaches that may have affected uptake. Key themes include perception of delayed or inconsistent delivery of Live Attenuated Influenza Vaccination (LAIV), promotional advertising less visible and negative publicity of vaccine efficacy, lack of awareness of and confidence in intranasal vaccine, resource impacts concerns (of running large scale campaigns), access/clinic hours.

Qualitative evidence statements

Q-ES 1.1 *Knowledge, information and over-coming misconceptions*

5 US [+[1,6,7]; ++[4,5]] and 1 AUS [+[2]] studies covering views and experiences from parents, teenagers, children and providers suggested that information on flu was desirable and may alter acceptability

of flu vaccination offers. The decision maker needed enough information to make an informed choice, the contents of which could include the risk and benefits of the vaccination, why it is needed annually, alternatives for children; as well as addressing a number of areas where there appeared to be concerns with or misconceptions about influenza including the vaccination causing illness or death, the seriousness of flu particularly complications for children, that the flu is not a broad name for a number of common cold like illnesses, or the building of immunity, along with the alternatives that may be less associated with pain such as the nasal spray.

1. Bhat-Schelbert 2012 [+]
2. Bond 2011 [+]
4. Flood 2011 [++]
5. Gazmararian 2010 [++]
6. Witteman 2015[+]
7. Birmingham 2011 [+]

Q-ES 1.2 *Perception of the severity of flu may impact on decision to accept vaccination offers*

4 US [+[1,6]; ++[4,5]] and 1 AUS [+[2]] studies examining the views and experiences of parents, teenagers and children indicated that risk perception of the severity of flu (for selves or others) may affect the uptake of flu vaccination offers. The necessity of accepting vaccination offers appeared to be based on a number of assumptions including the underlying health of the child or beliefs about their health behaviours such as having a good diet, the impact of the flu on the child/themselves"1 didn't think it was worth it to avoid a few days of sickness"[4]; "The flu does not appear to be that dangerous, an inconvenience at most"[6], as well as the capacity to control, exposure[2]. However, understanding some of that risk from personal experience or knowledge of impact may improve uptake "I had flu once and I would never want my children to experience that"; "If any of us get flu we may endanger someone else in the family. So we all get shots"[6].

1. Bhat-Schelbert 2012 [+]
2. Bond 2011 [+]
4. Flood 2011 [++]
5. Gazmararian 2010 [++]
6. Witteman 2015[+]

Q-ES 1.3 *Trust in government, practitioner and pharmaceutical company information may affect uptake decisions*

3 US [+[1 6]; ++[5]] and 1 AUS [+[2]] studies suggested issues of trust may affect uptake decisions by parents, some of which stems from the annual nature of the vaccine and projections; "my concern has always been that although they vaccinate against the flu strain – they don't know which one will hit during that year so it can't vaccinate against the current flu outbreak"[6]; "so the dad told me that he does not believe in the CDC projection of the next year influenza season"; the uncertainty of whether the vaccination is protective of current strains was unsettling[5]. There was also a lack of trust in whether practitioners or pharma had the population's best interests at heart non-immunisers believed that drug companies and doctors knew that vaccines were not safe but kept that information from the public[2]; pharmaceutical companies in particular were not seen as a credible source of information, as financial gain was believed to be their main aim[5].

1. Bhat-Schelbert 2012 [+]
2. Bond 2011 [+]
5. Gazmararian 2010 [++]
6. Witteman 2015[+]

Q-ES 1.4 *Accessibility including evening and weekend clinics may support uptake*

4 US [+[1,6,]:++[5,9]] studies and 1 UK [-] study indicated that parents and providers considered that accessibility may be a barrier or facilitator in improving uptake. Some parents suggested having to take time off work was a reason for not having their child vaccinated[1,6], some providers suggested uptake was reduced due to the times they offered flu vaccination "eligible children were in school when the GP practice could offer the vaccine"[10], other providers suggested additional or evening and weekend clinics may improve uptake[9] something corroborated by parents[1]. Multiple or opportunistic access was also suggested by parents to enable uptake "We got the vaccine because it was offered at Walgreens"; parents recommended "offer at as many locations as possible" to improve uptake (Gazmaraian 2010).

1. Bhat-Schelbert 2012 [+]
5. Gazmararian 2010 [++]
6. Witteman 2015[+]
9. Kempe 2014 [++]
10. Crocker 2016 [-]

Q-ES 1.5 *Vaccine supply limited planning and access to vaccinations*

4 US studies [+[1,6]; ++[5,9]] and 1 UK [-[10]] study indicated vaccine availability (or perceptions of this) may impede the delivery of campaigns to promote vaccinations[2,9,10], which could in turn reduce potential uptake rates particularly in practice. Parents indicated this was a real factor in their child's uptake of vaccination "I mentioned this to my doctor but they said they didn't have any"[6]; with some participants suggesting campaigns that included "information (if true) that there is adequate supply for all that want it"[5] may help.

1. Bhat-Schelbert 2012 [+]
5. Gazmararian 2010 [++]
6. Witteman 2015 [+]
9. Kempe 2014 [++]
10. Crocker [-]

Q-ES 1.6 *Belief in accuracy of records and prompts*

3 US [+[7,8]; ++[9]] studies indicated that providers needed to believe in the accuracy of computerised prompts or record keeping when working with others in terms of the match between the electronic health records (EHC) and the true vaccination status of the child to enable their use[8]; "it has to be accurate, it has to be a kid who needs vaccine and hasn't received it yet"[7]. The process to keep records up to date needed to be trusted and accurate "not familiar with our processes. So not a whole lot of help; they can give the vaccine but our employees need to enter it into our electronic medical records"[9]; but that providers also expressed the opinion that EHC prompts were useful if it reduced the administration needed for checking vaccination status and the improved identification of those in need.

7. Birmingham 2011 [+]
8. Szilagyi 2015 [+]
9. Kempe 2014 [++]

Q-ES 1.7 *Mandatory vaccination in schools is a factor that may affect uptake decisions*

3 US [+[1,6]; ++[5]] studies parents suggest mandating flu vaccination for school enrolment is a key factor affecting vaccination status of children. "lack of an official mandate to be vaccinated for flu prior to school enrolment" reduced its importance[1]; "school entry requirements would be a

compelling reason to get vaccinated"[5]; "my child got the flu vaccine mainly because it is a requirement to attend public school districts"[6].

1. Bhat-Schelbert 2012 [+]
5. Gazmararian 2010 [++]
6. Witteman 2015 [+]

Q-ES 1.8 *Vaccination Delivery Mode may affect uptake*

1 UK [-[3]] and 1 US [++[4]] study reported that children and parents suggested they were more likely to accept flu vaccination offers if they knew the nasal spray was the delivery mode.

3. Dyson 2015 [-]
4. Flood 2011 [++]

Q-ES 1.9 *Who endorses flu vaccination may be important in decision making*

1 UK [-[3]] and 1 US [++[5]] study indicate that advice from a health visitor has a positive influence on vaccination uptake, while celebrity endorsements tend not to influence uptake decisions. The UK study suggested that for parents a personal invitation from a healthcare professional was important in their decision making for flu vaccination in their 2-3 year old as all participants stated that advice from their health visitor was an important factor in helping them decide on the vaccination[3]. However 1 UK [-[3]] and 1 US [++[5]] studies suggested endorsement by celebrities was not usually considered credible or likely to influence their decision[3,5].

3. Dyson 2015 [-]
5. Gazmararaian 2010 [++]

Economic evidence

No health economic evaluations were identified for inclusion in this review.

Economic model

Please see the separate economic modelling report produced by the Economic Modelling Unit (EMU) for de novo modelling for this guideline

Appendix A: Review protocols

Review protocols for 'Flu vaccination: increasing uptake in children' (Review questions 1-3)

A number of elements within the protocols are common across each question namely:

- searches
- methods for selecting evidence (data screening);
- data extraction and quality assessment;
- strategy for data synthesis
- exclusion criteria
- strategy to manage low numbers of references

To reduce repetition these details are provided here:

Searches	The identification of evidence will conform to the methods set out in chapter 5 of the "Developing NICE Guidelines Manual" (October 2014). Relevant databases and websites will be searched systematically to identify relevant qualitative, quantitative and cost effectiveness evidence. The search will use a traditional systematic approach, using PICO to formulate the search strategy. Effectiveness Two searches will be carried out on effectiveness. One will cover interventions for effectiveness for the clinical risk groups, carers and children age 2-17 years and the other will cover the health and social care worker population. These will be carried out separately because the interventions vary between these groups.	

	Study filters will be applied for Systematic review, RCT, Observational study and Qualitative study types. Results will then be split between those with and without study filters for sifting so that, if necessary, studies that have been excluded by the study filters can be identified. <u>Cost-effectiveness</u> These searches will comprise: the effectiveness searches for Medline and Embase without study type filter but with an economics filter; effectiveness searches of the other databases with no filters applied (economics studies to be identified by sifting); additional searches of Econlit and NHS-EED using the main body of the effectiveness search strategy without study type filters. Limits: Sources will be searched from 1996-2016. Language: English language. A separate search will also be carried out about theories and models of behaviour change to address sub questions within question 1a and 4a. Sources to be searched: see Appendix 1. See Appendix 2 for details of the search strategy.	
Selecting evidence (data screening)	Stage 1. Title abstract screening All references from the database searches will be downloaded, de-duplicated and screened on title and abstract against the criteria above. A randomly selected initial sample of 10% of records will be screened by two reviewers independently. The rate of agreement for this sample will be recorded, and if it is over 90% then remaining references will screened by one reviewer only. Disagreement will be resolved through discussion. Where abstracts meet all the criteria, or if it is unclear from the study abstract whether it does, the full text will be retrieved.	As noted elsewhere, if large numbers of papers are identified and included at full text, the following may be implemented: • Prioritising evidence with critical or highly important outcomes

	Stage 2. Full text screening Full-text screening will be carried out by two reviewers independently on a 10% sample and any differences resolved by discussion. The rate of agreement for this sample will be recorded, and if it is over 90% then remaining references will screened by one reviewer only. Disagreement will be resolved through discussion. Reasons for exclusion at full paper will be recorded. Inter-rater agreement will be recorded.	• Prioritising evidence of higher quality in terms of study type • Prioritising evidence with larger participant numbers (> 100)or number of sites it applies to • Consideration of a date cut off (on advice of topic experts)
Data extraction and quality assessment	Data extraction of included studies will be conducted using approaches described in Developing NICE guidelines: the manual. Each included study will be data extracted by 1 reviewer and the data extraction sheet will be confirmed by a second reviewer. Any differences will be resolved by discussion or recourse to a third reviewer. Quality assessment for all included studies will be conducted using the tools in Developing NICE guidelines: the manual. Each included study will be quality assessed by 1 reviewer and checked by another. Any differences in quality grading will be resolved by discussion or recourse to a third reviewer.	
Strategy for data synthesis	Data will be grouped and synthesised into concise evidence statements in line with Developing NICE guidelines: the manual. We will routinely use narrative synthesis for the effectiveness reviews and may pilot GRADE on one review question. See individual protocols for potential a priori groupings. If sufficiently homogeneous and high-quality data are located, meta-analysis will be conducted, including any unintended consequences of an intervention.	

Exclusion criteria	Exclusion criteria: • The epidemiology of influenza • Uptake of pandemic influenza vaccines • Not English Language • Not EU/OECD countries • Dissertation and theses • Opinion pieces (e.g. letters, editorials, commentaries) • Conference abstracts • Poster presentations	
Strategy to manage low number of references	• Extrapolation to other groups i.e. Older people to other groups • Call for Evidence • Expert Testimony	

1

2 **PICO RQ 1-3 (Children)**

	Details			Additional comments
Study design	**(A)** Comparator studies (effectiveness): • Systematic reviews • Randomised or non-randomised controlled trials • Before and after studies Observational studies will only be included to fill gaps where	**(B)** Qualitative primary studies: • Interviews • Focus groups • Case studies	**(C)**Economic studies with both costs and benefits: • Economic evaluations • Cost-utility (cost per QALY) • Cost benefit (i.e. Net benefit) • Cost-effectiveness (Cost per unit of effect)	**Exclusions** (study design): Non-comparative studies. **Exclusions** (Quantitative): •Cross-sectional surveys, epidemiological studies, correlation studies and studies to assess coverage rates are excluded. **Exclusions** (Qualitative): •Cross-sectional surveys/epidemiological studies/

	Details			Additional comments
	effectiveness studies are not available: • Cohort studies • Case-control studies		• Cost minimisation • Cost-consequence	correlations studies/studies to assess coverage rates which contain information related to knowledge/attitudes/beliefs/ perception/intentions/acceptance about vaccination are excluded. **Exclusions** (study design): Systematic reviews will only be included if the review question matches the reviews questions in our reviews or as a source for citation searching if primary searches do not yield a substantial amount of evidence. **Exclusions** (econ): Theory papers, cost only studies, 'burden of disease' studies and 'cost of illness' studies, which do not report data to inform a model will be excluded. Cost-effectiveness of flu vaccine studies will be excluded.
Setting	**Settings:** o Primary and secondary healthcare settings o Community settings Included countries (Quantitative): Europe and OECD: Australia, Austria, Belgium, Canada, Chile, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Spain, Sweden, Switzerland, Turkey, UK, USA.			**Excluded settings** : Occupational health settings **Excluded countries (quantitative)**: Non-OECD. If too many studies are identified those OECD countries where there are significant cultural differences –

	Details				Additional comments
	Included countries (qualitative): Europe, North America, Canada, Australia, New Zealand only				Japan, Korea, South and Central America, and Eastern Europe will be excluded. **Excluded countries** (qualitative): Non-OECD, Japan, Korea, South and Central America. If too many studies are identified those European countries where there are significant cultural differences – Eastern Europe will be excluded and priority will be given to UK studies.
Population	Children aged 2-17 years				
Intervention group	**Information about, and acceptability of, flu vaccination (RQ1)**	**Access to flu vaccination (RQ2)**	**Provider based systems: (RQ3)**	**Behaviour change models, techniques and theories**	
Intervention	Information campaigns: ○ targeted ○ community based, including local radio campaigns ○ settings based ○ online campaigns., including social media and apps Education: ○ educational tools	Vaccination clinics in community settings : ○ community pharmacies ○ antenatal clinics ○ specialist clinics e.g. drug and alcohol services, mental health services	Local programme assigned lead for an annual flu programme local approach systems and processes in working with the community practice approach	Behaviour change models, techniques and theories, including: Motivational interviewing • Trans-theoretical model (stages of change) • Theory of planned behaviour	**Exclusions:** Interventions related to uptake of pandemic flu vaccines during pandemic outbreaks. Note: papers related to interventions to increase uptake of H1N1 vaccination (swine flu vaccine) where results are also relevant to uptake of seasonal flu vaccine (i.e. the intervention is not delivered during a pandemic outbreak) will be included.

	Details				Additional comments
	○ peer education (carried out by a community member who shares similar life experiences to the community they are working with) ○ lay education (carried out by community members working in a non-professional capacity) Tailored information and advice delivered: ○ during home visits ○ during consultation with health and social care workers ○ at support group meetings for patients and other people who use services. Flu vaccination 'champion' : ○ practitioner ○ peer Recommendations from a respected person:	○ community venues e.g. libraries, children's centres Dedicated flu vaccination clinics Mass vaccination clinics in community or other settings Walk in or open access immunisation clinics Extended hours clinics ○ weekends ○ evenings (after 6 pm) ○ early mornings (before 8 am) ○ 24 hour access. Outreach or mobile services: ○ home or domiciliary or day centre visits ○ support group meeting visits ○ residential or care home visits ○ special schools visits	Programmes to modify standard searches of patient databases to identify eligible patients. Reminder and recall systems (for providers) clinical alerts and prompts Personal invitation GP community pharmacist health or social care worker from several professionals Booking systems dedicated flu lines or online systems Payment systems (fiscal arrangements) outside primary care Reminders (to eligible groups) text messages emails postcards posters telephone call	Theory of reasoned action Health Protection Theory Protection motivation Theory Social cognitive theory Perceptions of risk	Interventions related to haemophilus influenza type B vaccine are excluded as this vaccine is not a flu vaccine. It is given to prevent against meningitis.

	Details				Additional comments
	○ health or social care worker ○ carer ○ peer ○ volunteer ○ family member	○ inpatient visits ○ custodial visits ○ immigration settings ○ mobile clinics e.g. in community Parallel clinics: ○ Offer flu vaccination in parallel with regular appointments e.g. with midwives, clinicians, inpatient and outpatient clinics, long stay wards, etc. ○ coordinated timing of other programmes e.g. retinal screening for diabetic patients within flu season Opportunistic vaccination e.g. visits to	Approaches to follow-up phoning patients Personal health record (so eligible people can see if their vaccination is due) Shared health records for providers. Integration of primary and secondary care health records Centralised uptake record Audit and feedback on uptake rates weekly statistics content and delivery of feedback practical relevance (e.g. how many more people need to be vaccinated to achieve target number)		

	Details				Additional comments
		GP ,practice nurse or consultant for other medical conditions Flu vaccination vouchers to enable eligible groups to receive flu vaccination from community providers	comparison data e.g. between GP practices Incentives (for eligible groups) voucher schemes Incentive schemes (for providers) targets quality and outcomes framework voucher schemes		
Comparator	Comparators that will be considered are: • Other intervention • Status quo • Time (before and after) or area (i.e. matched city a vs b) comparisons				
Outcomes	Primary outcome: • Changes in uptake rate among target groups Secondary outcomes: • Changes in: o knowledge o attitudes o beliefs o acceptance o intentions • Unintended consequences of an activity, including o increase uptake of other vaccines o increase in inequalities				

	Details	Additional comments
	o increase in issues of concern if vaccinated outside health and social care settings e.g. about resuscitation facilities, aseptic techniques, needle contamination o increase in distress caused by having the vaccine within specific groups e.g. people with learning disabilities o Vaccinations not captured by other providers o Risk of being vaccinated twice o Vaccine wastage • Cost effectiveness and economic outcomes: o Cost per quality-adjusted life year o Cost per unit of effect o Net benefit	

1

Appendix B: Health economic analysis

To be inserted pending decisions by Public Health Advisory Committee (PHAC) on areas for economic modelling prioritised – scheduled for initial discussion at PHAC meeting 3

Appendix C: Research recommendations

See full guideline for prioritised research recommendations.

Appendix D: Included evidence study selection

Bhat-Schelbert K, Lin CJ, Matambanadzo A, Hannibal K, Nowalk MP, Zimmerman RK. Barriers to and facilitators of child influenza vaccine - perspectives from parents, teens, marketing and healthcare professionals, Vaccine, 30, 2448-52, 2012

Birmingham E, Catallozzi M, Findley SE, Vawdrey DK, Kukafka R, Stockwell MS. FluAlert: A qualitative evaluation of providers' desired characteristics and concerns regarding computerized influenza vaccination alerts, Preventive medicine, 52, 274-277, 2011

Bond, L. and Nolan, T., 2011. Making sense of perceptions of risk of diseases and vaccinations: a qualitative study combining models of health beliefs, decision-making and risk perception. *BMC Public Health*, *11*(1), p.1.

Crocker, J. Meredith, N. and Roberts, R. Vaccine Preventable Disease Programme (VPDP): Survey of GP Practices Exploring Aspects of their 2014-15 Flu Vaccination Campaigns; 2016; NHS Wales

Dyson J., Meredith N. and Roberts R. Childhood flu vaccine focus groups report; 2015; Public Health Wales

Flood EM, Block SL, Hall MC, Rousculp MD, Divino VM, Toback SL, Mahadevia PJ.Children's perceptions of influenza illness and preferences for influenza vaccine. J Pediatr Health Care. 2011 May-Jun;25(3):171-9. doi: 10.1016/j.pedhc.2010.04.007. Epub 2010 Jun 1

Gargano, L.M., Pazol, K., Sales, J.M., Painter, J.E., Morfaw, C., Jones, L.M., Weiss, P., Buehler, J.W., Murray, D.L., Wingood, G.M. and Orenstein, W.A., 2011. Multicomponent interventions to enhance influenza vaccine delivery to adolescents. *Pediatrics*, *128*(5), pp.e1092-e1099

Gazmararian JA, Orenstein W, Prill M, Hitzhusen HB, Coleman, MS, Pazol K, Oster N V. Maternal knowledge and attitudes toward influenza vaccination: a focus group study in metropolitan Atlanta, Clinical pediatrics, 49, 1018-25, 2010

Hofstetter, Annika M., Vargas, Celibell Y., Camargo, Stewin, Holleran, Stephen, Vawdrey, David K., Kharbanda, Elyse Olshen, Stockwell, Melissa S., Impacting delayed paediatric influenza vaccination: a randomized controlled trial of text message reminders, American journal of preventive medicine, 48, 392-401, 2015

Joshi, A., Lichenstein, R., King, J., Arora, M. and Khan, S., 2009. Evaluation of a Computer-Based Patient Education and Motivation Tool on Knowledge, Attitudes and Practice towards Influenza Vaccination.*International Electronic Journal of Health Education*, *12*, pp.1-15.

Kempe A, Albright K, O'Leary S, Kolasa M, Barnard J, Kile D, Lockhart S, Dickinson LM, Shmueli D, Babbel C, Barrow J. Effectiveness of primary care-public health collaborations in the delivery of influenza vaccine: a cluster-randomized pragmatic trial, Preventive medicine, 69, 110-6, 2014

Ly, E., Peddecord, K.M., Wang, W., Ralston, K. and Sawyer, M.H., 2015. Student Column: Using Academic Detailing to Improve Childhood Influenza Vaccination Rates in San Diego. *Public Health Reports*, *130*(2), p.179.

Meredith N., Lewis R., Dyson J. and Roberts R. Vaccination in Practice (VIP) Scheme – Innovative practice in the annual flu campaign; Public Health Wales; May 2016

Pollack, A.H., Kronman, M.P., Zhou, C. and Zerr, D.M., 2014. Automated screening of hospitalized children for influenza vaccination. *Journal of the Pediatric Infectious Diseases Society*, *3*(1), pp.7-14.

Stockwell MS, Catallozzi M, Camargo S, Ramakrishnan R, Holleran S, Findley SE, Kukafka R, Hofstetter AM, Fernandez N, Vawdrey DK. Registry-linked electronic influenza vaccine provider reminders: a cluster-crossover trial, Paediatrics, 135, e75-82, 2015 (a)

Stockwell MS, Hofstetter AM, DuRivage N, Barrett A, Fernandez N, Vargas CY, Camargo S. Text message reminders for second dose of influenza vaccine: a randomized controlled trial, Paediatrics, 135, e83-91, 2015 (b)

Stockwell MS, Kharbanda EO, Martinez RA, Vargas CY, Vawdrey DK, Camargo S. Effect of a text messaging intervention on influenza vaccination in an urban, low-income paediatric and adolescent population: a randomized controlled trial, JAMA, 307, 1702-8, 2012

Suryadevara, M., Bonville, C.A., Ferraioli, F. and Domachowske, J.B., 2013. Community-centered education improves vaccination rates in children from low-income households. *Pediatrics*, *132*(2), pp.319-325.

Szilagyi PG, Serwint JR, Humiston SG, Rand CM, Schaffer S, Vincelli P, Dhepyasuwan N, Blumkin A, Albertin C, Curtis CR. Effect of provider prompts on adolescent immunization rates: A randomized trial, Academic paediatrics, 15, 149-157, 2015

Witteman HO, Chipenda Dansokho S, Exe N, Dupuis A, Provencher T, Zikmund-Fisher BJ. Risk communication, values clarification, and vaccination decisions. Risk Anal. 2015 Oct;35(10):1801-19. doi: 10.1111/risa.12418. Epub 2015 May 20.

Zimmerman RK, Nowalk MP, Lin CJ, Hannibal K, Moehling KK, Huang H-H, Matambanadzo A, Troy J, Allred NJ, Gallik G, Reis EC. Cluster randomized trial of a toolkit and early vaccine delivery to improve childhood influenza vaccination rates in primary care, Vaccine, 32, 3656-63, 2014

Appendix E: Economic evidence study selection

No cost effectiveness studies were identified for inclusion in this review

1 Appendix F:Literature search strategies

2 **Search Strategy 1 – Main search strategy (carers, clinical risk groups, children)**

3

Database: Ovid MEDLINE (R) <1996 to April Week 2 2016>
1 exp Influenza, Human/ (40799)
2 Influenza A virus/ (17642)
3 Influenza B virus/ (3359)
4 Influenzavirus C/ (309)
5 (influenza* or flu or grippe).tw. (93602)
6 or/1-5 (99916)
7 exp Vaccination/ (70018)
8 Vaccines/ (18041)
9 Immunization/ (46296)
10 (vaccin* or immuni*).tw. (387373)
11 or/7-10 (416475)
12 6 and 11 (30641)
13 exp Influenza Vaccines/ (18322)
14 12 or 13 (33248)
15 Disabled Persons/ (35102)
16 clinical risk group*.tw. (97)
17 ((underlying or exist* or chronic or long term) adj3 (condition* or illness* or disease*)).tw. (242566)
18 co-morbid*.tw. (15582)
19 Lung Diseases/ (63247)
20 chronic respiratory disease*.tw. (2113)
21 Asthma/ (109906)
22 asthma*.tw. (120671)
23 Pulmonary Disease, Chronic Obstructive/ (26787)
24 chronic obstructive pulmonary disease*.tw. (29526)
25 copd.tw. (27023)
26 Bronchitis/ or Bronchitis, Chronic/ (20924)
27 bronchitis.tw. (18234)
28 Emphysema/ (6551)
29 emphysema.tw. (18387)
30 Bronchiectasis/ (7053)
31 bronchiectasis.tw. (6474)
32 Cystic Fibrosis/ (30266)
33 cystic fibrosis.tw. (33453)
34 Lung Diseases, Interstitial/ (6875)
35 Idiopathic Pulmonary Fibrosis/ (1703)
36 ((interstitial lung or idiopathic pulmonary) adj2 (fibrosis* or disease*)).tw. (9318)

Database: Ovid MEDLINE (R) <1996 to April Week 2 2016>
37 Pneumoconiosis/ (6426)
38 pneumoconiosis.tw. (3617)
39 Bronchopulmonary Dysplasia/ (3494)
40 ((bronchopulmonary or lung) adj2 dysplasia).tw. (4486)
41 Respiratory Tract Diseases/ (20044)
42 respiratory tract disease*.tw. (2303)
43 Heart diseases/ (62496)
44 Coronary Artery Disease/ (45659)
45 coronary artery disease*.tw. (61377)
46 Heart Defects, Congenital/ (45915)
47 Myocardial Ischemia/ (34302)
48 ((congenital or isch?emic or chronic) adj3 (heart disease* or heart defect* or myocardial or malform*)).tw. (76447)
49 Hypertension/ (207757)
50 Heart Failure/ (93857)
51 (hypertension or hypertensive or heart failure).tw. (418293)
52 Renal Insufficiency, Chronic/ (10210)
53 Kidney Failure, Chronic/ (82195)
54 ((kidney or renal) adj3 (disease* or failure*)).tw. (157262)
55 renal insufficienc*.tw. (18844)
56 Nephrotic Syndrome/ (14539)
57 Kidney Transplantation/ (83636)
58 (nephrotic syndrome or kidney transplant*).tw. (42243)
59 (transplant* adj2 recipient*).tw. (41251)
60 Liver Diseases/ or Liver Cirrhosis/ (119266)
61 Biliary Atresia/ (2502)
62 Hepatitis, Chronic/ (5491)
63 (chronic adj3 (liver disease* or hepatitis)).tw. (52503)
64 (((biliary or bile duct) adj2 atresia) or cirrhosis).tw. (69797)
65 Multiple Sclerosis/ or Nervous System Diseases/ (80798)
66 ((nervous system or neurological or motor neurone or parkinson*) adj3 disease*).tw. 67 (81953)
67 (multiple sclerosis or ms).tw. (236121)
68 Cardiovascular Diseases/ (115708)
69 cardiovascular disease*.tw. (103272)
70 Stroke/ or Ischemic Attack, Transient/ (85925)
71 (stroke* or transient isch?emic attack* or TIA or cerebrovascular accident*).tw. 73 (163996)
72 Postpoliomyelitis Syndrome/ (739)
73 (postpolio* or polio*).tw. (25647)
74 Cerebral Palsy/ (17020)
75 cerebral palsy.tw. (15143)
76 Learning Disorders/ (13091)
77 (learning adj3 (disabilit* or disorder*)).tw. (7401)

Database: Ovid MEDLINE (R) <1996 to April Week 2 2016>
78 Diabetes Mellitus, Type 1/ or Diabetes Mellitus, Type 2/ or Diabetes Mellitus/ (243804)
79 diabet*.tw. (423612)
80 Immunosuppression/ or Immune System Diseases/ (40379)
81 (immun* adj3 (disease* or disorder)).tw. (36680)
82 immunosuppress*.tw. (107268)
83 Bone Marrow Transplantation/ (43235)
84 bone marrow transplant*.tw. (29053)
85 exp HIV Infections/ (243267)
86 (AIDS or HIV*).tw. (298104)
87 Multiple Myeloma/ (33980)
88 myeloma.tw. (38052)
89 Interleukin-1 Receptor-Associated Kinases/ (998)
90 Immunologic Deficiency Syndromes/ (13400)
91 Complement System Proteins/ (25518)
92 (interleukin-1 receptor-associated kinase* or interleukin 1 receptor associated kinase* or IRAK or NEMO or Nuclear factor-kappa B essential modulator* or Nuclear factor kappa B essential modulator*).tw. (1836)
93 (complement* adj3 (deficienc* or disorder* or system*)).tw. (10292)
94 aspleni*.tw. (1388)
95 ((splenic or spleen) adj3 dysfunction*).tw. (123)
96 Anemia, Sickle Cell/ (17969)
97 sickle cell.tw. (17893)
98 Celiac Disease/ (17410)
99 c?eliac.tw. (20524)
100 Pregnant Women/ (5605)
101 Pregnancy Trimester, Third/ or Pregnancy/ or Pregnancy Trimester, First/ or Pregnancy Trimester, Second/ (769116)
102 Pregnancy Trimesters/ (1477)
103 (pregnant or pregnancy or gestation*).tw. (430574)
104 Obesity, Morbid/ (13223)
105 (obes* adj2 morbid*).tw. (10134)
106 or/15-105 (3930956)
107 Child/ or Parents/ or Adolescent/ or Child, Preschool/ (2588133)
108 (child* or boy* or girl* or toddler* or kid or kids or adolescent* or youngster* or young person* or young people or schoolchild* or minor or minors or teen* or juvenile* or student* or pupil or pupils or pre-school* or preschool* or under 18* or under eighteen* or underage* or over 1* or over one* or parent*).tw. (1802780)
109 107 or 108 (3342672)
110 Caregivers/ (24586)
111 (carer* or careworker* or care worker* or care giver* or caregiver*).tw. (52544)
112 110 or 111 (60206)
113 Health Promotion/ (58861)
114 ((increas* or improv* or rais* or higher) adj4 (uptake or rate* or immuni* or vaccin* or complian*)).tw. (395235)

Database: Ovid MEDLINE (R) <1996 to April Week 2 2016>
115 ((information or advice or advised or recommend*) adj3 (campaign* or consult* or doctor* or GP or physician* or clinician* or nurse* or support group* or patient* or peer* or forum* or social media or online or apps or social care or socialcare or health care or healthcare or carer or volunteer* or famil* or parent* or son* or daughter* or child* or brother* or sister* or sibling*)).tw. (925543)
116 Health Education/ or Patient Education as Topic/ or Leadership/ (160477)
117 ((education* or learn*) adj3 (tool* or resource* or peer* or lay)).tw. (9381)
118 ((flu or influenza) adj3 (lead* or champion*)).tw. (213)
119 or/113-118 (688201)
120 Health Services Accessibility/ or House Calls/ or Mass Vaccination/ (61774)
121 ((vaccin* or immuni*) adj3 (access or communit* or pharmac* or clinic* or mass or service or GP or doctor* or physician* or clinician* or nurse practitioner* or midwife or midwives or walk-in or walk in or outreach or mobile or residential home* or care home* or residential care or nursing home* or home visit* or house call* or support group* or on-site or on site or weekend* or evening* or 24-hour* or 24 hour* or extended-hour* or extended hour* or opportunistic or opportunit* or open access or parallel* or voucher*)).tw. (11917)
122 or/120-121 (72786)
123 Health Policy/ or Reminder Systems/ or Motivation/ or Physician Incentive Plans/ or Reimbursement, Incentive/ or Medical Audit/ or Clinical Audit/ or Feedback/ or Registries/ or Immunization Programs/ or Information Systems/ or Medical Records Systems, Computerized/ or Electronic Health Records/ (268368)
124 ((local or vaccin* or immuni*) adj3 (policy or policies or program* or provider* or approach* or computer* or information system*)).tw. (23009)
125 ((system* or process* or search* or program*) adj3 (identif* or contact* or invit* or find* or locat*)).tw. (76839)
126 (remind* or track* or alert* or postcard* or mail* or email* or text* or sms or recall* or telephon* or registry or registries or letter* or appointment* or schedul* or invite* or invitation* or prompt* or poster*).tw. (856532)
127 "Appointments and Schedules"/ (7615)
128 ((book* or on-line or online or data or record*) adj3 system*).tw. (37248)
129 ((system* or process*) adj3 (re-book or re book or follow-up or follow up)).tw. (2517)
130 ((system* or process*) adj3 (audit* or feedback or statistic* or response*)).tw. (55445)
131 ((vaccin* or immuni*) adj3 (pay* or financ* or fiscal)).tw. (185)
132 ((incentive* or reward*) adj3 (scheme* or program* or target* or voucher*)).tw. (1701)
133 "quality and outcomes framework".tw. (282)
134 ((share* or personal or integrat* or centrali*) adj3 (health record* or healthcare record* or health care record* or social care record* or data interchange or data record*)).tw. (875)
135 or/123-134 (1240108)
136 or/119,122,135 (1886974)
137 or/106,109,112 (6567492)
138 and/14,136-137 (6166)
139 Randomized Controlled Trial.pt. (410079)
140 Controlled Clinical Trial.pt. (90300)
141 Clinical Trial.pt. (497803)
142 exp Clinical Trials as Topic/ (289214)
143 Placebos/ (33136)
144 Random Allocation/ (85966)

Database: Ovid MEDLINE (R) <1996 to April Week 2 2016>
145 Double-Blind Method/ (133970)
146 Single-Blind Method/ (21522)
147 Cross-Over Studies/ (37571)
148 ((random$ or control$ or clinical$) adj3 (trial$ or stud$)).tw. (806804)
149 (random$ adj3 allocat$).tw. (22641)
150 placebo$.tw. (161447)
151 ((singl$ or doubl$ or trebl$ or tripl$) adj (blind$ or mask$)).tw. (131082)
152 (crossover$ or (cross adj over$)).tw. (60235)
153 or/139-152 (1479689)
154 Observational Studies as Topic/ (1266)
155 Observational Study/ (19166)
156 Epidemiologic Studies/ (7023)
157 exp Case-Control Studies/ (764103)
158 exp Cohort Studies/ (1509575)
159 Cross-Sectional Studies/ (209746)
160 Controlled Before-After Studies/ (111)
161 Historically Controlled Study/ (45)
162 Interrupted Time Series Analysis/ (124)
163 Comparative Study.pt. (1729351)
164 case control$.tw. (83680)
165 case series.tw. (38633)
166 (cohort adj (study or studies)).tw. (97500)
167 cohort analy$.tw. (4089)
168 (follow up adj (study or studies)).tw. (38237)
169 (observational adj (study or studies)).tw. (49507)
170 longitudinal.tw. (145584)
171 prospective.tw. (369555)
172 retrospective.tw. (295058)
173 cross sectional.tw. (180405)
174 or/154-173 (3535459)
175 Meta-Analysis.pt. (62777)
176 Meta-Analysis as Topic/ (14637)
177 Review.pt. (2023681)
178 exp Review Literature as Topic/ (8461)
179 (metaanaly$ or metanaly$ or (meta adj3 analy$)).tw. (74269)
180 (review$ or overview$).ti. (298311)
181 (systematic$ adj5 (review$ or overview$)).tw. (69561)
182 ((quantitative$ or qualitative$) adj5 (review$ or overview$)).tw. (5049)
183 ((studies or trial$) adj2 (review$ or overview$)).tw. (28640)
184 (integrat$ adj3 (research or review$ or literature)).tw. (6241)
185 (pool$ adj2 (analy$ or data)).tw. (16315)
186 (handsearch$ or (hand adj3 search$)).tw. 95896)

Database: Ovid MEDLINE (R) <1996 to April Week 2 2016>
187 (manual$ adj3 search$).tw. (3527)
188 or/175-187 (2198774)
189 Qualitative Research/ (26004)
190 Nursing Methodology Research/ (15827)
191 Interview.pt. (25945)
192 exp Interviews as Topic/ (46155)
193 Questionnaires/ (337357)
194 Narration/ (5872)
195 Health Care Surveys/ (26736)
196 (qualitative$ or interview$ or focus group$ or questionnaire$ or narrative$ or 197 narration$ or survey$).tw. (941983)
197 (ethno$ or emic or etic or phenomenolog$ or grounded theory or constant compar$ or (thematic$ adj4 analys$) or theoretical sampl$ or purposive sampl$).tw. (45654)
198 (hermeneutic$ or heidegger$ or husser$ or colaizzi$ or van kaam$ or van manen$ or giorgi$ or glaser$ or strauss$ or ricoeur$ or spiegelberg$ or merleau$).tw. (7533)
199 (metasynthes$ or meta-synthes$ or metasummar$ or meta-summar$ or metastud$ or meta-stud$ or metathem$ or meta-them$).tw. (517)
200 or/189-199 (1098914)
201 or/139-200 (6824454)
202 and/14,106,136 (2929)
203 and/14,106,136,201 (2116)
204 and/14,109,136 (4474)
205 and/14,109,136,201 (3016)
206 and/14,112,136 (419)
207 and/14,112,136,201 (294)
208 animals/ not humans/ (4175932)
209 News/ (165247)
210 Editorial/ (373604)
211 or/208-210 (4693453)
212 202 not 211 (2819)
213 limit 212 to (english language and yr="1996 - 2016") (2316)
214 203 not 211 (2091)
215 limit 214 to (english language and yr="1996 - 2016") (1762)
216 204 not 211 (4346)
217 limit 216 to (english language and yr="1996 - 2016") (3477)
218 205 not 211 (2995)
219 limit 218 to (english language and yr="1996 - 2016") (2481)
220 206 not 211 (412)
221 limit 220 to (english language and yr="1996 - 2016") (369)
222 207 not 211 (294)
223 limit 222 to (english language and yr="1996 - 2016") (260)

1

Search Strategy 2 – Additional search strategy on behaviour change (carers, healthcare workers, children, clinical risk groups) – Psychinfo only

Database: Ovid PsycINFO <1996 to May Week 3 2016>
1 exp Immunization/ (3441)
2 (vaccin* or immuni*).tw. (9248)
3 1 or 2 (9301)
4 INFLUENZA/ (1089)
5 (influenza* or flu or grippe).tw. (2599)
6 4 or 5 (2602)
7 3 and 6 (1014)
8 exp Health Behavior/ or exp Health Attitudes/ or exp Behavior Change/ or exp Health Knowledge/ or exp Risk Management/ or exp At Risk Populations/ or exp Risk Perception/ or exp MOTIVATION/ or exp Planned Behavior/ or exp Behavioral Intention/ or exp Reasoned Action/ or exp Social Cognition/ or exp Behavior Modification/ (163753)
9 ((behavio?r* or cognitive or attitude* or knowledge* or lifestyle* or life-style*) adj3 (chang* or adapt* or alter* or intent* or influenc* or modification or modify or modifying or belie* or control* or adopt*)).tw. (140294)
10 ((increas* or improv* or rais* or high* or more or better or best or low* or less or worse or worst or fewer) adj3 (motivat* or confiden* or opportunit* or feasib* or plan*)).tw. (35163)
11 ((vaccin* or immuni*) adj3 (barrier* or facilitat* or hinder* or block* or obstacle* or restrict* or restrain* or obstruct* or inhibit* or impede* or delay* or constrain* or hindrance or uptake or take up or increas* or impact* or effect* or improve* or enhance* or encourag* or support* or promot* or optimiz* or optimis* or adher* or access* or motivat* or accept* or satisfaction or compliance or comply or complie* or refus* or availabl* or provision or provid* or offer or incentive* or start or attend* or adopt* or persuad* or persuation or attitude* or intend* or intention or counsel*)).tw. (2535)
12 or/8-11 (306151)
13 exp Psychological Theories/ or exp Motivational Interviewing/ (19480)
14 ("Trans?theoretical model*" or "stage* of change" or "theor* adj3 planned behavio?r" or "theor* adj3 reasoned action" or "health protection adj3 theor*" or "protection motivation adj3 theor*" or "social cogniti* adj3 theor*").tw. (3417)
15 ((theor* or trans?theor* or belie*) adj3 (framework* or model*)).tw. (52686)
16 (health belie* adj3 (model* or theor*)).tw. (1508)
17 ((theor* or model* or program* or therap* or treatment* or intervention*) adj3 (plan* or behavio?r or reason* or action* or protect* or motivat* or confiden* or opportunit* or feasib* or persua* or cognit*)).tw. (140448)
18 (motivation* adj3 (interview* or question* or model* or theor* or program*)).tw. (9878)
19 or/13-18 (202987)
20 12 or 19 (459291)
21 7 and 20 (600)
22 limit 21 to (english language and yr="1996 - 2016") (575)

Appendix G: Evidence tables

G.1 Effectiveness studies

G.1.1 Gargano 2011

Gargano 2011

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results
Full citation Gargano, L.M., Pazol, K., Sales, J.M., Painter, J.E., Morfaw, C., Jones, L.M., Weiss, P., Buehler, J.W., Murray, D.L., Wingood, G.M. and Orenstein, W.A., 2011. Multicomponent interventions to enhance influenza vaccine delivery to adolescents. Pediatrics, 128(5), pp.e1092-e1099. Quality score Study type Non-randomised control trial Aim of the study To compare school-versus provider based approaches to	Inclusion criteria Eligibility for the vaccine included: Adolescent being enrolled at a target school in a participating county Families resided in the target counties Parents provided written informed permission Parents completing a brief medical history for adolescent Exclusion criteria None reported Population characteristics and numbers Setting in rural area with 'substantial low income and black populations':	Intervention: 'A multi-component provider-based influenza vaccination condition' Included an educational intervention plus improved access (free vaccination) at the beginning of each intervention cycle. A brochure mailed home through the school, targeted	A list of eligible adolescents was provided to local healthcare providers, and a completed list of children vaccinated was returned. The effect of the intervention was assessed by comparing the percentage of vaccination coverage in each county's middle and high schools. Results: IC1 = intervention cycle 1, IC2 = intervention cycle 2 IC1: In provider based county (Education), 145/736 students returned consent forms; 110/145 were vaccinated.

	Baseline N total	Baseline N & (%) uptake	IC1 N	IC1 N & (%) uptake	IC2 N total	IC2 N & (%) uptake
Education (Intervention)	650	65 (10.0)	736	110 (14.9)	663	122 (18.4)
Usual care (Control)	853	56 (6.6)	889	71 (8.0)	861	131 (15.2)

Gargano 2011			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
improving influenza coverage among adolescents in rural Georgia. Location and setting Eastern Georgia, small (1 public middle and high school), rural Source of funding Centers for Disease Control and Prevention grant 5 R18 IP000116 and NIH grant 5T32AI074492-02 (to Dr Painter). LAIV used in this campaign was from an in-kind donation by MedImmune Inc.	% of black students: Provider based arm: 38% (Educational intervention) Standard-care arm: 53% (Usual care) % of students eligible for free or reduced lunch: Provider based arm: 65% (Educational intervention) Standard care arm: 69% (Usual care)	towards adolescents and their parents A school presentation targeted towards adolescents The educational intervention was based on the health belief model and the theory of reasoned action. The school presentation included a skit presented by a volunteer group of students, addressing health belief model and theory of	The 110 vaccinated, represents 15% of the student population and reflects a 33% increase from baseline. Students in the provider based county were 1.9 times more likely to be vaccinated compared with the students in the standard of care county. IC2: 183/663 students in the provider based county returned consent forms; 122/183 were vaccinated. The 127 vaccinated represents 18% of the student population and reflects 19% increase in coverage compared to IC1. There was no significant increase in vaccination rate between the provider based county and the standard of care county during IC2.

Gargano 2011			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
		reasoned action constructs, including self-efficacy, social norms, perceived barriers, perceived benefits, perceived susceptibility, perceived severity and students sense of invincibility. A question and answer session was also held. Comparator: Standard of care (Usual Care) in a county within the same public health district, which is also small with 1middle and 1 high	

Gargano 2011			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
		school, rural and with a substantial low income and black population. Usual care is not described. Also compared to baseline vaccination coverage rate in the same county.	
Limitations identified by authors One of the intervention cycles (IC2) coincided with the H1N1 pandemic (2009-2010) Number of adolescents and number of schools limited, therefore may not be generalizable to other rural locations. Not generalizable to urban populations. Influenza vaccination for the standard of care county only available on a county-wide level, whereas intervention counties had vaccination data specifically from the schools studied. The GRITS data used (Georgia's immunisation information system) may have been incomplete. Limitations identified by review team			

Gargano 2011			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
At baseline, adolescents in the provider-based county were ~50% more likely to receive influenza vaccine than were adolescents in the standard of care county. Therefore, baseline characteristics not wholly comparable.			

1

2 ## G.1.2 Hofstetter 2015

<table>
<tr><th colspan="4">Hofstetter 2015</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr>
<td>Full citation
Hofstetter, Annika M., Vargas, Celibell Y., Camargo, Stewin, Holleran, Stephen, Vawdrey, David K., Kharbanda, Elyse Olshen, Stockwell, Melissa S., Impacting delayed paediatric influenza vaccination: a randomized controlled trial of text message reminders, American journal of preventive medicine, 48, 392-401, 2015

Study type
RCT</td>
<td>Number of participants
Total = 5462.
Educational plus interactive text message [E+i SMS] n= 1,821
Text message arm [E only SMS] n=1,821
Usual care [UC] n = 1,820

The primary analytic sample (n=5,304) excludes the 158 children who were randomized, but received influenza vaccine prior to the intervention start.

Participant characteristics
Parents of 5,462 children aged 6 months–17 years from four academically affiliated paediatric clinics who were unvaccinated by mid-November 2011.
Children: Mostly publicly insured and Spanish speaking, urban, low-income, minority children who remained unvaccinated in the late fall.</td>
<td>Up to seven weekly educational plus interactive text message reminders sent to parents. One of the messages sent allowed selection of more information about influenza and influenza vaccination.

Educational-only text message reminders

Usual care: telephone appointment reminders</td>
<td>Primary outcomes
Influenza vaccination by March 31, 2012.

Influenza Vaccination Coverage by March 31, 2012 (primary analytic sample)
<table><tr><td></td><td>E+i SMS (n=1,780)</td><td>E only SMS (n=1,760)</td><td>UC (n=1,764)</td></tr><tr><td></td><td>% (n)</td><td>% (n)</td><td>% (n)</td></tr><tr><td>All ages</td><td>38.5 (686)</td><td>35.3 (621)</td><td>34.8 (613)</td></tr><tr><td>6-23 months</td><td>49.6 (121)</td><td>39.7 (92)</td><td>47.5 (115)</td></tr><tr><td>24 to 59 months</td><td>44.0 (272)</td><td>38.8 (240)</td><td>38.7 (237)</td></tr><tr><td>5 to 17 years.</td><td>31.9 (293)</td><td>31.8 (289)</td><td>28.7 (261)</td></tr></table></td>
</tr>
</table>

Hofstetter 2015

Aim of study
To examine the impact of educational plus interactive text message reminders versus educational-only text message reminders versus usual care on influenza vaccination during the 2011–2012 season among urban, low-income, minority children who remained unvaccinated in the late fall.

Location and setting
4 community-based paediatric practices (part of an ambulatory care network affiliated with a large academic medical centre in New York).

Length of study
November 14, 2011 to 31st March 2012.

Source of funding
Supported by Grant No. R40MC17169 from the

The study was powered to detect a 7% difference with 85% power in family medicine practices and a 2% difference with 97% power in paediatric practices.

Study Population characteristics, % (n)

	Primary analytic sample			
	E+i SMS % (n)	E only SMS % (n)	UC % (n)	p
	1,780	1,760	1,764	
Gender				.04
Female	47.5 (845)	51.0 (897)	47.0 (829)	
Male	52.5 (935)	49.0 (863)	53.0 (935)	
Age				.99
6–23 mths	13.7 (244)	13.2 (232)	13.7 (242)	
24–59 mths	34.7 (618)	35.2 (619)	34.7 (612)	
5–17 yrs	51.6 (918)	51.6 (909)	51.6 (910)	
Lang				.69
Span	57.2 (1,018)	57.1 (1,005)	58.7 (1,035)	
Eng	40.0 (712)	40.1 (706)	37.9 (668)	
Other	0.8 (15)	0.8 (14)	1.1 (20)	
Unknown	2.0 (35)	2.0 (35)	2.3 (41)	

general information about influenza vaccination procedures provided in the clinic.

Text messages were the same for both text messaging arms.

Text messages were generated by a customized text messaging platform integrated with the hospital immunization registry, EzVac.

	E+i SMS* vs. E only SMS		E+i SMS vs. UC	
	% diff	RR* (95% CI)	% diff	RR* (95% CI)
All ages	3.3%	1.09 (1.00, 1.19)	3.8%	1.11 (1.02, 1.21)
6-23 months	9.9%	1.25 (1.02, 1.53)	2.1%	1.04 (0.87, 1.25)
24 to 59 months	5.2%	1.14 (0.99, 1.30)	5.3%	1.14 (0.99, 1.30)
5 to 17 years.	0.1%	1.00 (0.88, 1.15)	3.2%	1.11 (0.97, 1.28)

*RR: relative risk ratio; SMS: text messages

Secondary outcomes
Timeliness of influenza vaccination, missed opportunities for influenza vaccination, and influenza vaccination of other household children by March 31, 2012."

There were 1,193 other children in the study households who were unvaccinated at the start of the intervention (404 household children of parents in the educational plus interactive text message arm, 414 in educational-only text message arm, and 375 in usual care arm).

As of March 31, 2012, influenza vaccination coverage of these household children did not differ significantly based upon the intervention arm of the parent (educational plus interactive text message arm, 36.1%; educational-only text message arm, 35.3%; usual care arm, 30.4%; p¼0.19), although it

Hofstetter 2015

Maternal and Child Health Bureau (Title V, Social Security Act), Health Resources and Services Administration, USDHHS.

Insure				.15
Public	89.6 (1,595)	88.1 (1551)	87.4 (1,542)	
Private	5.5 (98)	6.4 (113)	6.0 (105)	
Uninsured	4.9 (87)	5.5 (96)	6.6 (117)	

Inclusion criteria

Parents were eligible for participation if they had:
a child aged 6 months–17 years with a visit to one of the study sites in the 12 months prior to September 1, 2011, and a cell phone number listed in the child's record in the hospital registration system. This system includes all patients who have visited the hospital or an affiliated clinic, including the four study sites, in their lifetime.

In cases where there was more than one child in the household fulfilling the age and visit criteria, one was selected as outlined previously, but messages also encouraged parents to bring "other children" in for influenza vaccination.

Exclusion criteria

"When more than one child in the household (as determined by a matching telephone number in the registration system) fulfilled the age and visit criteria, only the youngest child was selected."

"The remaining children were included in the analytic sample used to examine the intervention effect on other children in the household."

tended to be higher if the parent was in either text messaging arm versus usual care arm (35.7% vs 30.4%, p¼0.07).

Concordance in influenza vaccination status by March 31, 2012, between the target child and other household children was high (80.0%), especially among household children with the parent in either text messaging arm compared to usual care arm (82.5% vs 74.4%, p<0.01).

Limitations identified by author

Hofstetter 2015
1. Only those with a cell phone number in the system were included. They may differ from those without a cell phone number, although majority of Americans have cell phones and 89% of parents in these practices have text message enabled phones. 2. Some parents who received the messages may have been unable to read them owing to low literacy levels, although all messages were no more than a fourth-grade reading level 3. The use of phone numbers to identify other household children could have resulted in misclassification of some subjects. 4. Under-reporting of influenza vaccination may have occurred, although is unlikely given the automated data extractions from the EHR and mandated reporting for those aged r18 years to the city immunization registry. <u>Limitations identified by review team</u> That a study is powered to detect a 7% difference with 85% power in family medicine practices, and a 2% difference with 97% power in paediatric practices are unusual power calculations and thresholds.

1

2

3 ### G.1.3 Joshi 2009

Joshi 2009			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Full citation Joshi, A., Lichenstein, R., King, J., Arora, M. and Khan, S., 2009. Evaluation of a Computer-Based Patient Education and Motivation Tool on Knowledge, Attitudes and Practice towards Influenza Vaccination.International Electronic Journal of	Inclusion criteria All guardians of children aged 6 months-59 months of age presenting to the ED or PC for any medical complaint or in the case of the PC, routine well child care Exclusion criteria Guardians of children less than 6 months or more than 59 months or children with presenting medical condition in the ED precluding computer education. Patients with existing prior contraindication to influenza vaccination such as	Intervention: Delivery of computer based educational material related to basic facts, mode of spread and methods of prevention of the flu in a	Results: Knowledge: Overall improvement in knowledge was 18% : (p<0.0001) Improvement in knowledge was also seen both in parents who had not vaccinated their child in the past and those who had vaccinated their child in the past (p<0.0001). | | Score mean | SD | | Overall | | |

<table>
<tr><th colspan="4">Joshi 2009</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr>
<td>Health Education, 12, pp.1-15.

Quality score

Study type
Uncontrolled before and after study

Aim of the study
To assess and describe changes in knowledge, attitudes and practice regarding influenza vaccination among parents, of 6month-5year olds using a self-guided, interactive computer-based influenza vaccine educational program.

Location and setting
Baltimore paediatric emergency department and the University of Maryland inner city clinical practice</td>
<td>severe egg allergy, aspirin therapy, previous severe reaction to influenza vaccination, history of Guillian Barre syndrome were also excluded from the study.

Number of participants

90 (58 in paediatric emergency department; 32 in paediatric clinic)

Population characteristics
Parents of 6month-5year olds

55% (n=50) – male
85% (n=77) – African American
94% (n=85) – had a primary care provider
87% (n=79) – on medical assistance or government insurance
51% (n=46) – had received some form of influenza vaccination the prior season

5 participants were unable to complete the program and were excluded from analysis</td>
<td>more structured, organised, interactive manner enhanced using multimedia in the form of animations, audio, text and images. 2 touch screen computer-based kiosks were provided for delivery and a quiet space provided.

The complete program lasted ~20 minutes and was embedded within the regular clinic visit.</td>
<td>
<table>
<tr><td>Pre-learning</td><td>3.9</td><td>1.19</td></tr>
<tr><td>Post-learning</td><td>4.9</td><td>1.29</td></tr>
<tr><td>Previous vaccination</td><td></td><td></td></tr>
<tr><td>Pre-learning</td><td>4.13</td><td>1.02</td></tr>
<tr><td>Post-learning</td><td>4.91</td><td>1.26</td></tr>
<tr><td>No previous vaccination</td><td></td><td></td></tr>
<tr><td>Pre-learning</td><td>3.65</td><td>1.31</td></tr>
<tr><td>Post-learning</td><td>4.89</td><td>1.33</td></tr>
</table>

Attitudes:

<table>
<tr><th>Attitude</th><th>% who believed pre-learning</th><th>% who believed post-learning</th><th>% change</th></tr>
<tr><td>Flu shot is painful</td><td>32</td><td>21</td><td>-11</td></tr>
<tr><td>Child can get flu from shot</td><td>42</td><td>30</td><td>-12</td></tr>
<tr><td>Child needs flu vaccination</td><td>9</td><td>67</td><td>+58</td></tr>
<tr><td>Child can get a bad reaction after shot</td><td>63</td><td>14</td><td>-49</td></tr>
</table>
</td>
</tr>
</table>

Joshi 2009			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Source of funding Unknown		This computer based educational program is comprised of a touch screen computer based on three learning theories: behavioural: technology based instructional applications should be divided into small portions of the material; cognitive: structured education to individuals along with positive reinforcement and	<table><tr><td>It's possible for child to get flu this year</td><td>84</td><td>92</td><td>+8</td></tr></table> Intention: Pre-learning, 89% (n=80) planned to get their child vaccinated Post-learning, 91% (n=82) planned to get their child vaccinated = 2% increase in intention to vaccinate following intervention Data collection: Questions were asked using the interactive computer based system, followed by the educational intervention, and follow up questions were also asked using the computer based system. Questions on knowledge, attitudes and practice (KAP) were based on the framework of the health belief model which suggests that an individual's intention to undertake any given health action is influenced by three main factors which include a set of beliefs, a cluster of motivational factors and various normative pressures. The knowledge questionnaire comprised of 6 questions, with a total available score of 0-6 depending on the number of correct answers.

Joshi 2009			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
		humanistic: individual willingness to learn and their ability to get evaluated.	The attitudes questionnaire comprised of 9 questions, primed to gain parents attitudes in relation to usefulness, benefits, safety, associated pain and side effects. Intention to treat was assessed by asking 1 question: "if they were planning to get the vaccine for their child this year"
Limitations identified by author Sample size small Multivariate regression analysis not performed Limited to 1 geographic area, so cannot be generalised No assessment of vaccination rates, and no knowledge of whether the improvement maintained over time Limitations identified by review team No others			

1
2

3 G.1.4 Kempe 2014

Kempe 2014			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Full citation Kempe A, Albright K, O'Leary S,	Number of participants Total = 41,500 Clinic with public health nurses in attendance (Intervention) = 26,123	1. Community clinics or practice sites involving	**Primary outcomes** Receipt of ≥ 1 seasonal influenza vaccine in intervention vs. control practices

Kempe 2014

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results

Kolasa M, Barnard J, Kile D, Lockhart S, Dickinson LM, Shmueli D, Babbel C, Barrow J. Effectiveness of primary care-public health collaborations in the delivery of influenza vaccine: a cluster-randomized pragmatic trial, Preventive medicine, 69, 110-6, 2014

Study type
Cluster-randomized

Usual care (Control) = 15,377

Participant characteristics (Population at baseline (Oct 2009))

	Overall	Usual care* (2 PP, 2FM) n = 15,377	Intervn* (2 PP, 2FM) n =26,123
Total no. of providers per practice	45	8 FM 9.5 PP	6.5 FM 21 PP
Total no. of patients 0–18 years per practice	45,500	861 FM 14,516 PP	1,015 FM 25,108 PP
Mean (sd) no. of providers per practice site	4.5 (1.410)	4.37 (1.38)	4.58 (1.56)
Mean (sd) patient population+ per practice site	4150 (3622)	3844 (4392)	4354 (3451)
Mean (sd)% high risk per practice site	10.24 (3.2)	9.7 (1.9)	10.6 (3.9)
Mean (sd) % VFC per practice site	19.4 (14.0)	15.8 (14.1)	21.8 (14.7)
Mean (sd) age in years per practice site	8.5 (1.9)	9.1 (1.5)	8.1 (2.2)

* no significant differences between control and intervention groups on any characteristic

practice staff and public health department nurses

2. Usual practice without public health department involvement.

Autodialer and mailed postcards were used to inform families about the collaborative efforts.

To note:
In intervention year 1, the earliest and latest dates of immunization were 8/31/2010 and 4/12/2011 in intervention

			%Vaccinated / % Change from baseline (C=Control; I=Intervention)						
	Age (yrs)	Baseline (2009)	Baseline (2009)		Year 1 (2010)		Year 2 (2011)		Diff chg Chi-sq (1df)*
			C	I	C	I	C	I	
Total	All	41,495	43.4	37.7	47.8 (+4.4)	45.6 (+7.9)	46.6 (+3.2)	46.9 (9.2)	58.17 p<.0001
	6mo-5	16,438	52.9	50	57.4 (+4.5)	57.2 (+7.2)	57.0 (+4.10	57.3 (+7.3)	.01 P=.9313
	6-12	16,301	43.7	32.1	47.5 (+3.8)	41.4 (+9.3)	46.5 (+2.8)	44.0 (+11.9)	80.92 P=<.0001
	13-18	8,756	27.5	23.1	34.3 (+6.8)	31.2 (+8.1)	32.9 (+5.4)	32.9 (+9.8)	21.29 P<.0001
	High risk	4,813	50.3	49.1	56.3 (+6.0)	54.2 (+5.1)	55.5 (+5.2)	56.7 (+7.6)	0.21 p=.6476
PP n=4	All	39,619	44.6	38.5	49.5 (+4.9)	46.8 (+8.3)	48.1 (+3.5)	48.0 (+9.5)	51.01 p<.0001
	6 mo-5	15,923	53.3	50.7	58.4 (+5.1)	58.1 (+7.4)	57.7 (+4.4)	58.0 (+7.3)	0.14 p=.7077
	6-12	15,753	44.6	32.6	48.9 (+4.3)	42.3 (+9.7)	47.6 (+3)	45.1 (+12.5)	77.90 p<.0001

Kempe 2014			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
pragmatic trial. Aim of the study "To assess effectiveness and feasibility of public-private collaboration in delivering influenza immunization to children." Location and setting Four paediatric and four family medicine (FM) practices in three urban counties in the Denver Metropolita	Inclusion criteria Total population of 6 months to 18 years: Three cross-sectional cohorts of eligible patients were defined each August (pre-season) during 2009–2011 at each intervention and control practice. Eligible patients included children seen at least once during the past two years and who were ≥6 months of age on August 1 of each study year. Influenza immunization rates were assessed for these cohorts at the end of each study year (July 2010–2012) using a combination of practice administrative data and data from the Colorado Immunization Information System (CIIS) in both the intervention and control arms. Individual practice sites were similar with respect to mean number of providers per practice site, mean patient populations and the percentage of patients with high risk conditions and qualifying for the Vaccines for Children (VFC) program. Exclusion criteria None mentioned.	practices and 8/2/2010 and 5/24/2001 in control practices; In intervention year 2, comparable dates were 8/1/2011 and 4/3/2012 in intervention and 8/4/2011 and 5/19/2012 in control practices.	<table><tr><td></td><td>13-18</td><td>7,943</td><td>29.2</td><td>21.2</td><td>36.3 (+7.1)</td><td>32.4 (+11.2)</td><td>35.2 (+6.0)</td><td>34.5 (+13.3)</td><td>18.07 p<.0001</td></tr><tr><td></td><td>High risk</td><td>4,678</td><td>515.5</td><td>497</td><td>57.5 (+6)</td><td>55.4 (+5.7)</td><td>56.9 (+5.4)</td><td>57.6 (+7.9)</td><td>0.45 p=.5002</td></tr><tr><td>FM n=4</td><td>All</td><td>1,876</td><td>23.3</td><td>17.7</td><td>24.7 (+1.4)</td><td>2.2 (+6.5)</td><td>23.4 (+0.1)</td><td>26.2 (+8.5)</td><td>10.60 p=.0011</td></tr><tr><td></td><td>6 mo-5</td><td>515</td><td>43.6</td><td>29.1</td><td>34.5 (-9.1)</td><td>32.3 (+3.2)</td><td>38.5 (-5.1)</td><td>40.1 (+11.0)</td><td>6.53 p=.0106</td></tr><tr><td></td><td>6-12</td><td>548</td><td>22.3</td><td>16.3</td><td>24.3 (+2.0)</td><td>22.5 (+6.2)</td><td>25.2 (+2.9)</td><td>23.0 (+6.7)</td><td>29.93 p<.0001</td></tr><tr><td></td><td>13-18</td><td>813</td><td>13.8</td><td>10.1</td><td>20.2 (+6.4)</td><td>19.3 (+9.2)</td><td>15.5 (+1.7)</td><td>18.0 (+7.9)</td><td>3.85 p=.0497</td></tr><tr><td></td><td>High risk</td><td>135</td><td>27.4</td><td>17.7</td><td>43.5 (+16.1)</td><td>22.0 (+4.3)</td><td>39.1 (+11.7)</td><td>31.0 (+13.3)</td><td>.05 p=.8176</td></tr></table> **Secondary outcomes** Missed opportunities: "In intervention year 2, 51.3% (n= 5490) of children in the control practices compared to 40.8% (n= 7078) had a missed opportunity for influenza vaccination (p <.0001)." The four intervention practices (including all sites at each practice) participated in 3–5 collaborations during intervention year 1 (2010;mean=4) and 2–4 during year 2 (2011; mean=3.25).

Kempe 2014			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
n area, Colorado, USA, with a common public healt h department (PHD). Length of study Study was in three phases, baseline year beginning Autumn 2009, Year 1, 2010 and Year 2, 2011. End point was May 2011. Source of funding Funded by a grant from the Centers for Disease			Sixty-three per cent of collaborations in year 1 and 62% in year 2 consisted of community vaccination clinics either at fire stations or community recreational centres, with the remainder of the collaborations involving public health nurses helping with vaccination at the practices.

Kempe 2014			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Control and Prevention, USA. Grant number #U01IP000320.			

Limitations identified by author:

The total number of providers and patients differed between control and intervention practices due to the multiple sites at one of the intervention practices.

The number of practices included in the study was small, limiting our ability to account for clustering and to balance study arms, especially with respect to unmeasured potential confounders. Although the practice sites were roughly balanced with respect to important characteristics, the practice sizes differed.

Vaccination rates were somewhat higher in the control than the intervention practices at baseline; however, all practices were below state-wide vaccination rates, approximately 58% in 2010, suggesting that a ceiling effect was not likely to be an issue confounding the comparison. The fact that participating practices had lower than average rates for the state may indicate that they were focusing less on influenza delivery than average practices.

Limitations identified by review team:

As the authors note, the low vaccination rate at baseline in the intervention group skews the results, giving an optimistic result.

That the vaccination rate was lower than the state rate may again give an over optimistic effect size.

All four control practices and only three out of four of the intervention practices reported conducting reminder/recalls for influenza vaccination during the baseline season (2009–2010) indicating potential differences between intervention and control practices at baseline.

1

2 ### G.1.5 Ly 2015

Ly 2015								
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**					
				Coverage rate		% change	OR (95% CI)	P-value
				%	N			
Full citation Ly, E., Peddecord,	Inclusion criteria	Academic detailing interventions						

<table>
<tr><th colspan="4">Ly 2015</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr>
<td>K.M., Wang, W., Ralston, K. and Sawyer, M.H., 2015. Student Column: Using Academic Detailing to Improve Childhood Influenza Vaccination Rates in San Diego. Public Health Reports, 130(2), p.179.

Quality score
+

Study type
Before and after study

Aim of the study</td>
<td>Parent of a child 6-64 months old attending appointments at participating medical clinics which included being seen by a physician.

Exclusion criteria
None mentioned

Population

Intervention group –
Key informant reviews (practice staff)= 9
Parents = 399

Control group-
Key informant reviews=9
Parents=389

Follow up:

Intervention group –
Key informant reviews = 9
Parents = 350

Control group-
Key informant reviews=9
Parents=367</td>
<td>consisted of practice staff (key informants) being provided with materials to implement evidence based practices, such as chart reminders, call and recalls, immunisation registry or electronic medical record reminders, special vaccination clinics and standing orders.

Project staff also discussed the benefits of implementing evidence based practices and provided baseline immunisation rates to practice staff.</td>
<td>
<table>
<tr><td>Intervention</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Baseline</td><td>55.4</td><td>194</td><td></td><td>1.00</td><td></td></tr>
<tr><td>Follow-up</td><td>63.1</td><td>221</td><td>+7.7</td><td>1.40 (1.04, 1.89)</td><td>0.03</td></tr>
<tr><td>Control</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Baseline</td><td>73.0</td><td>268</td><td></td><td>1.00</td><td></td></tr>
<tr><td>Follow-up</td><td>77.4</td><td>284</td><td>+4.3</td><td>1.30 (0.93, 1.82)</td><td>0.13</td></tr>
</table>

Improvement in influenza vaccination coverage rates in intervention group and in control group, but only statistically significant in intervention group

<table>
<tr><th>Site #</th><th>Interventions/changes related to influenza vaccination</th><th>Change in vaccination rate (%)</th></tr>
<tr><td>1</td><td>Introduced standing orders; introduced recall service</td><td>+16.1</td></tr>
<tr><td>2</td><td>Introduced standing orders; discontinued use of provider reminders</td><td>-2.9</td></tr>
<tr><td>3</td><td>Introduced standing orders; introduced provider reminders; introduced patient reminders</td><td>+0.7</td></tr>
<tr><td>4</td><td>Introduced standing orders; introduced recall service</td><td>+7.9</td></tr>
<tr><td>5</td><td>Discontinued provider reminders; discontinued recall services</td><td>+4.2</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><th colspan="4">Ly 2015</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr><td>To assess the effectiveness of an academic detailing intervention on immunisation rates in children.

Location and setting
San Diego County, primary care clinics

Source of funding
Unknown</td><td>Participant characteristics

Parents with children aged 6-64 months attending 6 paediatric clinics (2x community health centres, 2xgroup practice clinics, 2x private practice clinics)

No additional details provided such as age, sex, ethnicity.</td><td></td><td>
<table>
<tr><td>6</td><td>Introduced provider reminders; introduced patient reminders</td><td>+13.2</td></tr>
</table>

A variety of interventions were performed both as a consequence of the over-arching intervention (academic detailing) (sites 4-6) and at ‘control’ practices (sites 1-3), from no project intervention.

In intervention group, late season vaccination increased from 20.5% to 28.5% from baseline to follow-up, which was significant ($p<0.05$)
The control group also experienced an increase in late-season vaccination from 23.4% to 27.8% (increase not significant; $p=0.72$)

“Analysis revealed that the baseline-to-follow-up increase in vaccination rates experienced by the intervention group did not differ significantly from those experienced by the control group.”</td></tr>
<tr><td colspan="4">Limitations identified by author
Intervention implemented after baseline year (2008-2009), with expectation that follow-up would be 2009-2010. However, due to H1N1 pandemic, follow-up was postponed for 1 year. Therefore, cannot conclude that changes in vaccination rates weren’t due to extensive H1N1 media coverage.

Clinics in control group had higher baseline vaccination rates and therefore less potential for improvement; difference in baseline rates also makes it difficult to compare control and intervention groups.

Some clinics experienced changes in important vaccination management staff over 2 year trial period, meaning those familiar with the intervention and present at academic detailing were no longer at the clinic. This meant some key informant interviews were performed by staff who were not involved in the baseline year project.</td></tr>
</table>

Ly 2015			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Limitations identified by review team The demographic of the participants varied from control to intervention groups and from baseline to follow-up, with respect to gender, ethnicity and mother's highest education level. Not clear how the intervention and control, sites differ in term of the intervention based on the descriptions published. Other comments In part this is a randomised control before and after survey, in part a retrospective before and after survey, as all control practices performed interventions independently of this research, and their interventions and vaccination data were still captured and reported, alongside the interventions used by intervention group practices.			

1

2 ### G.1.6 Meredith 2016

Meredith 2016			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Full citation Meredith N., Lewis R., Dyson J. and Roberts R. Vaccination in Practice (VIP) Scheme – Innovative practice in the annual flu	Data collection Surveys to summarise the intervention used for each practice and the groups targeted were collected, including sections for general information and opinions on the intervention. Vaccination data (number of patients in group targeted and uptake in this group) was collected by practice report also. Method of analysis Each practice was given a GP practice ID number, with the change in vaccination uptake from the previous	Intervention: During the 2014/2015 influenza season, practices were offered £250 grants to deliver innovative interventions to improve	During the 2014/2015 season: 38% of practices demonstrated an increased uptake in children, accounting for any intervention theme. Using awareness raising intervention only, was implemented in 32 practices – vaccine uptake increased in children in 18 practices and decreased in 14. Change in % uptake ranged from -27.2% to 30.7%

Meredith 2016			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
campaign; Public Health Wales; May 2016 Quality score - Study type Before and after survey Aim of study Vaccination in Practice scheme aims to encourage and support primary care to identify and utilise new ideas for interventions for improving flu vaccination uptake and help practices to invigorate their annual flu campaign. A £250 grant	season presented for each practice, also showing the theme of the intervention that practice adopted: awareness raising, accessibility or both. The analysis was divided according to which groups were targeted (ie. Children or over 65's) Exclusion criteria None. Inclusion criteria NHS general practice Based in Wales Have a named lead for the intervention within the practice Practice able to identify and be willing to try new ways of improving flu vaccine uptake in their eligible patients. Participant numbers 71 practices agreed to utilise interventions aimed to increase uptake of flu vaccination in children during the 2014/15 influenza seasons Population characteristics Practices across 20 local authority areas throughout Wales participated.	influenza uptake in key target groups, including children aged 2-4. Some practices focused on one specific intervention such as awareness raising, whereas others were broad and multifaceted. Some practices addressed accessibility, some addressed communication and some awareness raising generally, or concentrating of targeted messaging. During the 2013/2014 influenza	35 practices used an intervention of both awareness raising and accessibility – 12 practices showed increase in % uptake, 2 were unchanged and 21 decreased. Change in % uptake ranged from -35.3% to 48.5%. 1 practice worked collaboratively to deliver flu immunisations in a local playgroup and rewarded children with bubbles, biscuits and stickers. This practice saw a decrease in uptake. 7 out of 8 practices which utilised text messaging interventions saw a decrease in percentage uptake and one increase (ranging from -22% to 19.7%). Similar initiatives do not appear to have similar impact between practices. During the 2013/2014 season: Sending invitations – 54% uptake: higher than mean average in their health board area that season (46.4%) and considerably higher than 2013/14 Welsh national average (37.8%) Saturday clinics – 42.2% uptake (higher than Welsh national average, but no report on other clinics in the area)

Meredith 2016			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
was provided to each participating practice, in order to target the increased uptake of flu vaccinations in particular groups. Location and setting All general practices throughout Wales; representation from all health body areas in Wales, covering 20/22 local authority areas Source of funding Not stated	Targeting children aged 2,3 and 4 in general practice	season, practices were also offered £250 to deliver interventions, but these were not necessarily to be delivered to key target groups such as children. However, 2 practices did target all 2 and 3 year olds in this season. 1 practice sent invitations including information leaflets and followed up with a second and third reminder if these children did not attend. The second practice improved accessibility by running a	

Meredith 2016			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
		Saturday clinic for children	

Limitations identified by author

May not be a representative sample of practices in Wales. As practices had to apply for the scheme, they may already have increased awareness, engagement or innovation and may be those who are more likely to have already been committed to a planned, engaging and innovative flu campaign.

Some practices may have been excluded due to a relatively short application time.

Direct comparisons were difficult because the interventions described by each practice, varied by theme and detail, with some practices describing several interventions, and some a discreet individual intervention.

Some practices struggled to report uptake data. Some practices may use clinical software system to measure uptake internally within the practice with a smaller denominator than the whole population denominator used for national surveillance.

Uptake in eligible children is not directly comparable between 2013/14 to 2014/15 due to changing cohort as part of the phased roll out of the routine childhood influenza campaign.

The range of individuals and organisations involved in planning and delivering the general practice flu vaccination programme varied between practices.

Limitations identified by review team

No others

Other comments

1

G.1.7 Pollack 2014

Pollack 2014				
Study details	**Research parameters**	**Inclusion / Exclusion criteria**	**Population**	**Results**
Full citation Pollack, A.H., Kronman, M.P., Zhou, C. and Zerr, D.M., 2014. Automated screening of hospitalized children for influenza vaccination. Journal of the Pediatric Infectious Diseases Society, 3(1), pp.7-14. Quality score + Study type Retrospective cohort study Aim of the study	Data collection Retrospective analysis of all admissions within the typical vaccination and illness season (Oct 1-Apr 30) during the 2003-2004 season to 2011-2012 season All elements of the electronic screening form were captured, including reasons for vaccine ineligibility and parental or guardian declination. All vaccine orders and administration records were captured within the electronic medical record. Screening status and vaccination status were collected. Method of analysis Chi-squared used to compare rates of vaccination between pre-intervention and post-	Inclusion criteria Children >6 months of age, hospitalised on medical, surgical, psychiatric or rehabilitation units. Children >6 months of age transferred from intensive care unit to one of the targeted units. Exclusion criteria Children <6 months of age Children admitted to either intensive care or oncology services, as were those vaccinated at Seattle Children's Hospital in the past 30 days.	Number of participants 42,716 patients meeting inclusion criteria during whole study 20,651 patients meeting inclusion criteria during intervention years (74.3% of admissions). Participant characteristics During intervention stage, of the total 20,651 subjects: Children aged 2-17 n= 16,457 (79.7%) Male n= 10,950 (53%) American Indian n=321 (1.6%) Asian n=1163 (5.6%) Black n=1286 (6.2%) White n=12,052 (58.36%) Native Hawaiian or other Pacific Islander n=212 (1.03%) Other/missing n= 5829 (28.2) Hispanic/Latino n=3196 (15.5%) Non Hispanic/Latino n=15,807 (76.5%) Other/missing n=1648 (8.0%) Medical admission n=11669 (56.5%)	Results Primary outcomes (uptake/vaccination rate): In a fully adjusted model, screening was associated with a 6-fold increase in odds of vaccination during hospitalisation (OR =6.8; 95% CI, 6.1-7.5) In-hospital vaccination rate increased from mean 2.1% (n=472) (pre-intervention) to 8.0% (n=1645) post-intervention (% of all subjects, irrespective of if screening was performed, parental consent or other contraindications) Secondary Outcomes: 11,194 (54.2%) of eligible patients were screened; over 4 years the screening rate varied from 19.8% to 81.1%

Pollack 2014				
Study details	**Research parameters**	**Inclusion / Exclusion criteria**	**Population**	**Results**
To examine whether an automated hospital-based influenza vaccination programme using the electronic medical record directed towards nursing increased influenza vaccination rates in children. The intervention flagged children when admitted or transferred on the electronic medical record and nurses performed a	intervention periods and across groups. Multivariate logistic regression was used to assess the associations between screening and vaccinations, adjusting for covariates		Surgical admission n=7472 (36.2%) Rehabilitation n=224 (1.1%) Psychiatry n=1286 (16.2%) High risk status (clinical risk group) n= 3341 (16.2%)	Subjects admitted into medical, rehabilitation and psychiatric teams had increased chance of being screened compared with those on surgical teams (54.6%, 65.6%, 72.2%, and 50.1%, respectively). Age, sex and race were not associated with the likelihood of being screened Patients at high risk of influenza complications were less likely to be screened (53.2%) than those classified low risk (54.4%) (OR = 0.91; 95% CI, .83-.99) 2396 subjects were screened and had no contraindications. Of these, 2153 (90%) had vaccine ordered and 1461 (67.9%) had vaccine ordered and administered. High-risk subjects were less likely to be vaccinated within the hospital compared to low-

Pollack 2014				
Study details	**Research parameters**	**Inclusion / Exclusion criteria**	**Population**	**Results**
screening check which could also be used to directly order the vaccine. Location and setting Seattle Children's Hospital Source of funding National Institute of Health (Grant T32 DK007662; to A.H.P)				risk subjects (6.6% vs. 8.2% respectively p=.01). However, high-risk were more likely to be vaccinated prior to hospitalisation. 59.8% vs. 47.2% respectively (p<.001). When combined high risk patients were more likely than low-risk to be vaccinated by discharge (p<.001)
Notes: Limitations identified by author Possible that clinical screening happened in some subjects without the use of the automated screening tool. The screening tool was not integrated with the state vaccination profile, so vaccination history relied on care-giver report. Secular trends such as public fear of H1N1 may have contributed to increase in vaccinations (but unscreened subjects in intervention period had a lower rate of vaccination than subjects prior to the intervention period, suggesting increase due to intervention) Limitations identified by review team				

Pollack 2014				
Study details	**Research parameters**	**Inclusion / Exclusion criteria**	**Population**	**Results**
No others Other comments None				

1

2 ## G.1.8 Stockwell 2012

Stockwell 2012			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Full citation Stockwell MS, Kharbanda EO, Martinez RA, Vargas CY, Vawdrey DK, Camargo S. Effect of a text messaging intervention on influenza vaccination in an urban, low-income paediatric and	Number of participants N=9213 children and adolescents aged 6 months to 18 years receiving care at 4 community-based clinics in the United States during the 2010-2011 influenza season. Participant characteristics Four community-based paediatric clinics affiliated with New York-Presbyterian Hospital/Columbia University Medical Centre in New York. The clinics serve a primarily Latino and publicly insured population. Of those who visit the clinics, approximately 95% are eligible for free vaccines through the Vaccines for Children Program. Study children and adolescents were primarily minority, 88% were publicly insured, and 58% were from Spanish-speaking families Baseline Characteristics by Randomization Group No. (%) of Children and Adolescents[a]	Parents of children assigned to the intervention received up to 5 weekly immunization registry–linked text messages providing educational information and instructions regarding Saturday clinics. Two follow up texts (one indicating recommendation of vaccination from physicians and the other providing remaining Saturday clinic dates) were sent to families of still	Primary outcomes Receipt of an influenza vaccine dose recorded in the immunization registry via an electronic health record by March 31, 2011 No. (%) of Children and Adolescents Age group / Intervention (n = 3790)a / Usual Care (n=3784) / % Difference (95% CI) / % RR (95% CI) / P value All ages / 1653 (43.6) / 1509 (39.9) / 3.7 / 1.09 / 0.001

Stockwell 2012

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results

adolescent population: a randomized controlled trial, JAMA, 307, 1702-8, 2012

Study type
Randomised controlled trial.

Aim of the study
"To evaluate targeted text message reminders for low-income, urban parents to promote receipt of influenza vaccination among children and adolescents. "

	Primary Analytic Sample[b]			Total Sample[c]		
	Intervention[d] (n=3790)	Usual Care (n=3784)	P	Intervention[d] (n = 4607)	Usual Care (n = 4606)	P
Age			.61			>.99
6-23 months	1051 (27.7)	1088 (28.8)		1234 (26.8)	1234 (26.8)	
2-<5 years	1525 (40.2)	1501 (39.7)		1854 (40.2)	1853 (40.2)	
5-18 years	1214 (32.0)	1195 (31.6)		1519 (33.0)	1519 (33.0)	
Sex						
Male	1858 (49.0)	1859 (49.1)	.93	2272 (49.3)	2274 (49.4)	.96
Female	1932 (51.0)	1925 (50.9)		2335 (50.7)	2332 (50.6)	

unvaccinated children and adolescents

Usual care - both the intervention and usual care groups received the usual care, an automated telephone reminder, and access to informational flyers posted at the study sites.

Intervention and Usual care details:

SMS interventions:
The first 3 text messages provided educational information including vaccine safety and emphasis on the seriousness of influenza infection tailored to the age of the child or adolescent. The last 2 messages informed families

			(1.5 to 5.9)	(1.04 to 1.15)	
6-23 months	615 (58.5)	569 (52.3)	6.2 (1.9 to 10.5)	1.12 (1.04 to 1.21)	0.004
2-<5 years	701 (46.0)	633 (42.2)	3.8 (0.2 to 7.4)	1.09 (1.01 to 1.18)	0.04
5-18 years	337 (27.8)	307 (25.7)	2.1 (−1.5 to 5.7)	1.08 (0.95 to 1.23)	0.25

Abbreviation: RRR, relative rate ratio.

A The intervention was text message reminders for influenza vaccination.

Stockwell 2012

Study detail	Inclusion/Exclusion and Patient population							Intervention/ Comparators	Results
Location and setting Four community-based clinics in the United States during the 2010-2011 influenza season Length of study 2010-2011 influenza season. Source of funding Supported by grant from the Maternal and Child Health Bureau (Title V, Social Security	Race/ethnicity							about dates for Saturday influenza vaccine clinics, which were held weekly from October 2010 through March 2011 at 1 clinic site and were available to all network patients. Text messages were sent using a customized text-messaging platform integrated with the institution's immunization information system, EzVac. EzVac automatically collects vaccine administrations from the EHRs for the 4 study sites as well as from the New York Citywide Immunization registry, thereby allowing capture of vaccines administered to clinic patients at practices other than	
	Black	464 (12.2)	453 (12.0)		545 (11.8)	545 (11.8)			
	Latino	1654 (43.6)	1628 (43.0)		1968 (42.7)	1949 (42.3)			
	White, non-Latino	50 (1.3)	56 (1.5)	.76	63 (1.5)	69 (1.5)	.84		
	Other	1619 (42.7)	1646 (43.5)		2028 (44.0)	2042 (44.3)			
	Unknown	3 (0.1)	1 (<0.1)		3 (0.1)	1 (<0.1)			
	Site								
	1	1279 (33.7)	1576 (34.2)		1576 (34.2)	1577 (34.2)			
	2	853 (22.5)	853 (22.5)	>.99	1042 (2.6)	1040 (22.6)	>.99		
	3	549 (14.5)	545 (14.4)		674 (14.6)	674 (14.6)			
	4	1109 (29.4)	1111 (29.4)		1315 (28.5)	13.15			

Stockwell 2012			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Act), Health Resources and Services Administration, Department of Health and Human Services.	<table><tr><td></td><td></td><td></td><td></td><td></td><td>(28.5)</td><td></td></tr><tr><td colspan="7">Abbreviation: SCHIP, State Children's Health Insurance Program.</td></tr><tr><td colspan="7">A Percentages may not equal 100% due to rounding.</td></tr><tr><td colspan="7">B Made up of children and adolescents who had not received vaccination prior to intervention start date.</td></tr><tr><td colspan="7">c Includes children and adolescents who had already received vaccination prior to intervention start date.</td></tr><tr><td colspan="7">D The intervention was text message reminders for influenza vaccination.</td></tr><tr><td colspan="7">e Includes Asian, American Indian, or other as indicated in the registration system. In this predominantly Latino community, in previous surveys, many Latinos, when asked about race/ethnicity, responded with "other."</td></tr></table> Randomization occurred with 1:1 allocation at an individual level, using a permuted block design with a block size of 6, and stratified by age and clinic site. Inclusion criteria Children and adolescents aged 6 months to 18 years as of September 28, 2010 that had visited 1 of the 4 clinical sites in the previous 12 months; and had a cellular telephone number recorded in the hospital registration system. Eligibility criteria did not include influenza vaccine status. Children aged 6 months to less than 5 years (59 months) who met eligibility criteria plus a random sample of eligible children and adolescents	the 4 clinic study sites. New York City Public Health Law requires documentation for all vaccinations administered to those younger than 19 years be submitted to the New York Citywide Immunization Registry,15 which captures an estimated 93% of vaccines administered by the Vaccines for Children Program. Usual care: Children and adolescents in both study groups also received the usual care from the staff at the 4 clinics, which for the 2010-2011 season was an automated telephone message in early November 2010	

Stockwell 2012			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
	aged 5 to 18 years (stratified by age: 5-8 and 9-18 years) were randomized. Exclusion criteria "We did not randomize all eligible 5- to 18-year-olds because the response to the intervention was unknown and there was concern that clinical capacity could be overwhelmed."	including information regarding the seriousness of influenza infection, indicating the existence of a safe vaccine, and providing information regarding the Saturday clinics. Flyers advertising the Saturday clinics were posted at the 4 study sites.	
Notes Limitations identified by author Vaccine administrations may have been underreported. Under-reporting in either setting would have affected the intervention and usual care groups similarly. 18% were vaccinated by the time the interventions started and thus not included in the primary analysis. Equal numbers participants in both arms were vaccinated before the start. The subgroup analysis comparing the 86% of participants in the intervention group for whom text messages were deliverable compared with participants in the usual care group was only confirmatory because the usual care group may not be fully comparable with this intervention subgroup. While randomization and analysis were performed at the individual level, the intervention was directed at parents, and some families had more than 1 participant randomized to arms. Because a small number (8%) had a sibling in the opposite study group, the observed intervention effect may have been diminished. The main finding that the text messaging intervention increased the rate of influenza vaccination was not materially different in the sensitivity analyses accounting for a participant from the same family being assigned to both groups.			

Stockwell 2012			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
May have underestimated the effects of the intervention in other ways. All parents received 1 telephone call reminder. Due to concerns of overcrowding of Saturday clinics by text message intervention families, not every family was made aware of every clinic date. Intervention families were not referred to their clinic sites for vaccination during regular office hours. This study took place in a single medical system that serves a primarily low-income, urban community so findings may not be generalizable to other settings. Limitations identified by review team As it was individuals, rather than practices being randomised, intervention dilution could happen by raising general awareness in staff who are more aware of the need to offer vaccination to all attendees			

1
2

G.1.9 Stockwell 2015a

<table>
<tr><th colspan="4">Stockwell 2015a</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr>
<td>Full citation
Stockwell MS, Catallozzi M, Camargo S, Ramakrishnan R, Holleran S, Findley SE, Kukafka R, Hofstetter AM, Fernandez N, Vawdrey DK. Registry-linked electronic influenza vaccine provider reminders: a cluster-crossover trial, Paediatrics, 135, e75-82, 2015 (a)</td>
<td>Number of participants
N=8,481

Participant characteristics
<table>
<tr><td colspan="5">Characteristics of study population in 2011–2012</td></tr>
<tr><td></td><td>Total Children Seen During Analytic Period, % (N = 8481)</td><td>Non–Up-to-Date Children Seen When Alert Was On, % (N = 3199)</td><td>Non–Up-to-Date Children Seen When Alert Was Off, % (N = 3394)</td><td>P</td></tr>
</table>
</td>
<td>Intervention:
Electronic vaccination reminders that appeared on screen when an electronic health record was accessed.
Reminders automatically retrieved vaccination information from local immunisation information systems,
Reminders displayed both a colour-</td>
<td>Primary outcomes

Proportion of Children Receiving Needed Influenza Vaccination During Clinic Visits When the Reminder Was ‘On’ Versus ‘Off’, 2011–2012 Season
<table>
<tr><td></td><td colspan="2">Children Receiving Needed Influenza Vaccination</td><td></td><td></td></tr>
<tr><td>Period</td><td>Reminder ‘On’ %</td><td>Reminder ‘Off’ %</td><td>Absolute Diff, % (95% CI)</td><td>RR of missed opportunity:</td></tr>
</table>
</td>
</tr>
</table>

Stockwell 2015a

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results

Study detail

Study type
Cluster-crossover trial.

Aim of the study
To determine the impact of a vaccination reminder in an electronic health record abstract supplemented with data from an immunization information system (IIS).

Location and setting
Four community-based paediatric clinics affiliated with New York–Presbyterian (NYP) Hospital/Columbia University Medical Centre in New York City.

Length of study

Inclusion/Exclusion and Patient population

Age				0.42
6–23 months	22.8 (1930)	23.0 (737)	22.7 (770)	
2-< 5 years	26.4 (2240)	26.1 (835)	24.9 (846)	
5–17 years	50.8 (4311)	50.9 (1627)	52.4 (1778)	
Language				0.8
English	38.7 (3209)	38.6 (1213)	38.3 (1265)	
Spanish	61.3 (5085)	61.4 (1928)	61.7 (2037)	
Gender				
Male	49.7 (4211)	50.3 (1609)	48.9 (1658)	0.24
Female	50.3 (4270)	49.7 (1590)	51.1 (1736)	

Inclusion criteria
"During the analytic period in 2011–2012, 8481 unique children had visits, and median age was 6.5 years (interquartile range 2.1–10.2). Nearly two-thirds came from Spanish-speaking families, and half were female (Table 1). At the time of their first visit during the analytic

Intervention/ Comparators

coded message based on the influenza vaccination status and the most recent seasonal and 2009 H1N1 vaccination dates.
An orange background indicated the child was non–up-to-date and allowed vaccine ordering using age-specific options or documentation of reason for vaccine non-administration
To account for seasonal variations in vaccination the season was divided into 2 phases fall and winter, each with a 28-day “on” and a 28-day “off” period
Each clinic was randomized to a cluster with an ‘on’ and an ‘off’ period in each phase.
During the ‘on period’, the reminder

Results

				Alerts ‘On’ vs ‘Off’ (95% CI)
Oct–Feb	76.2 (2436 of 3199)	73.8 (2504 of 3394)	2.4 (0.3, 4.5)	0.91 (0.84, 0.99)
Oct–Dec	76.8 (1895 of 2469)	76.5 (1975 of 2582)	0.3 (–2.1 , 2.6)	0.99 (0.89, 1.09)
Jan–Feb	67.9 (735 of 1082)	62.2 (720 of 1158)	5.8 (1.7, 9.8)	0.85 (0.76, 0.95)

Absolute differences in receipt of vaccination and RR of remaining unvaccinated (“missed opportunity”) when alert was on versus off. October–December analyses included the last visit when a child was in need of an influenza vaccine in the fall. January–February analyses included the last visit in the winter when a child was in need of an influenza vaccine in the winter.

CI= confidence interval; RR= relative risk.

<table>
<tr><th colspan="4">Stockwell 2015a</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr>
<td>2011–2012 influenza season

Source of funding
FUNDING: This study was supported by grant R18HS018158 (Stockwell) from the Agency for Healthcare Research and Quality.</td>
<td>period, 1478 (17.4%) had already been vaccinated that season and did not require another dose; 66 (0.8%) were vaccinated but were in need of a second dose, 21 of whom returned when they were due for that dose. A total of 6958 children had a visit in the analytic period for which they were not up-to-date, including those who were not up-to date at their first visit (n = 6937) and the 21 indicated earlier."

Characteristics of study population in 2011–2012
<table>
<tr><th></th><th>Total Children Seen During Analytic Period % (N = 8481)</th><th>Non–Up-to-Date Children Seen When Alert Was On, % (N = 3199)</th><th>Non–Up-to-Date Children Seen When Alert Was Off, % (N = 3394)</th><th>P value</th></tr>
<tr><td>Age</td><td></td><td></td><td></td><td>0.42</td></tr>
<tr><td>6–23 months</td><td>22.8 (1930)</td><td>23.0 (737)</td><td>22.7 (770)</td><td></td></tr>
</table>
</td>
<td>appeared when an electronic note was entered for well-child, follow-up, acute care, Supplemental Nutrition Program for Women, Infants, and Children, or vaccine-only visits.
During the ‘off period’, the reminder was not displayed.
The reminder was on for all 4 clinic sites through the season."</td>
<td></td>
</tr>
</table>

Stockwell 2015a						
Study detail	**Inclusion/Exclusion and Patient population**					**Intervention/ Comparators**	**Results**
	2-< 5 years	26.4 (2240)	26.1 (835)	24.9 (846)			
	5–17 years	50.8 (4311)	50.9 (1627)	52.4 (1778)			
	Language				0.8		
	English	38.7 (3209)	38.6 (1213)	38.3 (1265)			
	Spanish	61.3 (5085)	61.4 (1928)	61.7 (2037)			
	Gender						
	Male	49.7 (4211)	50.3 (1609)	48.9 (1658)	0.24		
	Female	50.3 (4270)	49.7 (1590)	51.1 (1736)			
	Exclusion criteria None mentioned.						
Limitations identified by author The study took place in 1 low-income, urban, academic setting using a commercial EHR; results may not generalize to other environments. A minority (5.2%) of children had a visit during both an on and off period and were excluded from the primary analysis. 14.8% of children had multiple visits that did not include both on and off periods. We chose to assess the last visit to best reflect the patient's final vaccination status; we also conducted a sensitivity analysis assessing the first visit, which included all children. Also, some children required 2 doses in a given season. Children were included in the analysis for the first dose they needed during the analytic period.							

Stockwell 2015a			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Randomization was not performed at the individual patient level due to potential carryover effects from 1 patient to another seen by the same provider. The study used a crossover trial giving each site on and off comparison periods. We cannot, however, control for the rare possibility that the reminder sites independently had better vaccination practices at the times the reminder was on versus off. The on/off design might also have felt disruptive to providers. Limitations identified by review team Potential cross-contamination between intervention and control groups due to cross-over trial Other comments Linked study, qualitative data: Birmingham E, Catallozzi M, Findley SE, Vawdrey DK, Kukafka R, Stockwell MS. FluAlert: A qualitative evaluation of providers' desired characteristics and concerns regarding computerized influenza vaccination alerts, Preventive medicine, 52, 274-277, 2011			

1

2G.1.10 Stockwell 2015b

<table>
<tr><th colspan="4">Stockwell 2015b</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr>
<td>Full citation
Stockwell MS, Hofstetter AM, DuRivage N, Barrett A, Fernandez N, Vargas CY, Camargo S. Text message reminders for second dose of influenza vaccine: a randomized</td>
<td>Number of participants
N=660

Subjects were randomly assigned centrally with a 1:1:1 allocation at an individual level by using a permuted block design with a block size of 9, stratified by age and clinic site.

Participant characteristics
"Most families were Latino and publicly insured with no significant between-arm differences between groups."</td>
<td>Educational text message [E+C SMS]

Conventional text message [C SMS]

Usual care: Written reminder-only [UC]

At enrolment, all arms received a</td>
<td>Primary outcomes

Receipt of second dose by due date (April 30) - Primary analytic sample

<table>
<tr><th>Intervention</th><th>Receipt Second Dose</th><th>Difference Versus Written Text Message Reminder</th><th>Difference Versus Conventional Text Message Reminder</th></tr>
</table>
</td>
</tr>
</table>

Stockwell 2015b

Study detail

controlled trial, Paediatrics, 135, e83-91, 2015 (b)

Study type
Randomized Controlled Trial.

Aim of the study
"To determine whether provision of vaccine-health-literacy-promoting information in abstract text message vaccine reminders improves receipt and timeliness of the second dose of influenza vaccine within a season for children in need of 2 doses."

Inclusion/Exclusion and Patient population

Characteristics of Study Population n (%)					
	Total	UC n = 219	C SMS n = 225	E+C SMS n = 216	P
Age					.91
6–23 months	484 (73.3)	161 (73.5)	163 (72.4)	160 (74.1)	
2 < 5 years	66 (10.0)	21 (9.6)	26 (11.6)	19 (8.8)	
5– 8 yrs	110 (16.7)	37 (16.9)	36 (16.0)	37 (17.1)	
Gender					.66
Girl	327 (49.5)	114 (52.1)	108 (48.0)	105 (48.6)	
Boy	333 (50.5)	105 (47.9)	117 (52.0)	111 (51.4)	
Race/ethnicity					.57
Latino	586 (88.8)	199 (90.9)	201 (89.3)	186 (86.1)	

Intervention/ Comparators

written reminder with next dose due date.
Conventional messages included second dose due date and clinic walk-in hours.
Educational messages added information regarding the need for a timely second dose.

At recruitment, families signed a consent form and texted an enrolment message into the text message platform, which automatically sent a confirmation messag e. All families received a written reminder with the date the next influenza vaccine dose was due. They also were verbally administered a demographic and

Results

	%	P value	Absolute Difference % (95% CI)	RR (95% CI)	Absolute Difference% (95% CI)	RR (95% CI)
E+C SMS (n = 216)	72.7 % (157)	P = .003	15.6% (15.1–16.1)	1.27 (1.11–1.47)	6.0% (5.6–6.5)	1.09 (0.96-1.23)
C SMS (n = 225)	66.7 % (150)		9.6% (9.1–10.0)	1.17 (1.01–1.35)	-	-
UC (n = 219)	57.1 % (125)		-	-	-	-

The number needed to text an educational reminder for 1 additional
child to receive a needed second dose by April 30 compared with written reminder-only was 6.4.

Secondary outcomes

Timeliness of second dose (receipt of second dose by 2 weeks after due date (day 42 post vaccination) - Primary analytic sample

Stockwell 2015b

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results

Study detail

Location and setting
Three community clinics in New York City.
USA.

Length of study
August 29, 2012, and March 31, 2013.
End point 30th April 2013.

Source of funding
FUNDING: This study was supported by an institutional career development grant (National Institutes of Health/National Cancer Institute grant number KM1 CA156709). Funded by the National

Inclusion/Exclusion and Patient population

African American	58 (8.8)	14 (6.4)	19 (8.4)	25 (11.6)	
White	2 (0.3)	1 (0.5)	0 (0)	1 (0.5)	
Other	14 (2.1)	5 (2.3)	5 (2.2)	4 (1.9)	
Language most comfortable speaking with health care provider					.47
Spanish	341 (51.7)	121 (55.3)	112 (49.8)	108 (50.0)	
English	318 (48.2)	98 (44.7)	112 (49.8)	108 (50.0)	
Other	1 (0.2)	0 (0)	1 (0.4)	0 (0)	
Insurance					.15
Medicaid/ State Children's Health Insurance Program	638 (96.7)	208 (95.0)	219 (97.3)	211 (97.7)	
Commercial	14 (2.1)	7 (3.2)	2 (0.9)	5 (2.3)	
Uninsured	8 (1.2)	4 (1.8)	4 (1.8)	0 (0)	

Intervention/ Comparators

attitudes survey and took the Short Test of Functional Health Literacy in Adults (S-TOFHLA). Parents received
$10 compensation."

Results

Intervention	Receipt Second Dose		Difference Versus Written Text Message Reminder		Difference Versus Conventional Text Message Reminder	
	%	P value	Absolute Difference % (95% CI)	RR (95% CI)	Absolute Difference % (95% CI)	RR (95% CI)
E+C SMS (n = 216)	43.5% (94)	P <.001	17.9% (17.5–18.4)	1.70 (1.30–2.24)	9.6% (9.1–10.0)	1.28 (1.01–1.63)
C SMS (n = 224)	33.9% (76)		8.4% (7.9–8.8)	1.33 (0.99–1.77)	-	-
UC (n = 219)	25.6% (56)		-	-	-	-

Receipt by day 42 does not include participant who received the second dose too early and was not revaccinated.
CI, 95% confidence interval; RR, relative rate.

Stockwell 2015b						
Study detail	**Inclusion/Exclusion and Patient population**					**Intervention/ Comparators**	**Results**
Institutes of Health (NIH).	Education				.56		
	High school	110 (16.7)	33 (15.1)	38 (16.9)	39 (18.1)		
	High school	230 (34.8)	83 (37.9)	70 (31.1)	77 (35.6)		
	At least some college	320 (48.5)	103 (47.0)	117 (52.0)	100 (46.3)		
	Text message plan type						
	Unlimited plan	583 (88.3)	190 (86.8)	200 (88.9)	193 (89.4)	.65	
	Limited plan	74 (11.2)	27 (12.3)	24 (10.7)	23 (10.6)		
	Did not know	3 (0.5)	2 (0.9)	1 (0.4)	0 (0)		
	Text message frequency						
	At least weekly	609 (92.3)	207 (94.5)	201 (93.1)	201 (89.3)	.18	
	Less often than weekly	39 (5.9)	11 (5.0)	17 (7.6)	11 (5.1)		
	Never	12 (1.8)	1 (0.5)	7 (3.1)	4 (1.9)		

Stockwell 2015b

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results

S-TOFHLAa

Adequate	434 (85.9)	140 (86.4)	149 (85.6)	145 (85.8)	.99
Marginal	27 (5.3)	8 (4.9)	10 (5.7)	9 (5.3)	
Inadequate	44 (8.7)	14 (8.6)	15 (8.6)	15 (8.9)	

Data are presented as n (%). a Short Test of Functional Health Literacy in Adults (S-TOFHLA) not available on all participants because of family's time availability at enrolment

Inclusion criteria

Children:

aged 6 months through 8 years old at vaccination

who received their first influenza dose of the season at a study site

who were in need of 2 doses that season according to the local influenza vaccination policy

who had a cellular phone with text message capabilities.

Exclusion criteria

None given.

Stockwell 2015b			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Notes Limitations identified by author Vaccination records could be incomplete Although we included the due dates of vaccination in the messages, one unintended consequence could be receipt of a second dose too early Although we did not have any undeliverable messages, at post survey some families did not remember receiving the text messages. We do not know if they did not receive them or forgot. This study took place in one network of clinics affiliated with an academic medical centre that serves a primarily minority and publicly insured population.			

1

2

G.1.11 Suryadevara 2013

Suryadevara 2013			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention\ Comparators**	**Results**
Full citation Suryadevara, M., Bonville, C.A., Ferraioli, F. and Domachowske, J.B., 2013. Community-centered education improves vaccination rates in	Inclusion criteria Children younger than 19 from families meeting the financial criteria for registration onto the gift distribution programme (families with incomes less than 150% of federal poverty guidelines) Exclusion criteria Allergy to vaccine components Number of participants 1531 children from 630 families	Intervention Each parent was met with for ~10 minutes, where vaccine concerns were addressed, appropriate parental education given with discussions of vaccine importance and review of both paediatric immunisation	Results 9 months following intervention, the influenza vaccine rates increased from 32% to 49%, broken down into age groups below: Age Group / Percent Increase in Coverage Over Duration of Influenza Seasons (95% CI) 6month-3yrs: 24.6 (20.1-29.1) 4-6yrs: 16.5 (12.4-20.5) 7-10yrs: 16.6 (12.7-20.4) 11-12yrs: 13.6 (8.2-18.9)

<table>
<tr><th colspan="4">Suryadevara 2013</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention\ Comparators</th><th>Results</th></tr>
<tr><td>children from low-income households . Pediatrics, 132(2), pp.319-325.

Quality score
-

Study type
Before and after

Aim of the study
Collaboration with a local health department and the largest community based organisation (Salvation Army), in order to</td><td>Participant characteristics
All from resource poor families

74% aged 4-18; 26% aged 0-3

51% (n=785) were boys
96% (n=1471) had medical insurance coverage
98% (n=1507) had an established medical home</td><td>schedule and relevant vaccine information sheets.

Immunisation records were reviewed for vaccine completeness, with a highlighted copy of the record given to families who were vaccine incomplete.

Parents were encouraged to bring their records to their primary care provider.

Immunisations were offered on site.

At 1 and 3 months post-</td><td>
<table>
<tr><td>13-18yrs</td><td>13.0 (9.0-17.0)</td></tr>
<tr><td>Total</td><td>17.5 (15.5-19.5)</td></tr>
</table>

The observed overall increase of 17% was markedly higher than increases in vaccination rate in the same age range observed at the county level, where an 8% increase was achieved.

152 children were vaccinated at their medical home following intervention

101 of the 1033 eligible children (10%) were vaccinated on site directly after the intervention, broken down into age groups below:

<table>
<tr><td>Age Group</td><td>Eligible (n)</td><td>Number vaccinated on site (% of eligible)</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th colspan="4">Suryadevara 2013</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention\ Comparators</th><th>Results</th></tr>
<tr><td>reach resource-poor families and their children, address individual vaccine concerns and educate regarding vaccine importance and safety in an effort to increase immunisation coverage rates in this high-risk population.

Location and setting
Greater Syracuse Area, New York State.
Within 10 community</td><td></td><td>intervention, families were contacted if they were not vaccine complete.
(Recall intervention)

Compared to other regions with the county</td><td>
<table>
<tr><td>6month-3yrs</td><td>299</td><td>34 (15%)</td></tr>
<tr><td>4-6yrs</td><td>228</td><td>21 (9%)</td></tr>
<tr><td>7-10yrs</td><td>253</td><td>21 (8%)</td></tr>
<tr><td>11-12yrs</td><td>114</td><td>7 (6%)</td></tr>
<tr><td>13-18yrs</td><td>210</td><td>18 (9%)</td></tr>
</table>

93% of children were thought to be vaccine complete at study enrolment; only 39% were thought to have received the current years influenza vaccine.</td></tr>
</table>

Suryadevara 2013			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention\ Comparators**	**Results**
sites during registration for a gift distribution program for families with incomes less than 150% of federal poverty guidelines Source of funding Support provided by Pfizer through the ASPIRE 2011 Junior Investigator Award in Pediatric Vaccine Research.			
Limitations identified by author Difficult to measure the contribution that parent counselling had on change in vaccine coverage			

Suryadevara 2013			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention\ Comparators**	**Results**
Limitations identified by review team Unsure of other interventions which may have impacted the decisions to vaccinate in this group. Other comments None			

1

2G.1.12 Szilagyi 2015

Szilagyi 2015			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Full citation Szilagyi PG, Serwint JR, Humiston SG, Rand CM, Schaffer S, Vincelli P, Dhepyasuwan N, Blumkin A, Albertin C, Curtis CR. Effect of provider prompts on adolescent immunization rates:	Number of participants 12 GR-PBRN and 12 CORNET Practices. Each practice randomised 160 patients. Participant characteristics Fourteen GR-PBRN and 15 CORNET practices agreed, before randomization, to participate in the randomized controlled trial intervention.	Intervention / Comparison Interventions: 1.Provider immunization prompts* delivered either by nurse/staff or delivered by	Primary outcomes Influenza immunization rates at baseline and end of study period by study group stratified by PBRN*c | | Baseline | End of Study Period |

[c] PBRN indicates practice-based research network; aOR, adjusted odds ratio; CI, confidence interval; GR-PBRN, Greater Rochester Practice-Based Research Network; CORNET, Continuity Clinic Research Network;

Szilagyi 2015

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results

A randomized trial, Academic paediatrics, 15, 149-157, 2015

Study type
Randomized Controlled Trial.

Aim of the study
"To test the impact of provider prompts on increasing adolescent immunization rates."

Location and setting
"The study was based in both a local and a national setting. The Greater Rochester PBRN (GR-PBRN) consists of 85 primary care practices, including 44 paediatric and 4 family medicine practices. The

Baseline Practice and Patient Characteristics and Preventive Care Visit Rates by Randomization Group

Characteristic	GR-PBRN			CORNET		
	Interv	Control	P*	Interv	Control	P*
Practice Characteristics No. of practices	5	5		6	6	
No. of paediatrics/family medicine practices	4/1	4/1	NA	6/0	6/0	NA
No. of practices by location		NA			NA	
Urban	0	0		6	6	
Suburban	4	4		0	0	
Rural	1	1		0	0	
Average size, mean (SD)†						
All ages	7,125 (5,808)	9,125 (2,462)	.63	8,029 (4,249)	13,375 (8,499)	.59

electronic health record (EHR) during patient visits, for study. EHRs displayed a provider prompt (alert) on the initial screen that health care providers viewed upon opening each patient's electronic medical chart.

*for Tdap, tetanus toxoid, reduced diphtheria toxoid, and acellular pertussis vaccine; MCV4, meningococcal

	Interv n (%)	Control n (%)	Interv n (%)	Control n (%)	aOR† (95% CI)	p
GR-PBRN	252 (32)	243 (30)	279 (35)	282 (35)	0.93 (0.69–1.25)	.78
CORNET	472 (49)	410 (43)	457 (48)	421 (44)	0.89 (0.69–1.16)	.54

The above table shows that:
baseline immunisation rates quite low for influenza vaccinations.
influenza vaccination rates increased slightly from baseline to end of study period for both control and intervention practices (i.e., secular trends).
the intervention did not appear to increase immunisation rates.
*Based on 160 randomly selected chart reviews per practice at baseline and again at the end of the study. The GR-PBRN included 5 practice pairs; the CORNET PBRN included 6 practice pairs. Denominators are n= 800 (GR-PBRN) n= 960 (CORNET)

†aOR is odds of change in outcomes (immunization rates) for intervention versus odds of change in outcomes (immunization rates) for control practices, expressed as odds ratio. Odds ratios come from robust multi-level mixed-effect logistic regression models with covariates pair assignment,

Szilagyi 2015

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results

national Continuity Clinic Research Network (CORNET) consists of 73 paediatric continuity clinics; many are large hospital-based continuity clinics.

Length of study

12 months, between June 6, 2011, to January 30, 2013 (CORNET; intervention/control practice pairs had staggered starts over a 4-monthperiod, but study time period was the same for all practices).

Source of funding

Funded by the US Centers for Disease Control and Prevention (grant 5U011P000312).

11–17 years	2,600 (1,980)	4,450 (5,020)	.55	1,815 (747)	2,500 (1,870)	.87
Adolescent Patient Characteristics	800	800		960	960	
Characteristic	GR-PBRN			CORNET		
From Baseline Chart Review No. of patients						
Female patients n (%)	393 (49 %)	399 (50)	.85	473 (49)	468 (49)	.86
Race n (%)‡	NA	NA	NA	340 (35)	191 (20)	<.01
White, non-Hispanic				366 (38)	345 (36)	
Black, non-Hispanic				105 (11)	186 (19)	
Hispanic				60 (6)	39 (4)	
Other, non-Hispanic				89 (9)	199(21)	
Missing	626 (78)	639 (80)	.50	808(84)	694(72)	.11

vaccine;and HPV,human papilloma virus vaccine (HPV1, first vaccination in series,etc) as well as influenza vaccine.

2. Standard care, (which did not include prompts).

Note: 2 intervention practices lacked EHRs so practitioners preferred nurse/staff prompts. These practices received 1 or 2 educational sessions, explaining the

study time period, intervention assignment, and an interaction between time and intervention assignment.

Secondary outcomes

Missed influenza vaccination opportunities.

Missed opportunities for Flu vaccine for intervention Versus control practices during base line and Intervention period by PBRN

	Baseline		Intervention period			
	Intervention n (%)	Control n (%)	Intervention n (%)	Control n (%)	Incident Risk Ratio (95% CI)	P
GR-PBRN Visits with missed opportunities	194/527 (37)	179/514 (35)	192/538 (36)	188/516 (36)	0.92 (0.79 – 1.06)	.26

Szilagyi 2015			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
	Patients with preventive care visit during study period n (%) GR-PBRN indicates Greater Rochester Practice-Based Research Network; CORNET, Continuity Clinic Research Network; and NA, not applicable. *P values from conditional logistics regression ,conditioning on matched practices. †P value from paired t test. ‡Race was missing in >75% of cases from the GR-PBRN (so is not presented here) and was also missing in 15% of cases from CORNET (recorded as"missing"). Inclusion criteria "The target population was all adolescents aged 11 to 17 years who were enrolled in a participating practice during the year before the intervention."No practice used provider prompts at baseline for adolescent immunizations. Exclusion criteria "Within the GR-PBRN, we created practice pairs: 4 suburban paediatric, 1 rural family medicine, and 1 urban community health centre. The community health centre pair was excluded because the intervention practice could not implement the intervention, leaving 5 practice pairs. Within CORNET we created 5 urban paediatric pairs and 1 rural paediatric pair of practices."	importance of immunisations to physicians, nurses and staff. In addition, a nurse/staff protocol was provided to prompt the review of every adolescent's immunisation record at each visit, to list the immunisations due at each visit, and to display vaccine information statement forms.	CORNET Visits with missed opportunities: 218/549 (40); 273/707 (39); 174/415 (42); 211/556 (38); 1.00 (0.80 – 1.24); .99 *Numerator is number of visits that involved a missed opportunity; denominator, total number of visits during the year when adolescents were eligible for a vaccine. The adjusted incidence-rate ratio is shown.

Szilagyi 2015			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Notes Limitations identified by author "Limitations include the limited number of practices (n=24 practices before randomization) with an inability to control for some practice-based factors that might have affected missed opportunities or vaccination rates, the loss of one practice pair from the GR-PBRN, an inability to determine precisely the degree to which prompts resulted in increased discussions about immunizations, and high baseline meningococcal and Tdap immunization rates. Importantly, many practices had recently converted to EHRs, and it is possible that the overwhelming impact of using EHRs dampened immunization prompts' effects. Further, in most cases the alerts were not modifiable; they simply appeared as standard prompts on the screen. Finally, we were unable to measure provider discussions with patients beyond assessing parent refusals or requests for delaying vaccinations. Nevertheless, in our study, refusal rates were similar for intervention and control practices, so we do not believe that parent refusals contributed substantially to the lack of benefit of the immunization prompts. Although provider prompts are recommended to improve immunization rates, in this study performed in both a local and national PBRN, provider prompts failed to improve adolescent immunization rates and generally failed to reduce missed opportunities for immunization. More rigorous practice-based changes are needed to improve rates." Limitations identified by review team The study was concerned with the effects of provider prompts on improving rates of all immunisations recommended for adolescents. As such, a proportion of the sample randomised to the intervention group had already received the influenza vaccine. Two of the intervention practices lacked EHRs and therefore relied on nurse/staff prompts. (To compensate these practices received educational sessions as well as a nurse/staff protocol)			

1

2G.1.13 Witteman 2015

Witteman 2015			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Full citation Witteman HO, Chipenda Dansokho S, Exe N, Dupuis A, Provencher T,	**Inclusion criteria** Live in the USA; be 18 or over; be a parent or guardian who makes medical decisions for at least 1 child aged 6 months -18 years.	**Intervention:** <u>Intervention 1:</u> Risk Communication presentation of	Participants who had previously decided to vaccinate one or more children were more inclined to do so again, and this was incorporated into the data analysis.

<table>
<tr><th colspan="4">Witteman 2015</th></tr>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr>
<td>Zikmund-Fisher BJ. Risk communication, values clarification, and vaccination decisions. Risk Anal. 2015 Oct;35(10):1801-19. doi: 10.1111/risa.12418. Epub 2015 May 20.

Quality score
-

Study type
RCT

Aim of the study
To better understand how to help people make more informed choices when presented with risk-benefit trade-offs.

Location and setting</td>
<td>Exclusion criteria
Participants child could not have received the influenza vaccine in the current flu season; child could not have a medical reason to avoid the flu vaccine.

Number of participants
407 at baseline
116 (29%) at follow-up

Participant characteristics
Predominantly female (63% original; 61% follow up)
Half parent respondents were aged 28-41 (mean 35yrs)
Ethnicities and races diverse
Half had no university degree
41% - child had never received influenza vaccine

Follow up participants generally characteristic of original group, although had a statistically significant older mean age of 37

Nearly all participant characteristics evenly distributed across experimental factors during</td>
<td>information about flu, showing absolute risk estimates of the risks and benefits of flu vaccination for children, including rates of paediatric deaths for 2012-13 due to influenza and side effects of flu vaccines among children in USA. Icon arrays were used to explain the differences in death rates between groups of vaccinated and unvaccinated children.
Numbers of children hospitalised in each group were shown, and</td>
<td>Neither Risk Communication nor Values Clarification condition alone increased the intention to vaccinate significantly when observing all participants intentions.

When Risk Communication and Values Clarification condition were combined, they increased intention to vaccinate from the control condition by nearly 1 point on the 9 point Likert scale (with -4 being “definitely NOT get my child vaccinated and 4 being “definitely WILL get my child vaccinated”)

Risk communication alone was sufficient to increase intention to vaccinate in line with joint interventions in those who had vaccinated their children in the last 5 years.

The combination of Risk communication and Values Clarification was especially important for participants who had not recently vaccinated. When both Risk Communication and Values Clarification were used in conjunction, the intention to vaccinate was almost neutral compared to negative as observed with just 1 intervention in this group.

Vaccination intentions of participants, split into those who have never previously vaccinated against flu and those who have. Intentions to vaccinate indicated by the 9 point Likert scale (with -4 being “definitely NOT get my child vaccinated and 4 being “definitely WILL get my child vaccinated”)
<table>
<tr><td></td><td>Standard risk presentation format</td><td>Standard risk information format + values clarification</td><td>Risk communication format</td><td>Risk communication + values clarification</td></tr>
</table>
</td>
</tr>
</table>

Witteman 2015			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
Online; living in the USA Source of funding Dr. Witteman received a small honorarium and travel funds from the Harvard Center for Risk Anal- ysis to present portions of this work at a conference hosted by the Center in 2014. Dr. Witteman is also supported by a Research Scholar Junior 1 career development award from the Fonds de recherche du Qu´ebec – Sant´ e. Dr. Zikmund-Fisher was supported by a career development award from the American Cancer Society (MRSG-06-130-01-CPPB). The funding agreements ensured the	randomisation. 3/18 Asian or Asian Americans were randomised to the value clarification factor, the rest were not. As these participants represented a small fraction of the sample and race was not a planned moderating factor in the analysis, the imbalance didn't change the analytical approach By helping people understand the different statistics for vaccinated and unvaccinated children and also guiding them through the process of aligning their choices with their values relevant to the decision, it was hypothesised that higher intentions among participants to vaccinate their children and thus higher rates of vaccination would be observed.	calculations to explicitly show the difference in numbers was provided. <u>Intervention 2:</u> Values Clarification condition, in which participants were asked to use sliders to indicate the importance of competing risks, eg avoiding Guillain-Barre Syndrome. The position of the sliders were dependant on each other, making trade-offs in the decision explicit. At the conclusion of the study, participants	<table><tr><td>All participants</td><td>0.3</td><td>0.3</td><td>0.4</td><td>1.3</td></tr><tr><td>No flu vaccination history</td><td>-1.1</td><td>-1.7</td><td>-1.8</td><td>-0.3</td></tr><tr><td>Flu vaccination history</td><td>1.4</td><td>1.6</td><td>2.1</td><td>2.3</td></tr></table> Vaccination status of participants, split into those who have never previously vaccinated against flu and those who have, observed at follow up. Values indicate the percentage of participants' children in each group who had received a flu vaccination <table><tr><td></td><td>Standard risk presentation format</td><td>Standard risk information format + values clarification</td><td>Risk communication format</td><td>Risk communication +values clarification</td></tr><tr><td>All participants</td><td>44%</td><td>33%</td><td>46%</td><td>31%</td></tr><tr><td>No flu vaccination history</td><td>8%</td><td>23%</td><td>0%</td><td>0%</td></tr><tr><td>Flu vaccination history</td><td>67%</td><td>45%</td><td>58%</td><td>48%</td></tr></table> Neither experimental factor showed any effects in vaccination status (as observed from follow-up); even in the groups that had vaccination history,

Witteman 2015			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
authors' independence in designing the study, in collecting, analyzing, and interpreting the data, and in writing the article.		were provided with a brief list of resources for learning more about flu vaccines, including where they could get their child vaccinated	which was a group with strong intention to treat, had an average of 54% vaccination positive participants across control and intervention groups
Limitations identified by author Participants were recruited from an online pool of potential survey participants and thus may not be representative of the broader population. There was difficulty recruiting enough participants meeting the criteria, and the rate of follow up was low (29%). Risk and benefit information and decision attributes used in the values clarification exercise consisted only of those for which data were available for risk estimates. Therefore other potentially important decision makers were left out, such as out-of-pocket cost of the vaccine, or the time required to take the child to a location for vaccination. The qualitative analysis suggests such barriers are important to at least some people. The mere act of asking questions about values is a values clarification intervention, therefore it is hard to measure values congruence. Links to further information about flu and locations to get the vaccine were provided at the end of the original survey, in all groups. Therefore, it could be that this affected the vaccination status of all groups, not just intervention groups. Limitations identified by review team No others Other comments None.			

1

1G.1.14 Zimmerman 2014

Zimmerman 2014

<table>
<tr><th>Study detail</th><th>Inclusion/Exclusion and Patient population</th><th>Intervention/ Comparators</th><th>Results</th></tr>
<tr>
<td>Full citation
Zimmerman RK, Nowalk MP, Lin CJ, Hannibal K, Moehling KK, Huang H-H, Matambanadzo A, Troy J, Allred NJ, Gallik G, Reis EC. Cluster randomized trial of a toolkit and early vaccine delivery to improve childhood influenza vaccination rates in primary care, Vaccine, 32, 3656-63, 2014</td>
<td>Number of participants
N=81,599
'4 Pillars toolkit' =43,293
Usual care =38,306

Participant characteristics
Patient and practice level variables related to vaccination status in two-level generalized linear mixed modelling
<table>
<tr><th>Variable</th><th>Odds Ratio (95% CI)</th><th>P value</th></tr>
<tr><td>Patient level variables</td><td></td><td></td></tr>
<tr><td>Age</td><td>0.91 (0.90-0.91)</td><td><0.001</td></tr>
<tr><td>White race (ref. = non-white)</td><td>1.29 (1.23 - 1.34)</td><td><0.001</td></tr>
<tr><td>Commercial health insurance (ref. = public/self-pay/uninsured)</td><td>1.30 (1.25-1.35)</td><td><0.001</td></tr>
<tr><td>Practice level variables</td><td></td><td></td></tr>
<tr><td>Pre-intervention vaccination rate (unit=10% increase)</td><td>1.25</td><td><0.001</td></tr>
</table>
</td>
<td>Intervention / Comparison
Education, vaccine supply interventions and 4 Pillars toolkit The 4 Pillars Toolkit was based on four evidence-based key strategies:
Pillar 1 – Convenient vaccination services;
Pillar 2 - Notification of patients about the importance of immunization and the availability of vaccines;
Pillar 3 - Enhanced office systems to facilitate immunization;</td>
<td>Primary outcomes

Influenza vaccination rates in intervention and control sites, (2010-11)and intervention 2011-12 seasons
<table>
<tr><th>Intervention sites</th><th>Children (n)</th><th>Pre-intervention season (2010 - 11) %</th><th>Children (n)</th><th>Intervention season 2011-12 %</th><th>Absolute difference (%)</th><th>P value*</th></tr>
<tr><td>Intervention Site 9</td><td>7,040</td><td>58.2</td><td>6,942</td><td>58.8</td><td>0.6</td><td>0.49</td></tr>
<tr><td>Control Site 19 (paired with site 9)</td><td>3,234</td><td>54.6</td><td></td><td></td><td></td><td>0.32</td></tr>
<tr><td>Intervention Site 10</td><td>4,719</td><td>63.6</td><td></td><td></td><td></td><td>0.37</td></tr>
<tr><td>Control Site 20 (paired with site 10)</td><td>4,835</td><td>62.9</td><td></td><td></td><td></td><td>0.65</td></tr>
<tr><td>Intervention sites overall</td><td>43293</td><td>46</td><td>49,039</td><td>53.9</td><td>7.9†</td><td><0.01</td></tr>
</table>
</td>
</tr>
</table>

Zimmerman 2014

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results

Study detail

Study type
Cluster randomised study.

Aim of the study
To increase childhood influenza vaccination rates using a toolkit and early vaccine delivery in a randomized cluster trial.

Location and setting
Primary care paediatric and family medicine practices from two practice-based research networks

Inclusion/Exclusion and Patient population

	(1.16 - 1.34)	
Intervention (ref. = Control)	1.23 (1.01-1.50)	<0.05

Inclusion criteria
"To be eligible, the office must have had a patient population of at least 200 children, ages 6 months through to 18 years; access to vaccination data via an EMR (Electronic Medical Record); and willingness to make office changes to increase influenza vaccination rates."

Exclusion criteria
None given.

Intervention/ Comparators

Pillar 4 - Motivation through an office immunization champion.

The 4 Pillars Toolkit includes background on the importance of protecting children against influenza, barriers to increasing influenza vaccination from both provider and parent/patient perspectives and strategies to eliminate those barriers.
Practices were expected to implement strategies from each of the 4 pillars.

Results

Control sites overall	38,306	45.7	38,626	50.1	4.4†	<0.01
*For difference in vaccination rates between pre-intervention and intervention seasons						
†Difference between Intervention and Control arms P<0.034.						

Data from linked study - Nowalk et al (full citation in 'other comments'):

Intervention arm:

	Pre-intervention year, vaccinated n (%) (n=43,292)	Intervention year, vaccinated n (%) (n=49,037)	p-value*
Overall	19,903 (46.0)	26,447 (53.9)	<0.001
Age group			
6-23 months	3,890 (70.2)	4680 (75.0)	<0.001
2-8 years	9,945 (49.8)	12,938 (57.9)	<0.001
9-18 years	6,068 (34.1)	8,829 (43.2)	<0.001
Race			
Non-white	3,334 (33.7)	6,660 (50.9)	<0.001
White	16,569 (49.6)	19,787 (55.0)	<0.001

Zimmerman 2014

Study detail	Inclusion/Exclusion and Patient population	Intervention/ Comparators	Results
Length of study Seven months. September 2011 through March 2012. Source of funding Funding Source: Centers for Disease Control and Prevention. supported by the National Institutes of Health		Usual care	Control arm:

	Pre-intervention year, vaccinated n (%) (n=38,306)	Intervention year, vaccinated n (%) (n=38,626)	p-value*
Overall	17,492 (45.7)	19,335 (50.1)	<0.001
Age group			
6-23 months	2,914 (66.3)	3,088 (72.7)	<0.001
2-8 years	9,450 (52.8)	9,138 (56.6)	<0.001
9-18 years	6,128 (34.2)	7,109 (39.0)	<0.001
Race			
Non-white	3,046 (36.4)	3,440 (43.1)	<0.001
White	14,446 (48.3)	15,895 (51.9)	<0.001

*for difference between pre-intervention and intervention years

Notes

Limitations identified by author

"This study was limited by the facts that the rural sites randomly assigned to each arm were two offices of the same practice and that the community educational outreach and/or the knowledge that they were in a study may have led to increases in rates in the Control arm practice, thereby reducing the observed differences between arms. Further, vaccination rates may have been underestimated because vaccines given outside the practice may or may not have been captured from other sources."

Zimmerman 2014			
Study detail	**Inclusion/Exclusion and Patient population**	**Intervention/ Comparators**	**Results**
"Intervention practices overall had a greater proportion of non-white, commercially insured, and younger children than Control practices (P<0.001). The number of eligible children ranged from 536 to 8,183." Limitations identified by review team Not all strategies were used so difficult to say which ones were effective in increasing uptake. Each arm differed in number of inner city and suburban practices. Intervention practices overall had a greater proportion of non-white, commercially insured and younger children than control practices. Other comments Linked study Qualitative data, linked by study Grant ID: Bhat-Schelbert K, Lin CJ, Matambanadzo A, Hannibal K, Nowalk MP, Zimmerman RK. Barriers to and facilitators of child influenza vaccine - perspectives from parents, teens, marketing and healthcare professionals, Vaccine, 30, 2448-52, 2012			

1

2 G.2 Qualitative studies

3 G.2.1 Bhat-Schelbert 2012

Bhat-Schelbert 2012				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Bhat-Schelbert K, Lin CJ, Matambanadzo A, Hannibal K,	Data collection Focus groups conducted with healthcare providers,	Inclusion Attendance at Clinic. Exclusion None mentioned	Number of participants Eight focus groups with 91 parents, teens, pediatric healthcare staff and providers, and immunization and marketing experts. Participant characteristics N= 91	Key themes Barriers to childhood influenza vaccination Lack of knowledge and misinformation Many participants, including teenagers, reported not having enough information to make an informed choice: ". . .I don't even know what's the difference between the flu and a cold."

Bhat-Schelbert 2012				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Nowalk MP, Zimmerman RK. Barriers to and facilitators of child influenza vaccine - perspectives from parents, teens, marketing and healthcare professionals, Vaccine, 30, 2448-52, 2012 Quality score + Study type Qualitative. Aim of the study	parents, teens, and marketing professionals. Used a field guide. Recruited via word of mouth, email, or telephone for eight focus groups. Method of analysis Grounded theory.		Immunization and health professionals =39 Parents, =21 Adolescents =22 Marketing professionals =9 Participants groups were ethnically mixed and included Caucasian, East Asian (Chinese, Thai), Asian Indian, and African American, and Hispanic individuals. Teen participants or parent participants had children who were in public school, private school, and in home school. Female n= 68 Caucasian n = 71. Survey population Members of the Allegheny County Immunization Coalition (ACIC) Clinical and non-clinical staff of an academic inner-city pediatric practice; Pediatricians from an academic inner-city practice; Parents and Teens from urban Pittsburgh; Parents and	Many reported that the media was a common source of misinformation, and that media reports frequently create hype, incite fear, represent only one side of a story, and provide mixed messages about influenza immunizations: "I really do question whether. . . there really was as much danger if it was really as bad as the media was portraying it, because I think the media just went wild with [pandemic influenza]." Fear, mistrust and belief that vaccine is unnecessary: Participants, especially parents, reported concerns about adverse effects of influenza vaccinations such as pain, illness or even death. Others reported lack of trust that the vaccine was effective or that providers and drug companies truly have the public's best interest in mind: "I do not vaccinate my kids for anything . . .I feel there's too many unknown risks with the vaccine and especially with the flu vaccine with a new one coming out every year –I really question . . .how truly safe it is." Many participants reported that they do not always trust the media or the government for information. One participant stated:: ". . .I asked 'Why do you hesitate?' So the dad told me that he does not believe in the CDC projection of the next year influenza season." Anti-vaccinators tend to propagate their fears regarding vaccines: "I'm not sure I fully understand how it works and I didn't want to do anything artificial, to spur something on in her system, if she

Bhat-Schelbert 2012				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Perspectives from parents, teens, marketing and healthcare professionals Location and setting Source of funding Supported by grant (U01 IP000321) from the Center for Disease Control and Prevention.			Teens from the suburban Pittsburgh region; and Marketing faculty in the Johnstown, PA area.	was naturally designed to fight the flu then I would rather her body build up the immunities naturally. And so chose not to give her the flu shot." Importantly, participants from all groups reported that they believed that influenza immunization was unnecessary, citing reasons such as low risk for healthy children ,past recovery from influenza without residual effects and lack of an official mandate to be vaccinated against influenza prior to school enrolment. Teenagers reported that their decisions against vaccination were largely influenced by their parents. Logistical barriers Many participants stated that they were unlikely to make a trip to the doctor simply to have a child receive an influenza vaccination, especially if they had to miss work to do so, or if accessing the physician's office is difficult: ". . . If you don't have evening hours, you don't have Saturday appointments, it's an inconvenience and the flu shot isn't something that's going to hold my child back from school. . ." An impediment to influenza vaccination reported by both healthcare providers and parents is the frequent mismatch between vaccine demand and vaccine availability. For example, late delivery of commercial or Vaccines for Children (VFC) supplies of vaccine preclude vaccination of children early in the season when well child and preventive visits are occurring, limit the ability of practices to effectively plan influenza vaccination

Bhat-Schelbert 2012				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
				clinics, and discourage vaccination among children who must make a special trip to the practice to receive influenza vaccine: ". . .my experience was [in] the month of October, there was a lot of demand and we could not fulfil that demand because we did not have it [vaccine]." Facilitators of childhood influenza vaccination Health promotion and beneficence; Perceived benefit and trust; Better information; Logistical facilitators Strategies for increasing childhood influenza vaccination Provider strategies; Media and marketing; Teen-specific strategies
Limitations identified by author "Limitations of this qualitative study include sampling from a single major metropolitan area and one small town, limiting its generalizability." Limitations identified by review team None Other comments Linked to Zimmerman RK, Nowalk MP, Lin CJ, Hannibal K, Moehling KK, Huang H-H, Matambanadzo A, Troy J, Allred NJ, Gallik G, Reis EC. Cluster randomized trial of a toolkit and early vaccine delivery to improve childhood influenza vaccination rates in primary care, Vaccine, 32, 3656-63, 2014				

1

G.2.2 Birmingham 2011

Birmingham 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Birmingham E, Catallozzi M, Findley SE, Vawdrey DK, Kukafka R, Stockwell MS. FluAlert: A qualitative eva2011luation of providers' desired characteristics and concerns regarding computerized influenza vaccination alerts, Preventive medicine, 52, 274-277, 2011 Quality score	Data collection Focus group with providers; Individual interviews with practice leaders. Data were collected during the 2009–10 influenza season. Participants were not given visual materials characterizing how alerts might look. During semi-structured interviews,	Inclusion criteria Part of a wider study to introduce an Electronic Health Record. Exclusion criteria None given	Number of participants Four focus groups with providers (n=21) Five individual interviews Participant characteristics Twenty-one pediatric providers participated, and the size of the groups ranged from 3 to 7, varying based on the size of the practice. Practice leaders in an urban, pediatric primary care network affiliated with an academic medical center in New York City. Practices were based in Manhattan, serving a primarily Latino, publicly insured population.	Key themes Views on influenza vaccine delivery barriers and alerts from health care providers using EHRs, focus group participants and interviewees, New York City(2009). Current barriers to influenza vaccine delivery “My tendency, actually, is to give it during well visits or follow-up visits, but when the kids are sick, I can't — or, I mean essentially walking in for other stuff, I may not think about it, honestly.” “The primary barriers have to do with checking the 18 different places that it could be recorded that they've had the shot.” “…almost all flu vaccine discussions involve a lengthy discussion about what are the benefits and what are the dangers of the regular flu vaccine…So I think there's a deficit in information that we can't — it's very hard for us to get over.” Desired characteristics of an alert “…in a perfect world I think it probably would be smart to tag it to opening a note. Why not see that upfront at the beginning of your visit because then that's going to make you sensitive also to make sure that you cover past medical history, co-morbidities, to figure out how you're going to deliver.” “My only issue with that is, it has to be accurate. It has to be a kid who needs the flu vaccine and hasn't received it yet, that — and then I would be happy.” “I think when you look at the, I guess, the immunization registry (city registry), I think it's nice when it says ‘due.’ Like it actually tells you when the next one is due, and I think that's great. If

Birmingham 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
++ Study type Qualitative Aim of the study To explore pediatric providers' perceived barriers to influenza vaccine delivery, and desired characteristics and potential concerns regarding an influenza vaccine alert integrated into the electronic health record (EHR).	practice leaders were also asked about the logistics of implementing the alert in their practices, and perceived impact on vaccination rates. Method of analysis Thematic analysis			only we had time to do that on every patient." "Well, ideally, that's what I was suggesting is that you click on the alert, it takes you directly to orders — and when you finally submit the note, then it just automatically prints up in the room and you can give those things to the parent, and can choose the language. That might be helpful." Potential concerns regarding alert "I don't believe anything I see on the computer, sorry." "Things that should be done with one or two clicks, having five clicks is just annoying, disruptive, and it ends up not being done right." "It certainly shouldn't be one of those stop things that if you don't, then you can't proceed." "We get assaulted by 50,000 things, and so if this becomes another assault that doesn't quickly help us, we're going to ignore it. If it's something where we have to sort through a whole array of an hour's worth of information about flu shots, we're going to ignore it." "You know, the more reminders we get, the more shots we're going to be giving, and the more burden it is on the nursing staff."

Birmingham 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Location and setting Manhattan (NY, USA); Pediatric ambulatory care group practices Source of funding Grant number R18HS018158 (Stockwell) from the Agency for Healthcare Research and Quality				
Notes Limitations identified by author				

Birmingham 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Participants were all part of the same ambulatory care network, located in an urban, academic center setting. They were familiar with EHRs, but did not have current experience with immunization alerts. The interviews were conducted during the 2009–2010 influenza season, when H1N1 vaccination required additional clinic resources. This qualitative research is part of work to develop an alert system, and future studies are needed to assess which alert characteristic lead to actual improved influenza vaccination rates." Limitations identified by review team No others				

1

2

3 ### G.2.3 Bond 2011

Bond 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Bond, L. and Nolan, T., 2011. Making sense of perceptions of risk of diseases and vaccinations : a qualitative	Data collection Semi-structured, one-on-one interviews to collect information from parents about their children's health, experience of	Inclusion criteria Mother of at least 1 child between ages 3-30 months. Exclusion criteria Poor English.	Number of participants 8+ in each immunisation category – 45 in total Participant characteristics Mothers of children aged between 3-30 months Mix of first time and experienced mothers 4 groups recruited – mothers of children who were completely immunised for their age; mothers of children who were	Key themes Controlling exposure or outcome: Immunisers argued that they could not control their child's exposure to disease, and so vaccination was safer Incomplete immunisers believed vaccination would contain or reduce effects of disease rather than prevent it completely Non-immunisers talked about being able to control their children's environment, and therefore their exposure to the disease. Insufficient information:

Bond 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
study combining models of health beliefs, decision-making and risk perception. BMC Public Health, 11(1), p.1. Quality score + Study type Qualitative Aim of the study and intervention To examine the utility of the risk perception and decision making	illness in the family, their understanding and interpretation of risk and how all of these related to their decision to immunise. Interviews covered 4 themes: How mothers keep their children healthy; experience, familiarity and concerns regarding vaccine preventable diseases; concepts and influences on risk perception and the		incompletely immunised (behind recommended schedule); mothers of children who were partially immunised (parents chose not to have a specific immunisation); parents of children who had no immunisation 66% of mothers had 2 or more children 42% of mothers held a health care card (indicating low income) 57% of mothers had post-secondary school qualifications	Lack of information regarding vaccine side effect susceptibility caused mothers to refrain from vaccinating their child or to hesitate. One mother had major hesitation as no-one had seriously considered her questions or considered her son's case on an individual basis: "I want someone to look at him as an individual and I don't feel that they are the medical community....I don't want people making the decisions for me. ...I want that information available so that I can make an informed choice" (Non- immuniser, #18) Some however 'shut their eyes' to the information provided about vaccine risk because it was unsettling. Anger regarding insufficient information was more often expressed by non-immunisers who believed that drug companies and doctors knew that vaccines were not safe but kept that information from the public. Omission bias: Whether parents chose not to act, when action may cause harm, was explored. 2 statements describing whether 1) it would be worse to have your child die due to immunisation or 2) it would be worse to have your child die due to inaction (and catch the disease) Most parents, irrespective of immunisation status, identified more with the second statement. Parents used their perceptions of the risks of the outcome of death from vaccine or the risk of getting the disease to explain

Bond 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
theories to provide a better understanding of the differences between immunisers' and non-immunisers' health beliefs and behaviours, when considering the risks of a 'new strain of flu'. Location and setting 5 metropolitan areas in Melbourne, Australia. Source of funding	decisions experience and outcomes regarding immunisation. Method of analysis Interviews were thematically coded. Focuses on whether the responses were congruent or incongruent with theories of health behaviour, decision-making and risk perception.			their choice – death from the vaccine wasn't perceived as likely to occur and this shaped the choice. Optimistic bias and illusion of control: Participants were given 2 hypothetical news reports – 1 describing themselves as the high risk group for influenza death and 1 describing children as the high risk group. Participants generally did not believe they were susceptible to flu and didn't identify themselves within the high risk group (even though in this information they were). All parents stated that the news article describing children as a high risk group would be of greater concern to them. Their first action would be to seek information from their health advisors. Responses to epidemiology: When provided with numbers of deaths form influenza, responses mainly were that their response would depend on how similar to their own circumstances were those who had died: Did they live in the same region/other developed countries? Were those who died previously healthy or were they sick and more susceptible? Participants wanted to know the details of who had died or suffered complications. It was not the statistics that were important for deciding risk, but the characteristics of those who had the disease.

Bond 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
This study was funded by the National Health and Medical Research Council, Australia. Lyndal Bond is currently funded by the CSO, Scottish Government Health Directorates.				
Limitations identified by author Data collected in late 1990's, and so different socio-temporal contexts now applicable may have created different issues Limitations identified by review team Some risk of bias in the recruitment of mothers, as recruited by nurses approaching those who 'to the best of their knowledge were mothers of high and low education and high and low income' – although final demographic well split. In addition, exclusion based on 'poor English' may mean this information is not transferable to all in society.				

1

2 ### G.2.4 Crocker 2016

Crocker 2016				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Crocker, J. Meredith, N. and Roberts, R. Vaccine Preventable Disease Programme (VPDP): Survey of GP Practices Exploring Aspects of their 2014-15 Flu Vaccination Campaigns; 2016; NHS Wales (intranet) Quality score - Study type	Data collection GP practices invited by email to complete quetsionnaire, with responses collected over a 3 month period. Method of analysis Percentage for each individual response and common themes of comments presented Open ended questions Thematic	Inclusion criteria GP practice in Wales Exclusion criteria None stated	Number of participants 108 practices Participant characteristics None stated Call/recall approaches – but note limitations identified by the NICE team “Little data presented to distinguish between which interventions performed at which practices and their resulting comments.”	Context/Intervention - (summary responses here only included to provide context for themes below): The majority of GP practices used the intervention of actively inviting all children at the beginning of the season (82, 75.9%) A variety of other interventions were utilised (number of practices, % of practices): Invitation of all children who had not attended by a certain date (13, 12.0%) Invitation of some of the children at the start of the season (2, 1.9%) Invitation of some who hadn’t attended by a certain date (5, 4.6%) Invitation as supplies of vaccine became available (2, 1.9%) The majority of GP practices sent a letter specifically tailored to the child flu vaccination campaign (51, 47.2%) Others: Sent a general flu letter (1, 0.9%) Invited children by telephone (10, 9.3%) Invited children opportunistically (2, 1.9%) Sent a letter to all these children via Child Health Department (1, 0.9%) Combination of the above

Crocker 2016				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Qualitative survey Aim of the study To explore aspects of GP Practice flu vaccination campaigns Location and setting GP practices throughout Wales Source of funding Public Health Wales	analysis (these are the key results			Children who did not attend a flu vaccination, were invited a second time in 52 (48.1%) of practices, using 1 or more of the previously described methods. COMMON THEMES/RESULTS: Perception of delayed or inconsistent central delivery of LAIV impeding the flu vaccination aimed at children in 10 practices Promotional advertising was less visible than previous years in 5 practices, and believed it was impacting awareness and uptake Negative publicity about low efficacy of vaccine impacted in 3 practices Lack of awareness of and confidence in relatively new intranasal vaccine reported at 3 practices Difficulty running large scale campaign and maintaining the other requirements and functions of the GP practice reported by 3 practices Uptake among children reduced as eligible children were in school when GP practice could offer the vaccine

Crocker 2016				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Notes Limitations identified by author GP practices were 'self-selecting' as they chose to be involved; response rate was low, so cannot be generalised to draw conclusions across Wales Limitations identified by review team Little data presented to distinguish between which interventions performed at which practices and their resulting comments. No demographic data on the practices which participated.				

1

2 ### G.2.5 Dyson 2015

Dyson 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Dyson J., Meredith N. and Roberts R. Childhood flu vaccine focus groups report; 2015; Public Health Wales	Data collection 3 focus groups Method of analysis Recordings transcribed and subject to thematic analysis	Inclusion criteria Parent Exclusion criteria None given	Number of participants 19 Participant characteristics 18 mothers, 1 father White, English first language Parents had 1-3 children Ages 16-44 (max and min)	Nasal flu vaccine awareness: 8/19 parents aware that nasal flu vaccine available (but majority (7/8) of parents with children eligible to receive nasal vaccine (children aged 2-3) were aware of it and their child had received it). 10/19 parents would be more likely to get their child vaccinated if the nasal spray was offered Parental experiences: 7 children were immunised with nasal vaccine. Of these parents, 6 reported a positive experience of the vaccination.

Dyson 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Quality score - Study type Aim of the study To explore parental awareness, experience and opinion relating to the childhood flu vaccine for 2 and 3 year olds during the 2013/14 flu season. Location and setting Playgroups, South East Wales Source of funding				Opinions on child's flu leaflet: When shown a child's flu leaflet, comments included: "would expect to see a child having the nasal spray" "I like the links" (when asked about inclusion of links to other sources in the leaflet) "trust info in leaflets" "good idea to have them" In response to the use of QR codes on leaflets: "they never work" (after explanation of their function) "I probably would use in the future" "it's a good idea" Beat the bugs flu awareness online game: Parental view generally negative Parents very reluctant to play online games Comments included: "I don't think it's a good idea" "Children wouldn't get the concept of a bug" "I ignore links to games on Facebook" Opinions of future promotion: All participants felt that a personal invitation with a copy of the children's flu leaflet, preferably to include an image of a child having their nasal spray vaccination, was the best way to promote the children's flu vaccination. When asked about posters, most parents felt there were already too many posters on the notice boards at the GP. Suggestions for good locations for posters included mostly

Dyson 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Public Health Wales?				places they waited to collect their children, such as the door of nurseries and bus stops and trains. What helps? All participants stated that advice from their health visitor was an important factor in helping them decide on the vaccination. Personal invitation and information leaflets also deemed helpful. Parents felt that radio advertisements, Twitter and celebrity endorsements would not influence their decision.
Notes <u>Limitations identified by author</u> Small sample size and lack of ethnic minority representation. Some parents included did not have children eligible for flu vaccination that year. An opt-in volunteering recruitment might have meant that more motivated parents with an interest in flu vaccination took part. Health visitor was known to parents and participated in 1/3 focus groups, which may have inhibited how freely participants answered the questions. <u>Limitations identified by review team</u> Flu uptake of eligible 2-3yr olds within with focus group was 87.5% compared to national uptake of 37.8% - attitudes and knowledge probably not representative of the whole population.				

1

G.2.6 Flood 2011

Flood 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Flood EM, Block SL, Hall MC, Rousculp MD, Divino VM, Toback SL, Mahadevia PJ.Children's perceptions of influenza illness and preferences for influenza vaccine. J Pediatr Health Care. 2011 May-Jun;25(3):171-9. doi: 10.1016/j.pedhc.2010.04.007. Epub 2010 Jun 1 Quality score ++	Data collection Interviews followed a semi-structured interview guide and asked each child about his or her experiences with influenza and experiences, perceptions and preferences regarding influenza vaccination. Method of analysis Thematic analysis	Inclusion criteria Children were: English speaking Between the ages of 6-12 Able to actively participate in a one-on-one interview Exclusion criteria None mentioned	Number of participants 28 Participant characteristics Aged 6-12 2 boys and 2 girls per year of age Average age of parents/caregivers was 41; 68% had a university degree Various races and ethnicities 79% had received an influenza vaccination in the past	Perceptions of Vaccines and Shots in General: In children aged 8-12, 17/20 (85%) had heard the word 'vaccine' before In children aged 6-7, 1/8 (12.5%) had heard the word 'vaccine' before ~50% of children 9-12 were able to give an accurate definition of a vaccine 20/28 children (71%) were able to give accurate responses on the purpose of vaccinations (younger children were not as able) 22/23 (96%) said their most recent shot was a good idea in order to keep them healthy Perceptions of Influenza: Definition, Risk and Severity: Most children had heard the word 'flu' before; older children could more accurately define flu, in more detail Some children did not think they would get flu this season because they are not sick often and they use preventative measures such as eating healthily and maintain personal hygiene. Younger children thought influenza was less serious than older children Perceptions of Influenza Vaccine: 23/27 children (85%) responded that getting the flu shot was a good idea

Flood 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Study type Qualitative interviews to assess knowledge and attitudes Aim of the study Better understand children's knowledge of influenza, including their perceptions about the severity of the illness and their perceived risk of acquiring it. Determine the vaccine attributes				Of those who said no, 3 referenced the pain as the reason, and 1 didn't think it was worth it to avoid "a few days of sickness". When hypothetically offered an alternative to a shot for the vaccination, they all now said they would get the vaccine. Preferences for influenza Vaccine Attributes: Mode of Administration 20/27 children (74%) preferred the nasal spray primarily because "shots hurt" 6/27 (22%) said they would choose the shot, due to familiarity, the shot being quicker, it not being that painful or the nasal spray being "weird" Preferences for Influenza Vaccine Attributes: Efficacy Given a hypothetical situation where the less preferred method of vaccination was 2x more effective, most children chose the more effective method

Flood 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
that are important to children and that influence their preferences for the available vaccine options; and investigate children's ability to understand ''risk'' (i.e., risk of having an adverse effect), as well as their ability to consider multiple attributes simultaneou sly (i.e., make trade-offs) when choosing between influenza				

Flood 2011				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
vaccine alternatives. **Location and setting** General population in Washington DC metropolitan area **Source of funding** Sponsored by MedImmune LLC				
Notes <u>Limitations identified by author</u> Parents of the sample of children were generally well-educated, with 68% of the consenting parents having attained a college degree or higher – this therefore may not represent the children within the general population. <u>Limitations identified by review team</u> The interview questions altered throughout the study – additional questions were added after the 8th interview; not disclosed which age range of children these additional questions were put to, and so there is inconsistency throughout population.				

G.2.7 Gazmararian 2010

Gazmararian 2010				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Gazmararian JA, Orenstein W, Prill M, Hitzhusen HB, Coleman, MS, Pazol K, Oster N V. Maternal knowledge and attitudes toward influenza vaccination: a focus group study in metropolitan Atlanta, Clinical pediatrics, 49, 1018-25, 2010 Quality score ++	Data collection 9 focus groups, each 1.5 hours long conducted. Participants were asked about their preferences for how to learn about influenza vaccines and vaccine policy and for their suggestions regarding influenza vaccine educational campaigns. Method of analysis Audiotapes, transcription	Inclusion criteria Mother/step mother/official female guardian of a child who had previously been immunised against any disease Comfortable conversing in English 18 years of age or older Primary or joint decision maker in the health care decisions for a child/children	Number of participants 4-7 in each focus group; 54 mothers in total. Participant characteristics All participants were mothers/step-mothers/female primary caregivers of a child aged between 5-12 years old Mixture of race and ethnicities (Caucasian; African American; Hispanic; Asian) Groups separated into those in favour of vaccination for influenza (pro-vaccination), those who were not in favour of influenza vaccination (anti-vaccination) and those who were undecided. Categories further split by income into 3 groups (<$35k, $35-50k and >$50k annual household income).	Key themes: Knowledge All groups aware of who was at risk for influenza and it's complications, and what those complications might be A range of misinformation and misunderstanding about how influenza vaccines work; eg participants believed a person can get influenza from the vaccines Flu was described as a catch-all term for a variety of illnesses Attitudes Participants whose children were generally healthy, did not feel compelled to get the vaccine, because they didn't feel they were at risk (all vaccination groups). All groups agreed that vaccination was a personal choice that did not impact on the rest of the community. Safety of vaccinations not disputed All groups recognised a benefit in not having their child at home sick, or having themselves bed-ridden due to the disruption this would cause. Barriers Pointed to a lack of knowledge about the degree of protection they could expect from influenza vaccines as a primary barrier to vaccination. The uncertainty of whether the vaccination is protective against current strains was unsettling.

Gazmararian 2010				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Study type Qualitative focus groups Aim of the study To explore the under-lying knowledge, concerns, and attitudes of mothers of school-aged children toward the influenza vaccine and to assess what methods of communicati on about influenza vaccination	and researchers notes were used by the facilitator to write a summary report, including direct quotes. 4 investigators independently reviewed the transcripts using systematic content analysis and compared the facilitators summary with their own observations of the groups and interpretations of the transcripts. Investigators then came to an agreement	between the ages of 5-12. Exclusion criteria Excluded if they or a household or immediate family member were employed in advertising, public relations, marketing, delivery of healthcare services, or development of health policy.		Some participants in anti-vaccination group, understood that it must be beneficial, but because the benefit was not adequately explained, they chose not to act. Many participants acknowledged that if influenza vaccination was required to enrol their children in school, they would comply. Participants preferences for how they learn about influenza vaccines and vaccine policy: Paediatricians were viewed as the most credible source for many participants, and many preferred that policy is filtered to them via their paediatrician “If [the recommendation] was more personalized coming down through the pediatrician to me specifically, then I would take note.” Some participants prefer to hear about vaccine recommendations from a local source, such as their pharmacy, the local health department or their child’s school. In some communities, older people were seen as an important source of information about family health, including vaccine recommendations The media and celebrity promotion generally not seen as an accurate source of information, or credible. Although certain celebrities were seen as a credible source:

Gazmararian 2010				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
and its delivery would work best to increase knowledge and promote vaccination among this audience. Location and setting Metro Atlanta Source of funding Grant Number 1P20RR020735 from the National Center for Research Resources, a	on the list of the key themes and discussion points.			"Oprah [is credible] because she doesn't need the money to be promoting something like this, she's a very intelligent woman." Pharmaceutical companies not seen as a credible source, as they are not trusted to only be promoting vaccination for financial gain. Participants' suggestions regarding influenza vaccination educational campaigns Encourage paediatricians to recommend vaccinations verbally Create a media campaign launching in September/October, beginning with the information (if true) that there is adequate vaccine for all that want it Clarify the idea that children are more likely to have severe complications from influenza Answer lingering questions about influenza vaccines: Can influenza be contracted from the vaccine? Why is annual vaccination necessary? Offer specific odds, if possible, on the protection offered by vaccines (eg. vaccination protects against 80% of the influenza strains this year) Communication must focus on personal protection Avoid scare tactics Offer vaccinations at as many locations as possible (such as schools, workplaces, grocery stores, pharmacists, the health department and churches) Set up a mobile unit that visits schools and dispenses influenza vaccines to school aged children

Gazmararian 2010				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
component of the National Institutes of Health				School entry requirements would be a compelling reason to get vaccinated
Limitations identified by author Modest sample size, Only 1 geographical area, Only those comfortable speaking English were eligible. Only mothers, not fathers, grandparents or foster parents spoken to. Group setting can shape the discussions (tried to avoid by splitting according to income and vaccination status), Groups were not replicated within the study Limitations identified by review team The statements reported from participants were very broad. This decreases the likelihood there was bias, but there's no information stating how many participants agreed with each statement.				

1

2 ### G.2.8 Szilagyi 2015

Szilagyi 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Szilagyi, P.G., Serwint, J.R.,	Data collection Phone interviews with 1	Inclusion criteria Practices within the Greater	Number of participants 11 intervention practices Participant characteristics	Key themes All 11 practices reported that they believed prompts were effective in reducing missed opportunities and improving immunisation rates.

Szilagyi 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Humiston, S.G., Rand, C.M., Schaffer, S., Vincelli, P., Dhepyasuwan, N., Blumkin, A., Albertin, C. and Curtis, C.R., 2015. Effect of provider prompts on adolescent immunization rates: a randomized trial. Academic pediatrics, 15(2), pp.149-157. Quality score + Study type Qualitative	practitioner of each intervention practice Assessed perceptions of feasibility, acceptability and sustainability Method of analysis Interviews reviewed by 3 authors with interpretive differences resolved through discussion	Rochester practice based research network or within the national continuity clinic research network Exclusion criteria None specified	Physician leader and an office manager from each intervention practice were interviewed. Practices included: 4x suburban paediatric practices 5x urban paediatric practices 1x rural family medicine practice 1x rural paediatric practice Provider prompts targeted at adolescents aged 11-17	Nearly all respondents (no quantitative measure provided) wished to continue using prompts. Most respondents stated that providers ignored prompts when practices were busy. Barriers to prompts: Prompt errors (due to incomplete vaccine records being held on the electronic health record which prompts relied on being accurate) Added time for documenting refusals for vaccination Time constraints for nurses (only applicable to practices which used nurse initiated prompts) Lack of complete intervention acceptance by all practice members, including physicians and staff

Szilagyi 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Aim of the study and intervention To assess the feasibility, acceptability and sustainability of either electronic health record delivered, or nurse/staff initiated provider prompts for influenza immunisation of adolescents aged 11-17, amongst practitioners. Location and setting				

Szilagyi 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Paediatric and family medicine practices in Monroe County, New York; paediatric continuity clinics within 36 states across USA (mainly large, hospital-based clinics) Source of funding US Center for Disease Control and Prevention (grant 5U011P00312)				
Notes				

Szilagyi 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Limitations identified by author Limited number of practices Loss of 1 intervention practice from study Many practices had recently changed their system onto electronic health records, therefore the overwhelming impact of using this, dampened the immunisation prompt effects Alerts were not modifiable Unable to measure provider discussions with patients Limitations identified by review team The intervention was inconsistent amongst the practices: 2 of the practices didn't use electronic health records, and their provider prompt was instead delivered by nurses or staff who reviewed immunisation records of each adolescent attending the practice. No data is given separating these practices, neither is it evaluated whether the nurse delivered prompt intervention was followed as per instructed.				

1

2

3 G.2.9 Witteman 2015

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Witteman HO, Chipenda Dansokho S, Exe N,	Data collection Online questions were completed by	Inclusion criteria Live in the USA; be 18 or over; be a parent or	Number of participants 407 in original survey 116 (29%) completed follow up survey	Key themes 2 broad themes were observed as to why participants chose to get their child vaccinated or not: belief and logistics

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Dupuis A, Provencher T, Zikmund-Fisher BJ. Risk communication, values clarification, and vaccination decisions. Risk Anal. 2015 Oct;35(10):1801-19. doi: 10.1111/risa.12418. Epub 2015 May 20. Quality score + Study type Qualitative survey Aim of the study	members of an online community of questionnaire participants, and compensated between $0.60-$1.11 depending on the timing of recruitment and continued participation in the study. A 2x2 factorial study was performed. Informed consent was given during an original (first) survey, followed by general information about flu before randomisation. A control	guardian who makes medical decisions for at least 1 child aged 6months-18 years. Exclusion criteria Participant's child could not have received the influenza vaccine in the current flu season; child could not have a medical reason to avoid the flu vaccine.	Participant characteristics Predominantly female (63% original; 61% follow up) Half aged 28-41; mean age 35 Ethnicities and races diverse Half had no university degree 41% - child had never received influenza vaccine Follow up survey generally characteristic of original group, although had a statistically significant older mean age of 37 Nearly all participant characteristics evenly distributed across experimental factors during randomisation. 3/18 Asian or Asian Americans were randomised to the value clarification factor, the rest were not. As these participants represented a small fraction of the sample and race was not a planned moderating factor in the analysis, the imbalance didn't change the analytical approach.	Beliefs were found to be concerning: Beliefs about the vaccine Immunity The flu How the decision to vaccinate their child or not might impact others Participants who DID get their child vaccinated almost exclusively cited beliefs as their reason. Among participants who did NOT get their child vaccinated, beliefs was still the most cited reason, but logistics was also a common theme. There were 6 participants who did not intend to have their child vaccinated, but at follow up had positive vaccination status. All 6 cited the theme of beliefs as their reason for the vaccination. There were 29 participants who did not vaccinate their children, but had intended to. Logistics was the dominant theme in their reason to not vaccinate. Sample quotes given as reasons for vaccination and lack of vaccination: No vaccination – beliefs:

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
To better understand how to help people make more informed choices when presented with risk-benefit trade-offs. By helping people understand the different statistics for vaccinated and unvaccinated children and also guiding them through the process of aligning their choices with their values relevant to the decision, it was	group were given the risks and benefits of flu vaccines for children in standard form, while test groups were given the information in risk communication format. Both groups were then randomised a 2nd time with 50% of participants undergoing values clarification and 50% not, before vaccination intentions were observed and additional open ended			"I don't get the flu vaccine for my children or myself because in my own experience, getting the vaccine has always made me actually get the flu, so I don't want to have that same thing happen for my children." "They [vaccines] genetically alter the person and can affect that person's offspring." "The flu virus does not appear to be that dangerous, an inconvenience at most… it was just not that important." "I believe in the power of the immune system. If my child gets the flu then she will develop the antibodies to prevent it in the future. A vaccine is no sure way of preventing the varying strains of the flu. In my experience the perpetual vaccination process only makes for stronger viruses that are more resistant in the future." "I have always felt the flu vaccine was unnecessary…My concern has always been that although they vaccinate against the flu strain— they don't know which one will hit during that year so it can't vaccinate against the current flu outbreak." No vaccination – logistics that hindered vaccination: "I did not take him to get the flu vaccine because it was difficult to take off of work to bring him."

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
hypothesised that higher intentions among participants to vaccinate their children and thus higher rates of vaccination would be observed. Location and setting Online; living in the USA Source of funding Dr. Witteman received a small honorarium and travel funds from the Harvard	questions asked. After 7 months, a follow up survey was provided to obtain vaccination status of each participant's children. The primary outcome of the original survey was to assess vaccination intentions following intervention. A secondary outcome was to assess values convergence. The primary outcome of			"I mentioned it to his doctor but they said they didn't have any. I intended to bring him back but didn't get around to it." "Honestly, we were so busy that I just forgot. Nothing else." Vaccination – beliefs: "I did not want my child to become ill and miss many school days." "I have a large family, with a lot of family gatherings. Some people in my family have sensitive health issues. If any of us gets the flu, we may endanger someone else in the family. So we all get shots." "I work in the healthcare industry. All members of my family get the flu vaccine every year. Because I work with high risk patients, and there is a chance that I might bring home the flu, it makes sense to vaccinate. This provides protection to my family, as well as lowering the risk that I might bring an illness to the patients that I work with on a day to day basis." "My kids have never had any negative side effects. I had the flu once and I would never want my children to experience that." "She was attending preschool and colds seemed to circulate from one child to another. I did it to give her added immune protection."

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Center for Risk Analysis to present portions of this work at a conference hosted by the Center in 2014. Dr. Witteman is also supported by a Research Scholar Junior 1 career development award from the Fonds de recherche du Qu´ebec – Sant´ e. Dr. Zikmund-Fisher was supported by a career developmen	the follow up survey was to assess vaccination status. A secondary outcome was to assess the reasons for not vaccinating. Intervention: Participants in the risk communication group were exposed to Risk Communication presentation of information about flu, showing absolute risk estimates of the risks and benefits of flu vaccination for children,			Vaccination – logistics that helped vaccination: “We got them the vaccine because it was offered at Walgreens [a large pharmacy chain in the U.S.]. I did notice that they were not sick as often this winter as they have been in the past.” “My child got the flu vaccine mainly because it is a requirement to attend public school districts…”

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
t award from the American Cancer Society (MRSG-06-130-01-CPPB). The funding agreements ensured the authors' independence in designing the study, in collecting, analyzing, and interpreting the data, and in writing the article.	including rates of paediatric deaths for 2012-13 due to influenza and side effects of flu vaccines among children in USA. Icon arrays were used to explain the differences in death rates between groups of vaccinated and unvaccinated children. Numbers of children hospitalised in each group were shown, and calculations to explicitly show the difference			

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
	in numbers was provided. Values Clarification condition was the second intervention, in which participants were asked to use sliders to indicate the importance of competing risks, eg avoiding Guillain-Barre Syndrome. The position of the sliders were dependant on each other, making trade-offs in the decision explicit. At the conclusion of			

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
	the survey, participants were provided with a brief list of resources for learning more about flu vaccines, including where they could get their child vaccinated. Method of analysis Thematic analysis of the responses to why participants had or had not had their children vaccinated were conducted, summarising the frequencies of			

Witteman 2015				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
	certain themes which were consistent within the responses.			

Notes

Limitations identified by author

Participants were recruited from an online pool of potential survey participants and thus may not be representative of the broader population.

There was difficulty recruiting enough participants meeting the criteria, and the rate of follow up was low (29%).

Risk and benefit information and decision attributes used in the values clarification exercise consisted only of those for which data were available for risk estimates. Therefore other potentially important decision makers were left out, such as out-of-pocket cost of the vaccine, or the time required taking the child to a location for vaccination. The qualitative analysis suggests such barriers are important to at least some people.

The mere act of asking questions about values is a values clarification intervention; therefore it is hard to measure values congruence.

Links to further information about flu and locations to get the vaccine were provided at the end of the original survey, in all groups. Therefore, it could be that this affected the vaccination status of all groups, not just intervention groups.

Limitations identified by review team

No others

1

2

G.2.11 Kempe 2014

Kempe 2014				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
Full citation Kempe, Allison, Albright, Karen, O'Leary, S., Kolasa, Maureen, Barnard, Juliana, Kile, Deidre, Lockhart, Steven, Dickinson, L. Miriam, Shmueli, Doron, Babbel, Christine, Barrow, Jennifer; Effectiveness of primary care-public health collaborations in the delivery of influenza vaccine: a	Data collection After year 1: Single focus group conducted with a representative (physicians, physician's assistant and practice administrator) from each practice and public health department representative After year 2: Individual phone interviews with practice and public health department	No specific information on inclusion/exclusion criteria of practices; "practices chosen to be roughly similar in size, % of children with high-risk conditions and % of children eligible for Vaccines for Children program"	Number of participants 5 Participant characteristics 4 intervention practices (each 1x representative) + 1x public health department representative Intervention practices in an urban setting	Key themes Assessing views on the intervention for practices to collaborate with the public health department by: 1) community clinics working with practices and the public health department and 2) public health department nurses coming to practice sites to aid delivery of flu vaccine Perceived benefits to practice and public health department: Increase in the personal connection between public health department and practices "I don't think I'd have thought about using (the public health department) before this study. Now, I think it's a great resource available" "It gives us a face and a name so we can call (the public health department) if we have other problems" Perceived benefits to patients: Additional clinics, particularly those held at different times (evenings; Saturdays) or those held in interesting of 'value-added' places (eg fire stations, or sports centre) were popular with patients "We did Saturday (collaborative clinics) and… we did get a lot of patients coming in and presumably they were all patients who were reached somehow by the automated phone message system or postcards. Because that's not something we have ever done before. So I think that part really helped to give people an alternative time to come in and they took advantage of it"

Kempe 2014				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
cluster-randomized pragmatic trial Preventive Medicine; 69:110-116; 2014 Quality score ++ Study type Qualitative Aim of the study and intervention A public-private collaboration was initiated between community clinics and public health department nurses who	representatives Method of analysis Transcripts independently read multiple times by 2 qualitative analysts; code categories independently developed, and compared until agreement achieved – codes applied to transcripts. ATLAS.ti v.7.0 used.			Perceived barriers: Practices had difficulty in predicting when influenza vaccine supplies would arrive, and they were often late. Public and private supplies arrived at different times. These issues made planning of a collaborative effort difficult. “We were going to do a family flu clinic in one of our offices in conjunction with (the public health department) and I know we had to cancel that because of the supply. We tried to do things collaboratively but some of those things that we don't have any control over get in the way.” Practices were concerned about having unused vaccine left at the end of the season. Some practices were disinclined to participate in a collaborative effort because they needed to use up their vaccine supply. “If we happen to have a year where flu hits early or there is a death, there is a lot of demand. If there's a shortage of flu vaccine and it's well publicized, there is more demand than usual. But if the weather is good and there's not much talk about flu… there's not a real urgency to it. I think that there were a couple of opportunities that we talked about where (the public health department) wanted to use their vaccine and their people and then we just get into, well, we really need to use our vaccine.” Concerns about recording and tracking immunisations given “If we had somebody in the office who is not familiar with our processes and our electronic records and things, it's not a whole lot of help. If anything, it's a little bit of a hindrance. You

Kempe 2014				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
aided in vaccine delivery at practices. Qualitative methods were used to enrich the understanding and interpretation of quantitative flu vaccination uptake results and to evaluate effectiveness and sustainability from practitioner perspective. Location and setting Pediatric and family medicine				know, they can give the vaccine but our employees still need to enter it into our electronic medical records." Staffing issues "It maybe because we're a larger practice ,but we usually don't have any problem staffing our flu clinics .So I think that in some ways our (staff) would think that they're losing the opportunity to get extra hours in by doing flu clinics if we had (the public health department) staff coming in."

Kempe 2014				
Study details	**Research Parameters**	**Inclusion/ Exclusion criteria**	**Population**	**Results**
private practices; urban Denver Metropolitan area (USA) Source of funding Grant from Center for Disease Control and Prevention (U01 IP000320)				
Limitations identified by author None Limitations identified by review team No information given on how the practices were recruited or the 'characteristics' of the practices Only 4 practices in intervention group, and only 5 representatives present in focus group and interview.				

1

2

Appendix H: Economic evidence tables

No economic studies were identified for inclusion in this review

Appendix I: GRADE tables

I.1 GRADE Profile 1

Review Question 1a: What interventions to promote information about, and acceptability of, flu vaccination are the most effective for increasing acceptability and uptake of seasonal flu vaccination among children

Outcome: uptake of seasonal flu vaccination in children

Quality assessment								Effect	Quality	Outcome rating
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	No. of participants	Relative risk (95% CI)		
Educational interventions vs. Usual care / no intervention control – children aged 6m to 18yrs [Forest plot Figure 1; [ES1.1]										
2[1-2]	Before and after, nRCT	Serious [a]	Serious [b]	Serious [c]	No serious	None	4,970	1.51 (1.40 to 1.64)	Very low	critical
1[3]	RCT	Serious [d]	n/a	No serious	Very serious [e]	None	116 (vaccination survey sample)	0.86 (0.54 to 1.39)	Very low	critical

1. Suryadevara 2013 [B&A]*
2. Gargano 2011 [nRCT]
3. Witteman 2015 [RCT]**

[a] downgraded 1 level - baseline characteristics differ significantly by group (Gargano 2011)
[b] downgraded 1 level - heterogeneity I^2 = 82%
[c] downgraded 1 level – includes age range outside that specified in review protocol inclusion criteria

[d] downgraded 1 level - high rate of attrition: vaccination information available only for 116/407 (29%)
[e] downgraded 2 levels – 95%CI crosses both lower and upper MID thresholds (RR 0.95 and RR1.05)RR and 95% CI based on post-hoc analysis by NICE team
** data from per protocol analysis

1

I.2 2 GRADE Profile 2

3 **Outcome: intention to vaccinate child against seasonal flu**

Quality assessment							No. of participants	Effect		Quality	Outcome rating
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations					
Educational interventions versus Usual care or no intervention (control) – children aged 6 months to 18 years [ES1.2]											
1 [1]	Before and after	No serious	n/a	No serious	Serious [a]	None	90	2.2 % increase in intention to vaccinate post intervention		Very low	Important
1[2]	RCT	No serious	n/a	No serious	Very serious [b]	None	407 (survey respondent sample)	Intervention/control	Change in response (-4 to 4)	Low	Important
								Standard risk presentation format -	0.3		
								Standard risk presentation format + Values clarification interface	0.3		
								Risk communication format	0.4		
								Risk communication format + Values clarification interface	1.3		

1.Joshi 20092 [B&A]
2.Witteman 2015 [RCT]

[a] downgrade 1 level – 95%CI not reported so imprecision could not be assessed; small study sample (total events<300) reduces certainty in evidence
[b] downgrade 2 levels – variance around mean difference in response scores not reported

1

I.32 GRADE profile 3

3 **Outcome: Increasing uptake of single or second dose of seasonal flu vaccination in children (6 months to 18 yrs)**

Quality assessment								Effect	Quality	Outcome rating
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	No. of participants	Relative risk (95% CI)		
SMS messaging to parents										
SMS messages (all) vs. Usual care or control [Forest plot Figure 2; ES 3.1]										
3[1-3]	RCT	No serious	No serious	No serious	Serious [a]	None	13,533	1.12 (1.04 to 1.19)	Moderate	critical
Subgroup: Complexity of intervention - SMS multi-component (SMS plus) vs Single component (SMS basic) [Forest plot Figure 2;ES 3.2]										
2[1,3]	RCT	No serious	No serious	No serious	Serious [a]	None	3981	1.09 (1.02 to 1.17)	Moderate	critical
Subgroup : Content of intervention - Educational SMS message vs Usual care (telephone or written reminder) [Forest plot Figure 3; ES 3.3]										

3[1-3]	RCT	No serious	No serious	No serious	Serious [a]	None	13,313	1.11 (1.03 to 1.19)	Moderate	critical
Subgroup: SMS messages vs. Usual care by age - child aged 24-59 months [ES 3.3]										
2[1-2]	RCT	No serious	No serious	No serious	Serious [a]	None	4,875	1.08 (1.01 to 1.16)	Moderate	critical
Subgroup: SMS messages vs. Usual care by age - child aged 5-17 years [ES 3.3]										
2[1-2]	RCT	No serious	No serious	No serious	Serious [a]	None	5,146	1.10 (1.00 to 1.20)	Moderate	critical
Provider Prompts										
Provider Prompts vs No provider prompts [Forest plot Figure 4; ES 3.4]										
2[4-5]	RCT	Serious [b]	No serious	No serious	Serious [a]	None	10,113	1.03 (1.01 to 1.06)	Low	critical
1[6*]	Controlled Before and After	Serious [c]	n/a	No serious	Serious [d]	None	788	Intervention: OR 1.40 (1.04 to 1.89)* Control: OR 1.30 (0.93 to 1.82)*	Very low	critical
1[7*]	Retrospective cohort	No serious	n/a	No serious	No serious	None	43,022	3.81 (3.45 to 4.21)**	Low	critical
Collaborative local programmes with an assigned organisational lead and using provider based systems										

Collaborative local programmes vs Usual care – 2nd year post-intervention [ES 123.1]											
1[8]	cRCT	Serious [e]	n/a	Serious [f]	No serious	None	41, 500	1.09 (1.06 to 1.11)		Low	critical
Subgroup: Collaborative local programmes vs Usual care by age: 6m-5yrs, 6-12yrs & 13-18yrs [ES 123.1]											
1[8]	cRCT	Serious [e]	n/a	Serious [f]	No serious	None	41,495	6months-5years 7.5% intervention vs. 4.5% control Chi² (1 df) = 0.01 p=0.93	6 to 12 years 9.8% intervention vs. 2.8% control Chi² (1 df) = 21.29 p<0.0001	13 to 18years 11.9% intervention vs. 5.4% control Chi² (1 df) = 80.92 p<0.0001	Low	critical
Multicomponent accessibility and/or awareness-raising interventions											
Practice-based multicomponent accessibility and/or awareness-raising, with or without SMS messaging vs. baseline (pre-intervention) [ES 123.2]											
1[9]	Before and After	No serious	n/a	Serious [g]	Very serious [h]	None	77 GP practices	72 practices - 38% found an increase in flu vaccination uptake (range -27.2% to 30.7%) 35 practices targeted 2 to 4 year olds - 12 practices showed an increase, 2 were unchanged and 21 decreased (range -35.3% to 48.5%)			Very low	critical

Multicomponent local programme										
Multicomponent local programme vs Usual care - children aged 6 months to 18 years [ES 123.3]										
1[10]	RCT	No serious	n/a	Serious [g]	Serious [a]	None	81,599	1.23 (1.01 to 1.50)	Low	critical

1.Hofstetter 2015 [RCT]
2.Stockwell 2012 [RCT]
3.Stockwell 2015b [RCT]
4.Stockwell 2015a [RCT]
5.Szilagyi 2015 [RCT]
6. Ly 2015 [cBA]
7. Pollack 2014 [retrospective cohort]
8.Kempe 2014 [cRCT]
9. Meredith 2016 [B&A]
10. Zimmerman 2014 [RCT]

[a] downgrade 1 level - 95%CI crosses upper MID threshold (RR 1.05)
[b] downgrade 1 level - unclear randomisation and lack of blinding in Szilagyi 2015
[c] downgrade 1 level - unclear selection of study centres in Ly 2015
[d] 95%CI for between-group difference in change uptake not reported in Ly 2015, so imprecision cannot be assessed
[e] downgrade 1 level - differences in baseline characteristics of intervention sites and participants
[f] downgrade 1 level - components of intervention outside scope of protocol
[g] downgrade 1 level - mix of single or multicomponent interventions; unable to determine differences associated with individual intervention types
[h] downgraded 2 levels - lack of patient level data; no sample sizes or measures of variance are reported so imprecision cannot be assessed

*Odds ratios are reported rather than risk ratios for Ly 2015. Risk ratio is not appropriate as before and after sample sizes differ and baseline uptake figures for control were higher than for intervention group. Risk ratio would misleadingly imply that the control group had better post-intervention uptake whereas the reported change in uptake between baseline and follow-up was greatest for the intervention group.
**Results for Pollack 2014 are not combined with Stockwell 2015a and Szilagyi 2015 as Pollack reports on a hospital-based intervention.

I.42 GRADE profile 4

Outcome: Missed opportunities to vaccinate

Quality assessment								Effect	Quality	Outcome rating
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	No. of participants	Relative risk (95% CI)		
Collaborative local programmes vs Usual care – 2nd year post-intervention [Forest plot Figure 5; ES123.4]										
1[1]	cRCT	Serious [a]	n/a	Serious [b]	No serious	None	28,049	0.80 (0.78 to 0.82)	Moderate	critical

1.Kempe, 2014 [cRCT]

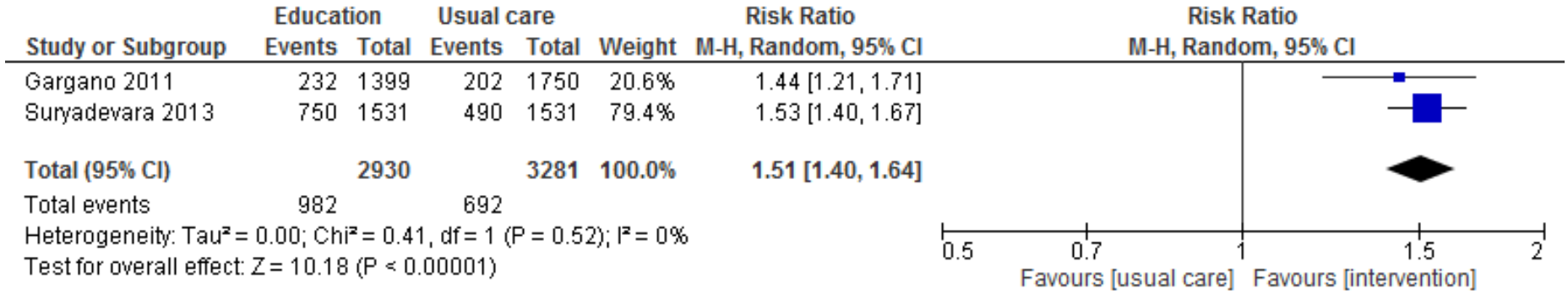
[a] downgrade 1 level - differences in baseline characteristics of intervention sites and participants
[b] downgrade 1 level - components of intervention outside scope of protocol

Appendix J: Health economic evidence profiles

No health economic studies were identified for inclusion in this review

Appendix K: Forest plots

Figure 1: Educational interventions for increasing flu vaccination uptake (children 6 months to 18 years) [linked GRADE profile 1; ES1.1]



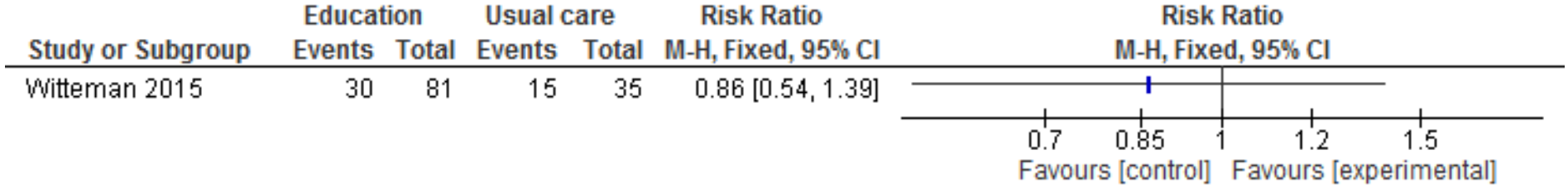


Figure 2: SMS messaging interventions for flu vaccination for children 6 months to 17 years) (subgroups on type/complexity of message): Increasing uptake [linked GRADE profile 3; ES 3.1, ES 3.2]

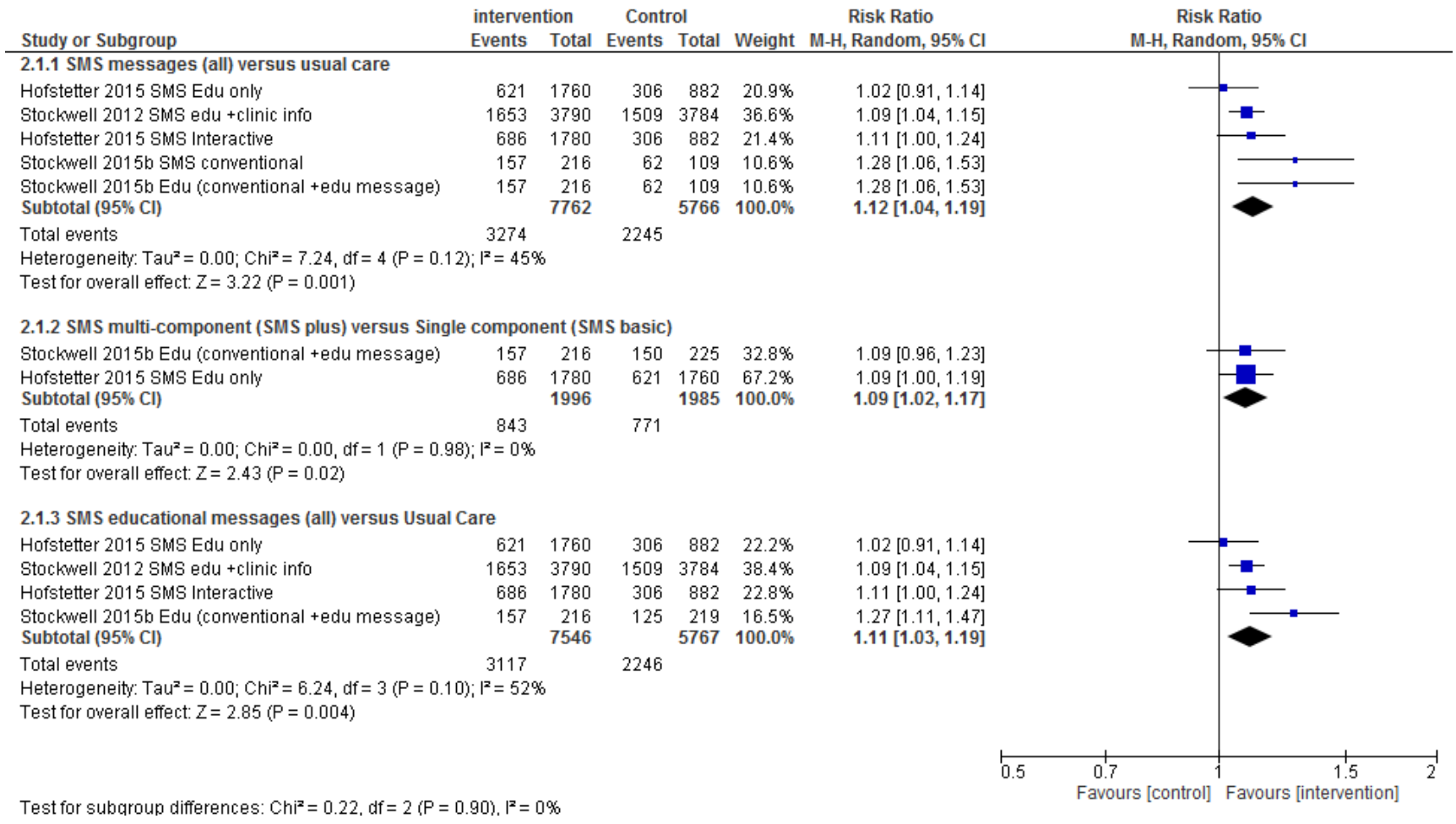


Figure 3: SMS messaging interventions for flu vaccination for children (6months to 17 years) (subgroups by age): Increasing uptake [linked GRADE profile 3; ES 3.3]

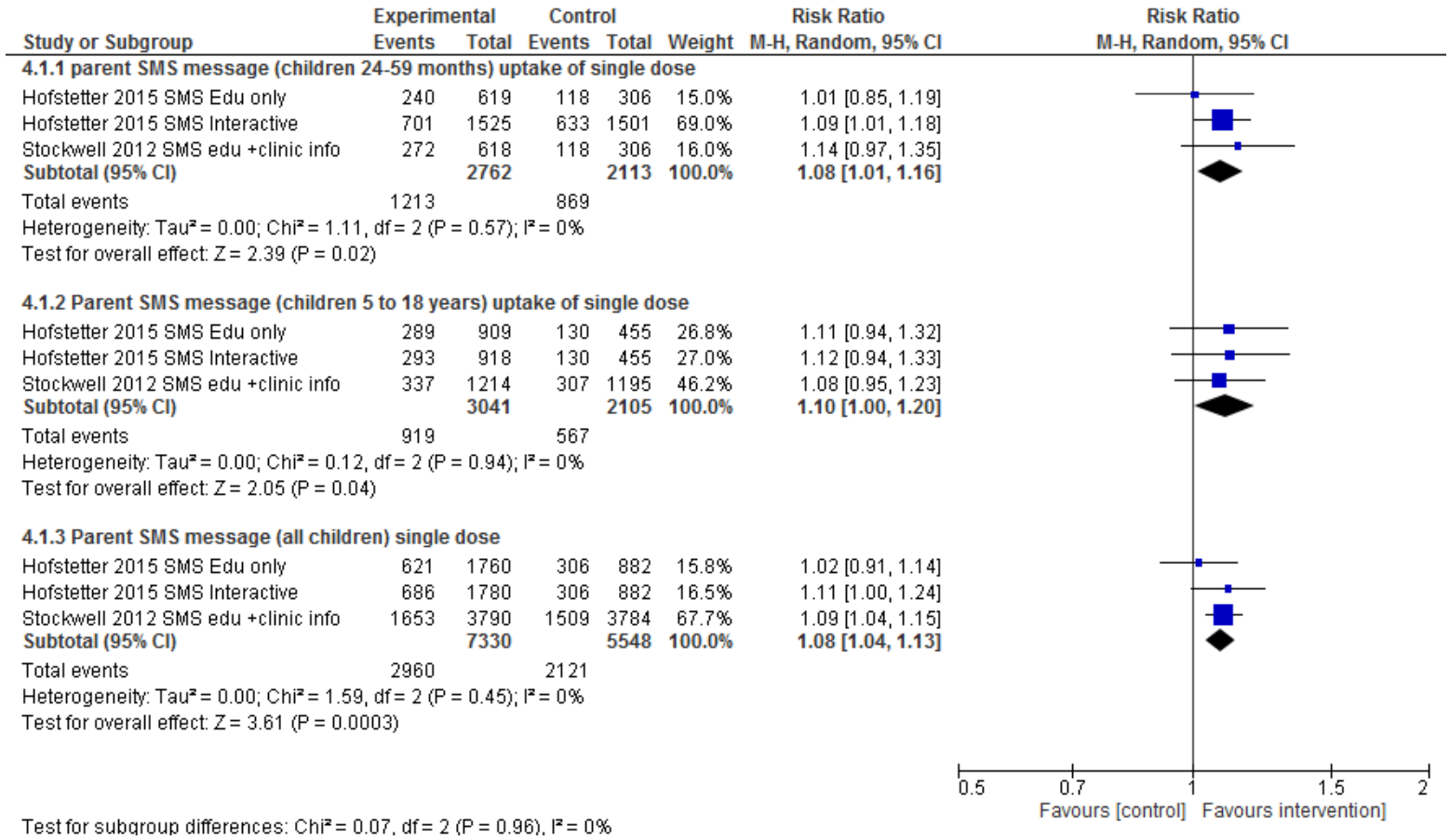
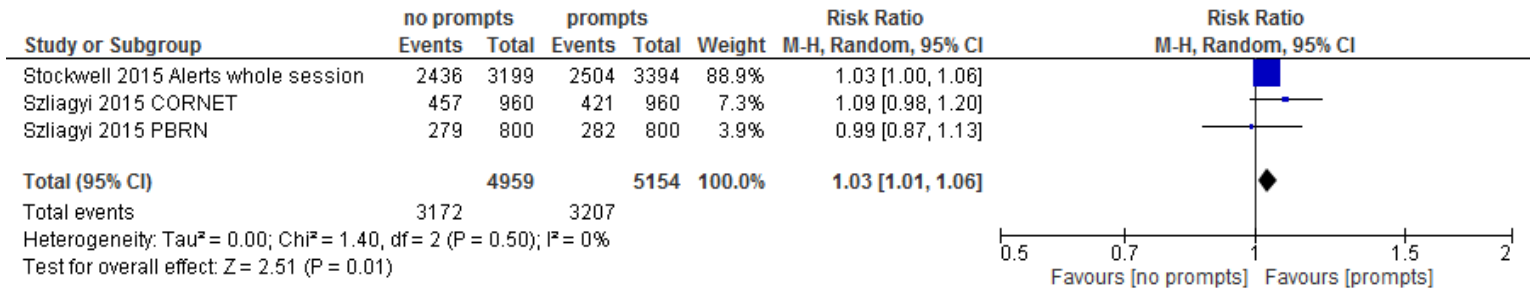


Figure 4: Provider prompts for increasing uptake of flu vaccination for children [linked GRADE profile 3; ES 3.4)

a. Community-based practice



b. Secondary care

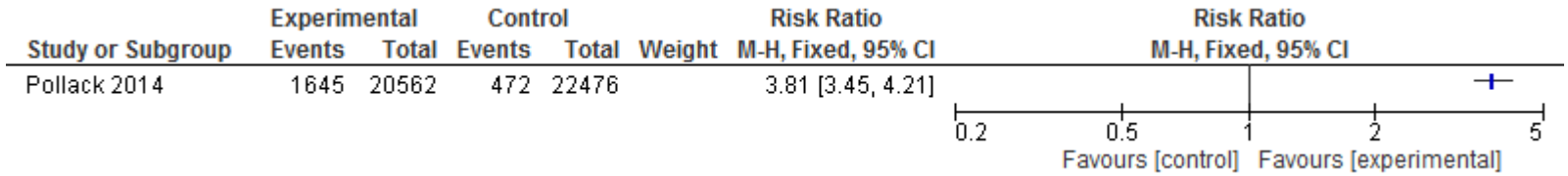
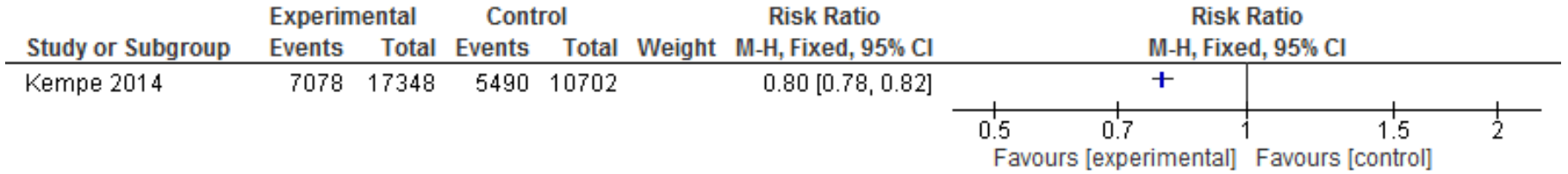


Figure 5: Missed opportunities to vaccinate [linked GRADE profile 4]



1 Appendix L:Excluded studies

2

Study	Reason for exclusion
Adams, W. G. Text messaging increases receipt of influenza vaccine among low-income, urban children. Journal of Pediatrics. 2012. 161:3;568-9	Not a relevant study type (i.e. letter, editorial, commentary)
Allison, Mandy A., Crane, Lori A., Beaty, Brenda L., Davidson, Arthur J., Melinkovich, Paul, Kempe, Allison. School-based health centers: improving access and quality of care for low-income adolescents. Pediatrics. 2007. 120:4;e887-94	Not a relevant population
Allred, Norma J., Cover, Alysia, Zoldessy, Aurian, Smith, Paula, Zhang, Fan. School located vaccination clinics. The Journal of the Arkansas Medical Society. 2012. 109:6;112	Not a relevant intervention
Ambrose, Christopher S., Toback, Seth L. Improved timing of availability and administration of influenza vaccine through the US Vaccines for Children Program from 2007 to 2011. Clinical pediatrics. 2013. 52:3;224-30	Not a relevant intervention
Angelillo, I. F., Ricciardi, G., Rossi, P., Pantisano, P., Langiano, E., Pavia, M. Mothers and vaccination: Knowledge, attitudes, and behaviour in Italy. Bulletin of the World Health Organization. 1999. 77:3;224-229	No relevant outcomes reported
Bambery, Ben, Selgelid, Michael, Maslen, Hannah, Pollard, Andrew J., Savulescu, Julian. The case for mandatory flu vaccination of children. The American journal of bioethics : AJOB. 2013. 13:9;38-40	Not a relevant study type (i.e. letter, editorial, commentary)
Beran, T. N., Ramirez-Serrano, A., Vanderkooi, O. G., Kuhn, S. Reducing children's pain and distress towards flu vaccinations: a novel and effective application of humanoid robotics. Vaccine. 2013. 31:25;2772-7	No relevant outcomes reported
Beutels, P., Vandendijck, Y., Willem, L., Goeyvaerts, N., Blommaert, A., Kerckhove, K., Bilcke, J., Hanquet, G., Neels, P., Thiry, N., Liesenborgs, J., Hens, N. Seasonal influenza vaccination: prioritizing children or other target groups? Part II: cost-effectiveness analysis (Structured abstract). Health Technology Assessment Database. 2013. :1;	Not a relevant intervention
Block, Stan L. The daunting practicalities of in-office pediatric influenza vaccination: 2009-2010. Pediatric annals. 2009. 38:12;655-60	Not a relevant study type (i.e. letter, editorial, commentary)
Borja, Mary C., Amidon, Christine, Spellings, Diane, Franzetti, Susan, Nasuta, Mary. School nurse perspectives. The Journal of school nursing: the official publication of the National Association of School Nurses. 2009. 25 Suppl 1:;29S-36S	Not a relevant study type (i.e. letter, editorial, commentary)
Briss, P. A., Rodewald, L. E., Hinman, A. R., Shefer, A. M., Strikas, R. A., Bernier, R. R., Carande-Kulis, V. G., Yusuf, H. R., Ndiaye, S. M., Williams, S. M. Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults. American journal of preventive medicine. 2000. 18:1 SUPPL. 1;97-140	Review not directly answering question
Bueving, H. J., van der Wouden, J. C. Influenza vaccination in healthy children. Vaccine. 2006. 24:23;4901	Not a relevant study type (i.e. letter, editorial, commentary)

Study	Reason for exclusion
Calder, Kristi, Bidwell, Susan, Brunton, Cheryl, Pink, Ramon. Evaluation of the Canterbury under-18 seasonal influenza vaccination programme. The New Zealand medical journal. 2014. 127:1398;19-27	Not a relevant intervention
Caskey,R.N., Macario,E., Johnson,D.C., Hamlish,T., Alexander,K.A. A school-located vaccination adolescent pilot initiative in Chicago: Lessons learned. Journal of the Pediatric Infectious Diseases SocietyJ.Pediatric Infect.Dis.Soc.. 2013. 2:3;198-204	Not a relevant intervention
Cawley, John, Hull, Harry F., Rousculp, Matthew D. Strategies for implementing school-located influenza vaccination of children: a systematic literature review. The Journal of school health. 2010. 80:4;167-75	Not a relevant intervention
Chien, Yu-Hung. Persuasiveness of online flu-vaccination promotional banners. Psychological reports. 2013. 112:2;365-74	Not a relevant population
Chou, T. I. F., Lash, D. B., Malcolm, B., Yousify, L., Quach, J. Y., Dong, S., Yu, J. Effects of a student pharmacist consultation on patient knowledge and attitudes about vaccines. Journal of the American Pharmacists Association. 2014. 54:2;130-137	Not a relevant population
Clements, Karen M., Chancellor, Jeremy, Nichol, Kristin, DeLong, Kelly, Thompson, David. Cost-effectiveness of a recommendation of universal mass vaccination for seasonal influenza in the United States. Value in health : the journal of the International Society for Pharmacoeconomics and Outcomes Research. 2011. 14:6;800-11	Not a relevant intervention
Clements, Karen M., Meier, Genevieve, McGarry, Lisa J., Pruttivarasin, Narin, Misurski, Derek A. Cost-effectiveness analysis of universal influenza vaccination with quadrivalent inactivated vaccine in the United States. Human vaccines & immunotherapeutics. 2014. 10:5;1171-80	No relevant outcomes reported
Cooper Robbins, Spring Chenoa, Leask, Julie, Booy, Robert. Parents' attitudes towards the influenza vaccine and influencing factors. Journal of paediatrics and child health. 2011. 47:7;419-22	Not a relevant study type (i.e. cross-sectional survey/epidemiological study/correlation study/narrative review)
Cummings, Ginny E., Ruff, Elizabeth, Guthrie, Stephen H., Hoffmaster, Margaret A., Leitch, Larry L., King, James C., Jr. Successful use of volunteers to conduct school-located mass influenza vaccination clinics. Pediatrics. 2012. 129 Suppl 2:;S88-95	Not a relevant intervention
Dalton, Ian, Great Britain. Department of, Health. A (H1N1) swine flu influenza : phase two of the vaccination programme; children over 6 months and under 5 years. . 2009. :;	Not a relevant study type (i.e. letter, editorial, commentary)
Davis, Mollie M., King, James C., Jr., Moag, Lauren, Cummings, Ginny, Magder, Laurence S. Countywide school-based influenza immunization: direct and indirect impact on student absenteeism. Pediatrics. 2008. 122:1;e260-5	Not a relevant intervention
DiClemente, Ralph J. "Build it and they will come. Or will they?" Overcoming barriers to optimizing delivery of seasonal influenza vaccine to US adolescents. Expert Review of Vaccines. 2012. 11:4;	Not a relevant study type (i.e. cross-sectional survey/epidemiological study/correlation

Study	Reason for exclusion
	study/narrative review)
Doroshenko, Alexander, Hatchette, Jill, Halperin, Scott A., MacDonald, Noni E., Graham, Janice E. Challenges to immunization: the experiences of homeless youth. BMC Public Health. 2012. 12:;338	No relevant outcomes reported
Ernst, M. E., Chalstrom, C. V., Currie, J. D., Sorofman, B. Implementation of a community pharmacy-based influenza vaccination program. Journal of the American Pharmaceutical Association (Washington,D.C. : 1996). 1997. NS37:5;570-80	Not a relevant population
Fairbrother, G., Hanson, K. L., Friedman, S., Butts, G. C. The impact of physician bonuses, enhanced fees, and feedback on childhood immunization coverage rates. American Journal of Public Health. 1999. 89:2;171-5	No relevant outcomes reported
Fiks AG, Grundmeier RW, Biggs LM, Localio AR, Alessandrini EA. Impact of clinical alerts within an electronic health record on routine childhood immunization in an urban pediatric population. Pediatrics. 2007;120(4):707-14.	No relevant outcomes reported
Findley, S. E., Irigoyen, M., Sanchez, M., Stockwell, M. S., Mejia, M., Guzman, L., Ferreira, R., Pena, O., Chen, S., Andres-Martinez, R. Effectiveness of a community coalition for improving child vaccination rates in New York City. American Journal of Public Health. 2008. 98:11;1959-1962	No relevant outcomes reported
Findley, S., Irigoyen, M., Sanchez, M., Guzman, L., Mejia, M., Sajous, M., Levine, D., Chimkin, F., Chen, S. Community empowerment to reduce childhood immunization disparities in New York City. Ethnicity and Disease. 2004. 14:3 SUPPL. 1;S1-141	No relevant outcomes reported
Frank, Oliver, Litt, John, Beilby, Justin. Opportunistic electronic reminders. Improving performance of preventive care in general practice. Australian family physician. 2004. 33:01-Feb;87-90	Not a relevant population
Gargano, Lisa M., Herbert, Natasha L., Painter, Julia E., Sales, Jessica M., Vogt, Tara M., Morfaw, Christopher, Jones, LaDawna M., Murray, Dennis, DiClemente, Ralph J., Hughes, James M. Development, theoretical framework, and evaluation of a parent and teacher-delivered intervention on adolescent vaccination. Health Promotion Practice. 2014. 15:4;556-67	No relevant outcomes reported
Gargano LM, Underwood NL, Sales JM, Seib K, Morfaw C, Murray D, DiClemente RJ, Hughes JM. Influence of sources of information about influenza vaccine on parental attitudes and adolescent vaccine receipt. Human vaccines & immunotherapeutics. 2015 Jul 3;11(7):1641-7.	Not a relevant study type (i.e. cross-sectional survey/epidemiological study/correlation study/narrative review)
Greene, G. R., Lowe, A., D'Agostino, D. Influenza vaccine for school-aged children [3]. Pediatrics. 2006. 118:2;840-841	Not a relevant study type (i.e. letter, editorial, commentary)
Ha, Chrysanthy, Rios, Lenoa M., Pannaraj, Pia S. Knowledge, Attitudes, and Practices of School Personnel Regarding Influenza, Vaccinations, and School Outbreaks. Journal of School Health. 2013. 83:8;554-561	Not a relevant intervention
Hayney, Mary S., Bartell, Julie C. An immunization education program for childcare providers. The Journal of school health. 2005. 75:4;147-9	Not a relevant population

Study	Reason for exclusion
Herbert, Natasha L., Gargano, Lisa M., Painter, Julia E., Sales, Jessica M., Morfaw, Christopher, Murray, Dennis, DiClemente, Ralph J., Hughes, James M. Understanding reasons for participating in a school-based influenza vaccination program and decision-making dynamics among adolescents and parents. Health Education Research. 2013. 28:4;663-672	Not a relevant intervention
Hilton, S., Hunt, K., Petticrew, M. Gaps in parental understandings and experiences of vaccine-preventable diseases: a qualitative study. Child: Care, Health and Development. 2007. Health and Development:;170-179	No relevant outcomes reported
Hogg, W., Lemelin, J., Graham, I. D., Grimshaw, J., Martin, C., Moore, L., Soto, E., O'Rourke, K. Improving prevention in primary care: Evaluating the effectiveness of outreach facilitation. Family practice. 2008. 25:1;40-48	Not a relevant population
Hull, Harry F. A survey of physician-led influenza immunization programs in schools. Clinical pediatrics. 2010. 49:5;439-42	Not a relevant intervention
Hull, Harry F., Ambrose, Christopher S. Current experience with school-located influenza vaccination programs in the United States: a review of the medical literature. Human vaccines. 2011. 7:2;153-60	Not a relevant study type (i.e. cross-sectional survey/epidemiological study/correlation study/narrative review)
Hull, Harry F., Frauendienst, Renee S., Gundersen, Margene L., Monsen, Susan M., Fishbein, Daniel B. School-based influenza immunization. Vaccine. 2008. 26:34;4312-3	Not a relevant intervention
Humiston, Sharon G., Poehling, Katherine A., Szilagyi, Peter G. School-located influenza vaccination: can collaborative efforts go the distance?. Academic pediatrics. 2014. 14:3;219-20	Not a relevant intervention
Jacobson Vann, Julie C., Szilagyi, Peter. Patient reminder and patient recall systems to improve immunization rates. The Cochrane database of systematic reviews. 2005. :3;CD003941	Review not directly answering question
Jarrett C, Wilson R, O'Leary M, Eckersberger E, Larson HJ; SAGE Working Group on Vaccine Hesitancy. Strategies for addressing vaccine hesitancy – A systematic review. Vaccine. 2015 Aug 14;33(34):4180-90. doi: 10.1016/j.vaccine.2015.04.040. Epub 2015 Apr 18.	Review not directly answering question
Kansagra, Susan M., McGinty, Meghan D., Morgenthau, Beth Maldin, Marquez, Monica L., Rosselli-Fraschilla, Annmarie, Zucker, Jane R., Farley, Thomas A. Cost comparison of 2 mass vaccination campaigns against influenza A H1N1 in New York City. American journal of public health. 2012. 102:7;1378-83	Not a relevant study type (i.e. theory paper/cost only study)
King, James C., Jr., Cummings, Ginny E., Stoddard, Jeffrey, Readmond, Bernard X., Magder, Laurence S., Stong, Mary, Hoffmaster, Margaret, Rubin, Judith, Tsai, Theodore, Ruff, Elizabeth, SchoolMist Study, Group. A pilot study of the effectiveness of a school-based influenza vaccination program. Pediatrics. 2005. 116:6;e868-73	Not a relevant intervention.
Kowal, Stephanie P., Jardine, Cynthia G., Bubela, Tania M. "If they tell me to get it, I'll get it. If they don't...": Immunization decision-making processes of immigrant mothers. Canadian journal of public health = Revue canadienne de sante publique. 2015. 106:4;e230-5	No relevant outcomes reported

Study	Reason for exclusion
Libster, Romina, Edwards, Kathryn M. The necessity of influenza vaccination in children. Pediatric annals. 2010. 39:8;490-6	Not a relevant study type (i.e. cross-sectional survey/epidemiological study/correlation study/narrative review)
Lind, Candace, Russell, Margaret L., Collins, Ramona, MacDonald, Judy, Frank, Christine J., Davis, Amy E. How rural and urban parents describe convenience in the context of school-based influenza vaccination: a qualitative study. BMC health services research. 2015. 15:;24	Not a relevant intervention
Lind, Candace, Russell, Margaret L., MacDonald, Judy, Collins, Ramona, Frank, Christine J., Davis, Amy E. School-based influenza vaccination: parents' perspectives. PloS one. 2014. 9:3;e93490	Not a relevant intervention
Lott, John, Johnson, Jennifer. Promising practices for school-located vaccination clinics-- part II: clinic operations and program sustainability. Pediatrics. 2012. 129 Suppl 2:;S81-7	Not a relevant intervention
Lott, John, Johnson, Jennifer. Promising practices for school-located vaccination clinics--part I: preparation. Pediatrics. 2012. 129 Suppl 2:;S75-80	Not a relevant intervention
Ly, E., Peddecord, K. M., Wang, W., Ralston, K., Sawyer, M. H. From the schools and programs of public health: Student column: Using academic detailing to improve childhood influenza vaccination rates in san diego. Public Health Reports. 2015. 130:2;179-187	Duplicate of an include
Ma, K. K., Schaffner, W., Colmenares, C., Howser, J., Jones, J., Poehling, K. A. Influenza vaccinations of young children increased with media coverage in 2003. Pediatrics. 2006. 117:2;e157-63	Not a relevant study type (i.e. cross-sectional survey/epidemiological study/correlation study/narrative review)
MacDougall, D., Crowe, L., Pereira, J. A., Kwong, J. C., Quach, S., Wormsbecker, A. E., Ramsay, H., Salvadori, M. I., Russell, M. L. Parental perceptions of school-based influenza immunisation in Ontario, Canada: A qualitative study. BMJ open. 2014. 4:6;no pagination	Not a relevant intervention
Macknin, J., Marks, M., Macknin, M. L. Effect of telephone follow-up on frequency of health maintenance visits among children attending free immunization clinics: a randomized, controlled trial. Clinical pediatrics. 2000. 39:11;679-81	No relevant outcomes reported
Mak, Donna B., Carcione, Dale, Joyce, Sarah, Tomlin, Stephania, Effler, Paul V. Paediatric influenza vaccination program suspension: effect on childhood vaccine uptake. Australian and New Zealand journal of public health. 2012. 36:5;494-5	Not a relevant study type (i.e. letter, editorial, commentary)
Mazyck, Donna. School-located vaccination clinics: then and now. The Journal of school nursing : the official publication of the National Association of School Nurses. 2010. 26:4 Suppl;3S-6S	Not a relevant study type (i.e. cross-sectional survey/epidemiological study/correlation

Study	Reason for exclusion
	study/narrative review)
McGlone, M. S., Bell, R. A., Zaitchik, S. T., McGlynn 3rd, J. Don't let the flu catch you: agency assignment in printed educational materials about the H1N1 influenza virus. Journal of health communication. 2013. 18:6;740-756	Not a relevant intervention
McGlone, Matthew S., Bell, Robert A., Zaitchik, Sarah T., McGlynn, Joseph, 3rd. Don't let the flu catch you: agency assignment in printed educational materials about the H1N1 influenza virus. Journal of health communication. 2013. 18:6;740-56	Duplicate of an exclude (above)
Middleman, A. B., Short, M. B., Doak, J. S. Focusing on flu parent perspectives on school-located immunization programs for influenza vaccine. Human Vaccines and Immunotherapeutics. 2012. 8:10;1395-1400	Not a relevant intervention
Middleman, Amy B., Short, Mary B., Doak, Jean S. Focusing on flu: Parent perspectives on school-located immunization programs for influenza vaccine. Human vaccines & immunotherapeutics. 2012. 8:10;1395-400	Duplicate of an exclude (above)
Minkovitz, C. S., Belote, A. D., Higman, S. M., Serwint, J. R., Weiner, J. P. Effectiveness of a practice-based intervention to increase vaccination rates and reduce missed opportunities. Archives of pediatrics & adolescent medicine. 2001. 155:3;382-6	No relevant outcomes reported
Nowalk MP, Lin CJ, Hannibal K, Reis EC, Gallik G, Moehling KK, Huang HH, Allred NJ, Wolfson DH, Zimmerman RK. Increasing childhood influenza vaccination: A cluster randomized trial. American journal of preventive medicine. 2014 Oct 31;47(4):435-43.	Duplicate of an include
Oyo-Ita, A., Nwachukwu, C. E., Oringanje, C., Meremikwu, M. M. Interventions for improving coverage of child immunization in low-income and middle-income countries. Cochrane Database of Systematic Reviews. 2009. :4;no pagination	No relevant outcomes reported
Painter, Julia E., Sales, Jessica M., Pazol, Karen, Grimes, Tanisha, Wingood, Gina M., DiClemente, Ralph J. Development, theoretical framework, and lessons learned from implementation of a school-based influenza vaccination intervention. Health Promotion Practice. 2010. 11:3 Suppl;42S-52S	Not a relevant intervention
Painter, Julia E., Sales, Jessica M., Pazol, Karen, Wingood, Gina M., Windle, Michael, Orenstein, Walter A., DiClemente, Ralph J. Adolescent attitudes toward influenza vaccination and vaccine uptake in a school-based influenza vaccination intervention: a mediation analysis. Journal of School Health. 2011. 81:6;304-312	Not a relevant intervention
Pannaraj, P. S., Wang, H. L., Rivas, H., Wiryawan, H., Smit, M., Green, N., Aldrovandi, G. M., El Amin, A. N., Mascola, L. School-located influenza vaccination decreases laboratory-confirmed influenza and improves school attendance. Clinical Infectious Diseases. 2014. 59:3;325-332	Not a relevant intervention
Pappano, Dante, Humiston, Sharon, Goepp, Julius. Efficacy of a pediatric emergency department-based influenza vaccination program. Archives of pediatrics & adolescent medicine. 2004. 158:11;1077-83	Not a relevant population
Patwardhan, Anjali, Kelly, Kelleher, Cunningham, Dennis. The use of a mandatory best practice reminder in the electronic record improves influenza vaccination rate in a pediatric rheumatology clinic. Clinical Governance: an international journal. 2011. 16:4;308-319	Not a relevant population
Plaspohl, Sara S., Dixon, Betty T., Streater, James A., Hausauer, Elizabeth T., Newman, Christopher P., Vogel, Robert L. Impact of school flu vaccine program on student absences. The Journal of school nursing : the official publication of the National Association of School Nurses. 2014. 30:1;75-80	Not a relevant intervention

Study	Reason for exclusion
Poehling KA, Talbot HK, Williams JV, et al. . Impact of a School-based Influenza Immunization Program on Disease Burden: Comparison of Two Tennessee Counties. Vaccine. 2009. 27:20;2695-700	Not a relevant intervention
Poehling, K. A., Szilagyi, P. G. Not Just for Kids: New Paradigms for Vaccine Delivery in Pediatrics. Academic pediatrics. 2009. 9:5;293-294	Not a relevant study type (i.e. letter, editorial, commentary)
Ransom, James. School-located influenza vaccination clinics: local health department perspectives. The Journal of school nursing : the official publication of the National Association of School Nurses. 2009. 25 Suppl 1:;13S-7S	Not a relevant study type (i.e. cross-sectional survey/epidemiological study/correlation study/narrative review)
Rao, Neel, Mobius, Markus M., Rosenblat, Tanya. Social networks and vaccination decisions. . 2007. :;	Not a relevant population
Ringel, M. Practical solutions to boost adult and childhood immunization rates. Medical management network. 1998. 6:3;01-May	Not available
Schieber, Richard A., Kennedy, Allison, Kahn, Emily B. Early experience conducting school-located vaccination programs for seasonal influenza. Pediatrics. 2012. 129 Suppl 2:;S68-74	Not a relevant intervention
Schmier, J., Li, S., King Jr, J. C., Nichol, K., Mahadevia, P. J. Market watch: Benefits and costs of immunizing children against influenza at school: An economic analysis based on a large-cluster controlled clinical trial. Health Affairs. 2008. 27:2;w96-w104	Not a relevant intervention
Schmier, Jordana, Li, Su, King, James C., Jr., Nichol, Kristin, Mahadevia, Parthiv J. Benefits and costs of immunizing children against influenza at school: an economic analysis based on a large-cluster controlled clinical trial. Health affairs (Project Hope). 2008. 27:2;w96-104	Duplicate of an exclude
Shlay, Judith C., Rodgers, Sarah, Lyons, Jean, Romero, Scott, Vogt, Tara M., McCormick, Emily V. Implementing a School-Located Vaccination Program in Denver Public Schools. Journal of School Health. 2015. 85:8;536-543	Not a relevant intervention
Short, M. B., Middleman, A. B. Focusing on flu: Adolescents' perspectives on school-located immunization programs for influenza vaccine. Human Vaccines and Immunotherapeutics. 2014. 10:1;2892-2899	Not a relevant intervention
Short, Mary B., Middleman, Amy B. Focusing on flu: adolescents' perspectives on school-located immunization programs for influenza vaccine. Human vaccines & immunotherapeutics. 2014. 10:1;216-23	Duplicate of an exclude
Shropshire, Ali M., Brent-Hotchkiss, Renee, Andrews, Urkovia K. Mass media campaign impacts influenza vaccine obtainment of university students. Journal of American college health : J of ACH. 2013. 61:8;435-43	Not a relevant population
Sinn, J. S., Morrow, A. L., Finch, A. B. Improving immunization rates in private pediatric practices through physician leadership. Archives of Pediatrics and Adolescent Medicine. 1999. 153:6;597-603	Not a relevant population
Szilagyi PG, Bordley C, Vann JC, Chelminski A, Kraus RM, Margolis PA, Rodewald LE. Effect of patient reminder/recall interventions on immunization rates: a review. Jama. 2000 Oct 11;284(14):1820-7.	Review not directly answering question

Study	Reason for exclusion
Szilagyi, P. G., Rand, C. M., McLaurin, J., Tan, L., Britto, M., Francis, A., Dunne, E., Rickert, D. Delivering adolescent vaccinations in the medical home: A new era?. Pediatrics. 2008. 121:SUPPL. 1;S15-S24	Review not directly answering question
Szilagyi, P., Vann, J., Bordley, C., Chelminski, A., Kraus, R., Margolis, P., Rodewald, L. Interventions aimed at improving immunization rates. Cochrane database of systematic reviews (Online). 2002. :4;CD003941	Review not directly answering question
Tang, P. C., LaRosa, M. P., Newcomb, C., Gorden, S. M. Measuring the effects of reminders for outpatient influenza immunizations at the point of clinical opportunity. Journal of the American Medical Informatics Association. 1999. 6:2;115-21	Not a relevant population
Taylor, J. A., Rietberg, K., Greenfield, L., Bibus, D., Yasuda, K., Marcuse, E. K., Duchin, J. S. Effectiveness of a physician peer educator in improving the quality of immunization services for young children in primary care practices. Vaccine. 2008. 26:33;4256-4261	No relevant outcomes reported
Thomsen, R., Smyth, W., Gardner, A., Ketchell, J. Centrelink: An innovative urban intervention for improving adult Aboriginal and Torres Strait Islander access to vaccination. Healthcare Infection. 2012. 17:4;136-141	Not a relevant population
Tin, S. S., Wiwanitkit, V. Parental perceptions about required influenza immunization. Infection control and hospital epidemiology. 2015. 36:1;113-114	Not a relevant study type (i.e. letter, editorial, commentary)
Tran, Cuc H., McElrath, Josephine, Hughes, Patricia, Ryan, Kathleen, Munden, Jean, Castleman, Joan B., Johnson, Jackie, Doty, Randell, McKay, Dallas R., Stringfellow, Jim, Holmes, Rosalee A., Myers, Paul D., Small, Parker A., Morris, J. Glenn. Implementing a community-supported school-based influenza immunization program. Biosecurity and bioterrorism : biodefense strategy, practice, and science. 2010. 8:4;331-41	Not a relevant intervention
Underwood, N., Gargano, L., Seib, K., Sales, J., Morfaw, C., Murray, D., Clemente, R., Hughes, J. Influence of parent sources of information about influenza vaccine on adolescent vaccine receipt. Journal of Adolescent Health. 2015. 56:2 suppl. 1;S81	Not a relevant study (poster presentation)
Voogd, Caroline. Childhood flu immunisation programme: Running the day. British Journal of School Nursing. 2015. 10:6;272-275	Not a relevant study type (i.e. letter, editorial, commentary)
Vora S, Verber L, Potts S, Dozier T, Daum RS. 2009. Effect of a novel birth intervention and reminder-recall on on-time immunization compliance in high-risk children, Human Vaccines, 5:6, 395-402, DOI: 10.4161/hv.5.6.7282	Not a relevant population
Wiggs-Stayner, Kathleen S., Purdy, Teresa R., Go, Gailya N., McLaughlin, Natalie C., Tryzynka, Penny S., Sines, Joyce R., Hlaing, Thein. The impact of mass school immunization on school attendance. The Journal of school nursing : the official publication of the National Association of School Nurses. 2006. 22:4;219-22	Not a relevant intervention
Williams, V., Rousculp, M. D., Price, M., Coles, T., Therrien, M., Griffin, J., Hollis, K., Toback, S. Elementary School-Located Influenza Vaccine Programs: Key Stakeholder Experiences From Initiation to Continuation. Journal of School Nursing. 2012. 28:4;256-267	Not a relevant intervention

Study	Reason for exclusion
Williams, Valerie, Rousculp, Matthew D., Price, Mark, Coles, Theresa, Therrien, Michelle, Griffin, Jane, Hollis, Kelly, Toback, Seth. Elementary school-located influenza vaccine programs: key stakeholder experiences from initiation to continuation. The Journal of school nursing : the official publication of the National Association of School Nurses. 2012. 28:4;256-67	Duplicate of an exclude (above)
Wilson, Dulmini, Sanchez, Kathleen M., Blackwell, Susan H., Weinstein, Eva, El Amin, A. Nelson. Implementing and sustaining school-located influenza vaccination programs: perspectives from five diverse school districts. Journal of School Nursing. 2013. 29:4;303-314	Not a relevant intervention
Wood, D., Halfon, N., Donald-Sherbourne, C., Mazel, R. M., Schuster, M., Hamlin, J. S., Pereyra, M., Camp, P., Grabowsky, M., Duan, N. Increasing immunization rates among inner-city, African American children: A randomized trial of case management. Journal of the American Medical Association. 1998. 279:1;29-34	No relevant outcomes reported
Yamazaki, T., Suzuki, T., Yamamoto, K. Vaccinating Japanese schoolchildren against influenza. The New England journal of medicine. 2001. 344:25;1947-8	Not a relevant study type (i.e. letter, editorial, commentary)
Yoo, B. K., Humiston, S. G., Szilagyi, P. G., Schaffer, S. J., Long, C., Kolasa, M. Cost effectiveness analysis of elementary school-located vaccination against influenza: results from a randomized controlled trial (Provisional abstract). Vaccine. 2013. 31:17;2156-2164	Not a relevant intervention
Yoo, Byung-Kwang, Humiston, Sharon G., Szilagyi, Peter G., Schaffer, Stanley J., Long, Christine, Kolasa, Maureen. Cost effectiveness analysis of Year 2 of an elementary school-located influenza vaccination program-Results from a randomized controlled trial. BMC health services research. 2015. 15:;511	Not a relevant intervention

Additional citations screened following citations chasing in excluded systematic reviews

Study	Reason for exclusion
Kempe et al. Implementation of universal influenza recommendations for healthy young children: results of a randomized, controlled trial with registry-based recall. Paediatrics 2005.	Not a relevant population (6-24months only).

Appendix M: PRISMA