



STRATEGIES FOR ADDRESSING VACCINE HESITANCY – A SYSTEMATIC REVIEW

WHO SAGE working group dealing with vaccine hesitancy

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Abbreviations

A-CASI	Audio-Computer Assisted Self Interview
AFR	WHO Africa Region
ALO	Aboriginal Liaison Officer
AMR	WHO Americas Region
BBI	Blood Born Infection
BCG	Bacille de Calmette et Guérin vaccine
DFID	Department for International Development`
CCT	Conditional Cash Transfer
CDC	Centre of Disease Control
CDSS	Clinical Decision Support System
CINAHL	Cumulative Index to Nursing and Allied Health Literature
CM	Community Mobiliser
COLNISA	Community Level Nutrition Information System for Action
DTP	Class of combination vaccines against diphtheria, pertussis and tetanus.
DCVM	Developing Country Vaccine Manufacturers Network and the International
EA	Enumeration Area
ECDC	European Centre for Disease Prevention and Control
EMR	WHO Eastern Mediterranean Region
EPHPP	Effective Public Health Practice Project
EPI	Expanded Program on Immunisation
EUR	WHO European Region
GIS	Global Information Systems
GMP	Growth Monitoring Programme
GPEI	Global Polio Eradication Initiative
HAPA	Health Action Process Approach
HBM	Health Belief Model
HBV	Hepatitis B Virus vaccine

HCP	Health Care Practice
HCW	Health Care Worker
HPV	Human Papillomavirus vaccine
HSCT	Hematopoietic Stem Cell Transplantation
IBSS	International Bibliography of the Social Sciences
IEC	Information, Education and Communication
IFPMA	International Federation of Pharmaceutical Manufacturers & Associations
IMEMR	Index Medicus for the Eastern Mediterranean Region
ISA	Influenza Strategic Alliance
MCV	Measles Containing Vaccine
MMR	Measles, Mumps and Rubella vaccine
MNT	Maternal Neo-natal Tetanus vaccine
NGO	Non-Governmental Organisation
NICE	National Institute for Health and Care Excellence
NIDS	National Immunisation Days
NSW	New South Wales (Australia)
OPV	Oral Polio Vaccine
PACV	Parental Attitude about Childhood Vaccine
PCN	Polio Communication Network
PCHMS	Personally Controlled Health Management System
PRAMS	Pregnancy Risk Assessment Monitoring System
PEI	Polio Eradication Initiative
RCT	Randomised Control Trial
SAGE	Strategic Advisory Group of Experts (on Immunisation)
SEAR	WHO South East Asia Region
SIMS	Saskatchewan Immunisation Management System
SHR	Saskatoon Health Region
UCT	Unconditional Cash Transfer
UNFPA	United Nation's Population Fund

UNICEF	United Nations Children’s Fund
WASH	Water Sanitation and Hygiene
WHO	World Health Organisation
WIC	Women Infants and Children
WPR	WHO Western Pacific Regions

Definitions

<i>Dialogue-based Intervention</i>	Dialogue between those implementing the intervention and the target community. In this review, we included the involvement of religious or traditional leaders, social mobilisation, social media interventions, mass media interventions, communication tool-based health care worker (HCW) training, information-based HCW training.
<i>Financial incentive-based Intervention</i>	Financial compensation in exchange for free vaccination.
<i>Grey literature</i>	The definition applied in this report was set out by the Fourth International Conference on Grey Literature (GL '99) in Washington, DC, in October 1999: “That which is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers.”(1)
<i>Intervention</i>	Body of activity undertaken to address an issue; may include one or more strategies.
<i>Multi-component Intervention</i>	Includes two or more different types of strategy within one intervention, for example, one aspect of the intervention may be dialogue-based and one aspect may be reminder-recall-based.
<i>Non-financial incentive-based Intervention</i>	Provision of food or other goods to encourage vaccination.
<i>PICO</i>	A method of putting together a search strategy that allows you to take a more evidence based approach to literature searching when searching bibliographic databases. PICO stands for: P atient/ P opulation - who or what?; I ntervention - how?; C omparison - what is the main alternative?; O utcome - what are you trying to accomplish, measure, improve, effect? (2)
<i>Reminder-recall based Intervention:</i>	Telephone call/letter to remind the target population about vaccination.
<i>Social Mobilisation</i>	A process that engages and motivates a wide range of partners and allies at national and local levels to raise awareness of and

demand for a particular development objective through face-to-face dialogue. Members of institutions, community networks, civic and religious groups and others work in a coordinated way to reach specific groups of people for dialogue with planned messages. In other words, social mobilisation seeks to facilitate change through a range of players engaged in interrelated and complementary efforts.(3)

Strategy

A single activity contained within an intervention; there may be multiple strategies within an intervention.

Vaccine hesitancy

Vaccine hesitancy refers to delay in acceptance or refusal of vaccines despite availability of vaccine services. Vaccine hesitancy is complex and context specific varying across time, place, and vaccines. It includes factors such as complacency, convenience, and confidence.

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EXECUTIVE SUMMARY

SAGE working group dealing with vaccine hesitancy – Systematic Review of Strategies

Introduction

The purpose of the systematic review of strategies for addressing vaccine hesitancy is to identify strategies that have been implemented and evaluated across diverse global contexts in an effort to respond to, and manage, issues of vaccine hesitancy. This is to fulfil the requirements of the SAGE working group (WG) dealing with vaccine hesitancy in respect to:

- a) identifying existing and new activities and strategies relating to vaccines or from other areas that could successfully address vaccine hesitancy;
- b) identifying strategies that do not work well, and;
- c) prioritising activities and strategies based on an assessment of their potential impact.

These requirements were translated into the following specific objectives:

1. Identify published strategies related to vaccine hesitancy and hesitancy of other health technologies (reproductive health technologies (RHT) were chosen as the additional focus) and provide a descriptive analysis of the findings;
2. Map all evaluated strategies to the SAGE WG “Model of determinants of Vaccine Hesitancy” (Appendix 1) and identify key characteristics;
3. Evaluate relevant evaluated strategies relating to vaccine hesitancy using GRADE (Grades of Recommendation, Assessment, Development and Evaluation); relevance was informed by the PICO questions defined *a priori* by the WG, and;
4. Synthesise findings in a manner which aids the design of future interventions and further research.

Methods

Objective 1 - A systematic literature review methodology was applied to access and assess both peer-reviewed and grey literature. Interventions relating to hesitancy towards RHT were analysed to obtain greater insights surrounding lack of uptake of available health technologies and to ascertain whether strategies aimed at addressing hesitancy towards RHTs could be adopted to address vaccine hesitancy.

Objective 2 – Characteristics of evaluated interventions were mapped against the SAGE WG Model of determinants of vaccine hesitancy and also grouped according to one of four identified themes which characterise the type of intervention:

- i) Multi-component
- ii) Dialogue-based
- iii) Incentive-based
- iv) Reminder/recall-based

Objective 3 - The GRADE approach was applied for grading the quality of evidence of a selection of peer-reviewed primary studies that evaluated interventions; selection was based on the relevance of studies to the fifteen PICO questions set out *a priori* by the SAGE WG (Table 2). These questions were developed under one of three intervention themes (further defined below): 1) Dialogue-based,

2) Incentive-based (non-financial), and 3) Reminder-recall. The multi-component theme was excluded in this section because of a preference expressed by the WG to focus on identifying and assessing the impact of single component approaches. However, data were included where a multi-component intervention provided suitable data to assess the effect of its individual component parts. Risk of bias was assessed for each study and the evidence was set out against each individual PICO question.

Theme categories for PICO questions:

- i) **Dialogue-based**, which included the involvement of religious or traditional leaders, social mobilisation, social media, mass media, and communication or information-based tools for health care workers;
- ii) **Incentive-based (non-financial)**, which included the provision of food or other goods to encourage vaccination, and;
- iii) **Reminder/recall-based**, including telephone call/letter to remind the target population about vaccination.

There were two outcomes of interest:

1. Outcome 1: Impact on vaccination uptake (behavioural shift);
2. Outcome 2: Impact on vaccine/vaccination knowledge/awareness and/or attitude (psychological shift).

Results

Objective 1. Identification of published interventions and descriptive analysis of the findings

Table 1 sets out the number of studies identified across the literature that acknowledged interventions relating to hesitancy (vaccines and RHTs), and whether these were evaluated or not. All evaluated interventions were coded by country, WHO region¹, target vaccine, target population and publication year.

Table 1. Number of studies identified across peer-reviewed and grey literature by hesitancy (vaccine/reproductive health technologies) and intervention type (evaluated/suggested)

¹ The [World Health Organization](#) (WHO) divides the world into six WHO regions, for the purposes of reporting, analysis and administration: WHO African (AFR), WHO region of the Americas (AMR), WHO South East Asia (SEAR) WHO European (EUR), WHO Eastern Mediterranean (EMR) and WHO West Pacific (WPR).

			Total count	Outcome 1	Outcome 2	Outcomes 1 & 2
Vaccine Hesitancy	Peer-reviewed literature	Primary studies identified	1149	-	-	-
		Evaluated intervention	166 (14%)	115 (69%)	37 (22%)	14 (9%)
		Suggested intervention	983 (86%)	-	-	-
	Grey literature	Studies/articles identified	59	-	-	-
		Evaluated intervention	15 (25%)	9 (60%)	3 (20%)	3 (20%)
		Suggested intervention	44 (75%)	-	-	-
Hesitancy around Reproductive Health Technologies	Grey literature	Studies/articles identified	51	-	-	-
		Evaluated intervention	13 (25%)	4 (31%)	2 (15%)	7 (54%)
		Suggested intervention	38 (75%)	-	-	-

Overall, for the period January 2007-October 2013, the number of peer-reviewed studies evaluating interventions peaked in 2011 and has remained relatively stable since. However, only five studies actually used the terms ‘vaccine hesitant/hesitancy’, which indicates the relative newness of the concept and use in research vernacular. Studies that did not explicitly mention vaccine hesitancy were however retained because they indicated research on conceptually similar issues that matched one or more of the determinants of vaccine hesitancy as set out in the SAGE WG model of determinants of vaccine hesitancy. Very few evaluated interventions were identified in the grey literature with one or two articles annually at most from 1996-2012. However, in 2013, eight relevant articles were found.

Objective 2. Mapping of evaluated strategies and identification of key characteristics.

Vaccine hesitancy

The majority of evaluated studies were based in the AMR region and primarily focused on influenza, HPV and childhood vaccines. In low- and middle-income regions, particularly SEAR and AFR, the focus was on DTP and polio. All regions had studies anticipating or researching acceptance of the newly introduced HPV vaccine.

Most interventions targeted parents, healthcare workers and the local community/parents (found mostly in the AMR and EUR regions). Interventions from the AFR region dominated the grey literature and tended to focus on the local community and religious leaders.

When the interventions were assessed against the SAGE WG model of determinants of vaccine hesitancy, the most common type of intervention sought to address individual and social group influences such as using knowledge and awareness raising strategies. For vaccine and vaccination-specific interventions, approaches focused mainly on mode of delivery and the role of healthcare professionals. The engagement of religious and other community leaders was most commonly applied to address contextual influences of vaccine hesitancy such as religious, cultural and gender issues.

Across all the literature and WHO regions, most of the interventions were multi-component. Dialogue-based interventions were common in all regions except EMR; reminder –recall approaches featured predominantly in higher-income regions; and, incentive-based interventions were only found in AMR and AFR (single-component), and SEAR (part of a multi-component approach).

Which interventions have been most successful?

Overall for Outcome 1 (vaccination uptake), the interventions with the largest positive effect estimates are those that (not in order of importance): 1) directly target unvaccinated or under-vaccinated populations; 2) aim to increase knowledge and awareness surrounding vaccination; 3) improve convenience and access to vaccination; 4) target specific populations such as the local community and HCW; 5) mandate vaccinations or impose some type of sanction for non-vaccination; 6) employ reminder and follow-up; and 7) engage religious or other influential leaders to promote vaccination in the community. For Outcome 2 (psychological shift), the introduction of education initiatives, particularly those that embed new knowledge into a more tangible process (e.g., hospital procedures, individual action plans), were most successful at increasing knowledge and awareness and changing attitudes. For both outcomes, some education/awareness strategies are, of course, better than others. In particular, those that tailor the intervention to the relevant populations and their specific concerns or information gaps are most effective. Altogether, the most effective interventions employed a number of these strategies (multi-component interventions) to increase vaccine uptake, knowledge and awareness and shift attitudes towards pro-vaccination.

Which interventions have been least successful?

In general, interventions that focused on quality improvement strategies (e.g., standing orders, improved data collection and monitoring, extended clinic hours) at clinics did not reap great changes in vaccine uptake. Similarly, interventions that adopted interventions that were only applicable to the individual from a distance (e.g., posters, websites, media releases, radio announcements) brought little benefit. Incentive-based interventions using either conditional or non-conditional cash transfers were not successful, although these interventions were usually targeting general preventive health engagement and not just vaccination. Lastly, while reminder-recall interventions have been shown to be effective, they can also be ineffective. These findings highlight the

importance of not generalising interventions before understanding the different target audiences, vaccine of interest and setting.

RHTs

Interventions relating to hesitancy around RHT were found across all WHO regions but the majority were from in AFR and SEAR. Many interventions did not focus on a specific RHT but male and female condoms featured prominently. Many interventions sought to address contextual issues such as gender norms (often aimed at men) and the influence of individual/social group determinants, especially beliefs and attitudes about reproductive health. Most interventions, particularly in low income regions, adopted a dialogue-based (57%) approach; the primary target populations were healthcare workers, and religious and influential leaders, who as part of the strategy, were encouraged to involve local community members to bring about change.

Which interventions have been most successful?

The interventions with the largest effect estimates on uptake of RHT focused on leaders having dialogue with their communities. Leaders included those from government, religious institutions, and the local community (both male and female). These interventions centred on the interpretation of local religious and cultural norms, particularly around the understanding and perceptions of men, and sought to create an environment to support pro-RHT decision-making. At a broader contextual level, group sessions with journalists and mass media campaigns were also used to positive effect to support message consistency. As found for vaccine hesitancy, multicomponent interventions proved most effective.

Which interventions have been least successful?

There are not as many examples to draw more general statements from for RHT however, the interventions that were less successful were those that did not engage closely with the individual. Specifically, the use of field workers instead of local opinion leaders was not as effective as employing both in community group discussions. Familiarity and trust with the messenger seems to be a key feature in these instances.

Objective 3. Evaluation of relevant evaluated strategies relating to vaccine hesitancy.

Of 129 studies available to potentially address the questions set out by SAGE, only 13 studies were relevant (reporting on Outcome 1) and eligible (usable data) for inclusion in this section. Overall, of the fifteen original PICO questions, only ten were able to be addressed, and often each had only one study from which to draw evidence.

Thirteen studies met the inclusion criteria for evaluation using GRADE; three were cluster randomised; three were individually randomised; four were single group cohorts and three were two group cohorts. The process of delivering the interventions varied as did the outcomes reported. Consequently only one outcome (two studies) for a single vaccine was pooled; meta-analysis was not feasible for any of the other outcomes. Summary of relative risk ratios (RR) and evidence quality (GRADE) for each question are presented in Table 2.

Table 2. PICO questions proposed by SAGE working group, RR (95% CI), and evidence quality (GRADE)

Theme	PICO#	Question	Evidence available	RR & 95% CI	Evidence Quality (GRADE)
Dialogue-based	1	Does the involvement of a religious leader increase uptake of all vaccines included in primary routine immunisation in populations with low baseline vaccination coverage ($\leq 50\%$) compared to a control group/no intervention?	Yes	RR 4.12 (3.99, 4.26)	Very low
	2	Does the involvement of a religious leader increase uptake of all vaccines included in primary routine immunisation in populations with high baseline vaccination coverage ($\geq 80\%$) compared to a control group/no intervention?	No	-	-
	3	Does the involvement of a traditional leader increase uptake of all vaccines included in primary routine immunisation in populations with low baseline vaccination coverage ($\leq 50\%$) compared to a control group/no intervention?	Yes	RR 4.12 (3.99, 4.26)	Very low
	4	Does the involvement of a traditional leader increase uptake of all vaccines included in primary routine immunisation in populations with high baseline vaccination coverage ($\geq 80\%$) compared to a control group/no intervention?	No	-	-
	5	Does social mobilisation increase uptake of all vaccines included in primary routine immunisation by parents in low income settings compared to a control group/no intervention?	Yes	Range of findings; RR 1.54 (1.1, 2.15) to RR 1050.00 (147.96, 7451.4)	Range: Very low to Moderate
	6	Do social media interventions increase uptake of all vaccines included in primary routine immunisations by parents in high income settings compared to a control group/no intervention?	Yes	Range of findings; RR 2.01 (1.39, 2.93) to RR 2.38 (1.23, 4.6)	Range: Very low to Low
	7	Do awareness raising/information provision using mass media interventions increase uptake of all vaccines included in primary routine immunisation by parents in high income settings compared to a control group/no intervention?	Yes	RR 1.57 (1.4, 1.75)	Moderate
	8	Does communication tool-based health care worker (HCW) training increase uptake of all vaccines included in primary routine immunisation by (rostered) patients compared to a control group/no intervention?	Yes	Range of findings; RR 1.54 (1.33, 1.79) to RR 3.09 (2.19, 4.36)	Range: Low to Moderate
	9	Does information-based health care worker (HCW) training increase uptake of all vaccines included in primary routine immunisation by (rostered) patients	Yes	Range of findings; RR 0.99 (0.93,	Very Low

		compared to a control group/no intervention?		1.06) to RR 2.83 (2.6, 3.08)	
Non-financial incentive-based	1	Do non-financial incentives increase uptake of all vaccines included in primary routine immunisation in parents compared to a control group/no intervention?	No	-	-
	2	Do non-financial incentives increase uptake of all vaccines included in primary routine immunisation in parents/communities located in low-income settings compared to a control group/no intervention?	Yes	RR 2.16 (1.68, 2.77)	Moderate
	3	Do non-financial incentives increase uptake of all vaccines included in primary routine immunisation in populations targeted by vaccination campaigns compared to a control group/no intervention?	No	-	-
	4	Do non-financial incentives increase uptake of all vaccines included in primary routine immunisation in populations with low baseline vaccination coverage ($\leq 50\%$) compared to a control group/no intervention?	No	-	-
Reminder/recall-based	1	Do reminder or recall-based interventions increase uptake of all vaccines included in primary routine immunisation in parents or communities located in low-income settings compared to a control group/no intervention?	Yes	RR 1.26 (1.13, 1.42)	Moderate
	2	Do reminder or recall-based interventions increase uptake of all vaccines included in primary routine immunisation in populations with low baseline vaccination coverage ($\leq 50\%$) compared to a control group/no intervention?	Yes	RR 3.22 (1.59 to 6.53)	Very Low

Dialogue-based interventions

Eleven studies evaluated by PICO and GRADE deployed dialogue based interventions to address vaccine hesitancy (see definition page 7). There was appreciable variability in the quality of evidence supporting the use of these interventions and their impact varied considerably, by type of intervention, by vaccine and by setting.

For polio, the involvement of religious or traditional leaders in populations with low baseline uptake indicated a large, positive effect on vaccine uptake but the evidence quality was assessed as very low.

Five studies using social mobilisation among parents in low-income settings had a positive effect on uptake of measles (RR 1.63 [1.39, 1.91]), DTP3 (RR 2.17 [1.8, 2.61]), DTP1 (RR 1.54 [1.1, 2.15]), and polio (RR 1050.00 [147.96, 7451.4]) vaccines. The quality of evidence for each outcome ranged from moderate (measles, DTP3), to low (polio) and very low (DTP1). Two studies targeting those declining polio vaccination were associated with large increases in uptake in this population.

Two studies evaluated interventions utilising social media; these had a positive effect on uptake for MCV4/Tdap (RR 2.01 [1.39, 2.93]) and seasonal influenza (RR 2.38 [1.23, 4.6]) although respectively, the evidence was assessed as of very low and low quality respectively.

A study utilising mass media to target parents with low levels of awareness of health services was associated with increased uptake of all routinely recommended vaccines (RR 1.57 [1.4, 1.75]). The quality of evidence was moderate but the effect size was not large.

The provision of communication tool-based training for health care workers had a positive impact on uptake of EPI (RR 3.09 [2.19, 4.36]) and DTP3 (RR 1.54 [1.33, 1.79]) among rostered patients; evidence quality was assessed as moderate and low respectively.

One study assessed the impact of information-based training for health care workers on uptake for rostered patients, with varying results. There was little or no increase in uptake of DTP/OPV-1 (RR 0.99 [0.93, 1.06]), DTP/OPV-2 (RR 1.04 [0.97, 1.12]), BCG (RR 1.01 [0.95, 1.08]) and measles (RR 1.02 [0.96, 1.09]), a moderate increase in uptake of HepB-2 (RR 1.63 [1.49, 1.79]), HepB-3 (RR 1.89 [1.74, 2.04]) and DTP/OPV-3 (RR 1.42 [1.33, 1.51]), and a substantial increase in uptake of HepB-1 (RR 2.83 [2.6, 3.08]); but the evidence quality was very low for all.

Non-financial incentives

The evidence for non-financial incentives for parents/communities located in low-income settings was moderate for a large, positive effect on uptake of EPI vaccines (RR 2.16 [1.68, 2.77]).

Reminder-recall interventions

Two studies assessed the impact of reminder-recall interventions on vaccine uptake in a) low income and b) under-vaccinated populations. The impact of reminder-recall interventions in low-income settings was positive for DTP3 (RR 1.26 [1.13, 1.42]) with moderate quality evidence. For settings with low baseline uptake, the effects were large and positive for scheduled childhood vaccines (RR 3.22 [1.59, 6.53]) but the quality of evidence was very low.

Discussion

PICO & GRADE studies

All interventions were associated with increases in vaccine uptake but there are several issues that hinder interpretation of the evidence. Interventions varied considerably in outcome impact, type of strategy, setting and target vaccine, which makes generalisability difficult; variations in study design further increased issues of heterogeneity. The majority of studies were observational and so we cannot assume a causal relationship between the intervention and vaccine uptake. Two studies were at major risk of bias and the quality of the evidence varied considerably.

Dialogue-based interventions

Despite the low quality of the evidence for the **involvement of religious or traditional leaders** in populations with low baseline uptake, the strength of the intervention's impact deserves exploration. This intervention is important as it addresses one of the more difficult determinants of vaccine hesitancy, namely misconceptions and community distrust. It attempts to address these using a variety of communication and engagement channels and gives attention to all aspects of community life that might influence vaccination decisions irrespective of age. This intervention also appears to align itself with natural community processes – seeking out community leaders; and encouraging dialogue across multiple levels in order to both inform and influence. In essence, the success of the intervention could be attributed to the efforts made to seek understanding of the target audience, facilitate open dialogue and integrate activities with familiar processes and systems.

The broad success of the **social mobilisation** intervention for populations refusing polio vaccination could be attributed to the design and application of specific strategies that directly targeted this clearly defined population. By comparison, the other two social mobilisation interventions for measles and DTP were much less targeted. Positive outcomes associated with these interventions appear to be due to meaningful dialogue at both the group and individual level.

The use of **social media** interventions showed positive effects but the quality of evidence was low to very low. The examples suggest that this approach might work well for those who have already started their vaccination schedule, or are familiar using such systems to organise different aspects of their lives. However, there is important evidence that social media is also very open to exploitation if not managed well.

The application of **mass media** to target parents with low levels of awareness of health services appears to have a valid place as an effective intervention, and whilst in the identified example, impact is limited, there is good potential for a true positive effect across a larger population. However, the limited impact in this case also suggests that there may be other underlying issues affecting low impact that need investigation and subsequent tailoring of more-specific strategies in response.

The provision of **communication tool-based training for health care workers** generally had a positive effect (for EPI, DTP3) but the size of the effect and evidence quality varied. The observations about this example and mass media suggests that interventions that adopt a unidirectional (top down) approach to communication, may be successful among some individuals and groups, but not all; success is dependent on the nature and degree of hesitancy.

The impact of **information-based training for health care workers** on uptake of several vaccines for rostered patients was generally poor. A possible explanation for these results is that there was no clear understanding of the underlying reasons for the low vaccination uptake and as such, the intervention was not appropriately targeted. Nonetheless, the intervention did achieve good success with Hepatitis (all doses) and DTP/OPV (dose 3); one possible reason for this is that the health workers exhibited greater confidence but it is not clear whether this was an issue prior to the intervention.

Non-financial incentives

The moderate to large impact of non-financial incentives for parents/communities located in low-income settings on vaccination uptake is promising. However, in this study the target group was very disadvantaged and as such, the food-based incentive, so closely linked with basic survival, was unsurprisingly readily received. Furthermore, the baseline vaccination rates were very low (2%), which suggests that this target group were underserved and more likely to show greater outcome changes with an intervention. In this instance, it is possible that by addressing basic needs, this intervention simultaneously built confidence and reduced vaccine hesitancy because the target population felt that their other critical needs were being recognised, and not superseded by vaccines alone. This symbiotic approach could be particularly important for more marginalised groups.

Reminder-recall interventions

Although positive, the relatively low observed impact of reminder-recall interventions in low-income settings seems to reflect the limitations of using this kind of intervention in isolation. In this example, a complex set of issues was identified in the target population but the intervention only addressed one of them. Reminder-recall on its own is clearly not enough to tackle contexts where there are multiple determinants at play.

Overall completeness and applicability of evidence

Despite the low number of studies, there is some opportunity to be moderately confident in several of the interventions including: social mobilisation, mass media, communication tool-based training for HCW, non-financial incentives, and reminder-recall activities. However, none of these interventions were without shortcomings, and given the additional caveats around indirectness and the variability in content, setting, delivery method, target population composition and effect estimates across outcomes, the success, and potential application, of these interventions must be cautiously considered when looking to deliver them in different circumstances.

Objective 4. Synthesis of findings

Overall this review has found that there are 1) few existing strategies that have been explicitly designed to address vaccine hesitancy; and 2) even fewer strategies that have been evaluated for impact. The first of these issues is most likely because 'vaccine hesitancy' is an emerging issue, which to date, has not had a clear definition from which to explore and interrelate identified concerns. As such, interventions are often only half-conceived; target audiences are not always appropriately identified, and there is a lack of rigorous understanding of the actual problem. Interventions around polio vaccination are the exception to this – and the findings of this review indicate their greater success as a result.

At present, the efforts that have been made to address issues of hesitancy are disparate. This is not surprising given the complexity of the problem but it does make interpretation of the evidence more difficult. Specifically, while a number of interventions did have a positive impact, it was variable. Wide variation was observed in the effect size between studies, settings and target populations. Even within studies there was wide variation on the impact on uptake of specific vaccines. In addition, the high level of heterogeneity across study design and outcomes coupled with few available studies further limited our ability to draw many general conclusions about the effectiveness of different strategies.

Nonetheless, across the literature, interventions that are multicomponent and/or have a focus on dialogue-based approaches tend to perform better. This message is corroborated by the more formal GRADE assessment of the evidence which indicated greater quality of evidence for social mobilisation, mass media and communication tool-based training for HCW. Together, these interventions suggest that taking a comprehensive approach that targets multiple audiences and layers of social interaction are more likely to bring positive results. The evidence for the other interventions, non-financial incentives and reminder-recall activities, was also of good quality, and carries the potential to bring positive change by addressing the more practical aspects of vaccination. It is important to reiterate however, that the key to success seems to lie in designing more complex, but integrated, multi-component interventions.

This review shows that vaccine hesitancy is a complex issue and no single strategy will be able to address it single-handedly. There are some promising examples, but many are incomplete and most are not directly comparable. Perhaps one of the greatest drawbacks of the interventions identified is that so many operate from an assumption-based rather than an evidence-based approach; appropriate evaluation is also lacking. On a more positive note, there is a growing body of research on the determinants of vaccine hesitancy which can help inform and refine currently used approaches that look promising but have not yet been fully implemented nor evaluated, as well as supporting the formative research, design and evaluation of new interventions. This is an opportunity to develop early learnings and set the precedent to advance the understanding and management of issues of vaccine hesitancy.

Limitations

This review may be subject to publication bias, in that unsuccessful interventions may be less likely to be documented in either the peer-reviewed or grey literature. Consequently, although the review gives some indication of interventions that successfully reduced vaccine hesitancy in specific

populations and settings, interventions that were found to have no effect or a negative effect may be under-represented.

Conclusions and implications

Literature identified

- Despite extensive literature searches, only 14% (166/1149) of the peer-reviewed studies and 25% (15/59) of the grey literature, discussed evaluated interventions relating to vaccine hesitancy; the bulk of the literature originated from AMR and EUR.
- Across all regions and literature, the majority of interventions were multi-component in nature, followed by dialogue-based approaches (except EMR which only featured multi-component). Reminder-recall interventions featured only in higher-income regions (AMR, EUR, WPR), and incentives appeared only in AMR and AFR.

Interventions – which were successful and which were not?

- Whilst several approaches taken independently can be successful, the most effective interventions employed a number of strategies (multi-component interventions) to increase vaccine uptake, knowledge and awareness, and shift attitudes towards pro-vaccination. The most promising strategies for Outcome 1 (vaccination uptake) included (in no particular order): 1) directly target unvaccinated or under-vaccinated populations; 2) aim to increase knowledge and awareness surrounding vaccination; 3) improve convenience and access to vaccination; 4) target specific populations such as the local community and HCW; 5) mandate vaccinations or impose some type of sanction for non-vaccination; 6) employ reminder and follow-up; and 7) engage religious or other influential leaders to promote vaccination in the community. For Outcome 2 (psychological shift), the introduction of education initiatives, particularly those that embed new knowledge into a more tangible process (e.g., hospital procedures, individual action plans), were most successful at increasing knowledge and awareness and changing attitudes.
- Consistent with the above and notwithstanding the small number of studies, the GRADE approach yielded evidence in which there is moderate confidence for several types of interventions including: social mobilisation, mass media, communication tool-based training for HCW, non-financial incentives, and reminder-recall activities. However, all studies had weaknesses and strategies should be carefully considered before adopting them in different settings.
- Review of the interventions adopted to address hesitancy around RHT showed an important parallel with those for vaccine hesitancy. Specifically, dialogue-based interventions, particularly those incorporating a focus on community engagement/social mobilisation and the improvement of HCW communication, were most effective for improved uptake.
- Interventions that were single-component did not work as well as those that were multi-component. Also, interventions that were the most passive (e.g., posters, radio announcements, websites and media releases) that did not have an additional engagement component were less effective. It is possible that there are more examples of interventions

that have failed in the field but these receive little attention in the literature; identification of and lessons from these experiences will need to be explored through different means.

Opportunities

- Despite the large body of literature on the many determinants of vaccine hesitancy, most interventions have focused on individual level issues (e.g., knowledge, awareness) and vaccine/vaccination specific concerns (e.g., mode of delivery, role of healthcare professionals). There needs to be more attention given to understanding and addressing hesitancy at the community level (e.g. social norms).
- There is an opportunity to broaden the outcomes of interest when assessing the effects of interventions, in particular, more intermediary outcomes such as changes in knowledge, norms, attitude and awareness. These outcomes might indicate important shifts along the vaccine continuum, either away from or towards acceptance, even if they do not necessarily lead to a change in vaccination uptake. Appreciating where individuals and communities lie on the continuum and what defines this offers another insight to inform intervention design.

Limitations

- The term/concept of 'vaccine hesitancy' has only recently been coined and has not yet found general currency among researchers or immunisation professionals. To overcome this issue, the SAGE WG Model of determinants of Vaccine Hesitancy was used as a default coding tool whereby only those studies that reported on interventions to address one or more of the determinants were included. Studies that reported on strategies that impacted on vaccination uptake in general were excluded (such as system or supply issues).
- Another reason for the paucity of relevant studies is that the questions emphasise specific, single component strategies, but many evaluated strategies are neither designed nor presented in this way. Evaluated, multi-component interventions were identified but only overall impact data were presented and VH data was not separately available.

Key lessons

- Vaccine hesitancy is complex and dynamic; future strategies need to reflect and address these complexities in both design and evaluation. In the first instance, implementers must adequately identify the target population and understand the true nature of their particular vaccine and/or vaccination concerns; this will help ensure a well-informed intervention.
- Well integrated, multi-component strategies should be promoted and must be accompanied by an appropriate evaluation process. Specifically, implementers must be able to appreciate the influence of individual components which will benefit the immediate operations and the design of future interventions.
- Overall, the design and delivery of interventions should try to reflect the following points: 1) Target audiences should be clearly identified and specific issues well researched and understood; 2) Interventions should focus on meaningful engagement (i.e., dialogue-based,

social mobilisation) that supports realistic action; 3) Contextual influences, from the individual through to the health system, should be acknowledged and accounted for when choosing strategies; 4) Interventions should be multi-component and seek to address primary determinants of uptake across the different domains of influence; 5) Interventions must be evaluated.

Section 1 – Systematic literature review - strategies addressing vaccine hesitancy

(Addresses objectives 1 and 2)

1.1 Introduction

As a companion to the systematic review on the barriers and promoters of vaccine hesitancy (4) conducted on behalf of the SAGE working group on vaccine hesitancy, the purpose of this systematic review of peer review and grey literature was to identify strategies that have been put forward to respond to and manage vaccine hesitancy. Since the findings of the first review indicated that much of the peer-reviewed literature on vaccine hesitancy focuses on high income countries, particularly AMR and EUR, this second review was broadened to include grey literature, with the goal of identifying strategic approaches more comprehensively and from all WHO regions. In addition, given the relatively new development of the concept of vaccine hesitancy and the potential learnings from other areas of health that may have experienced similar issues, this report also includes a review of strategies used to address hesitancy around reproductive health technologies to seek relevant experiences outside of immunisation and to ascertain whether strategies aimed at addressing hesitancy surrounding reproductive health technologies could be used to address vaccine hesitancy. Lastly, in accordance with the working groups terms of reference, a selection of interventions were assessed using GRADE in an effort to provide a sense of the quality of the evidence that supports the working group’s recommendations to the SAGE committee.

1.1.a Objectives

In accordance with the SAGE WG’s terms of reference , the objectives of the review were to:

1. Identify published strategies related to vaccine hesitancy and hesitancy of other health technologies (reproductive health technologies (RHT) were chosen as the additional focus) and provide a descriptive analysis of the findings;
2. Map all evaluated strategies to the SAGE WG “Model of determinants of Vaccine Hesitancy” (Appendix 1) and identify key characteristics;
3. Evaluate relevant evaluated strategies relating to vaccine hesitancy using GRADE (Grades of Recommendation, Assessment, Development and Evaluation); relevance was informed by the PICO questions defined *a priori* by the WG, and;
4. Synthesise findings in a manner which aids the design of future interventions and further research.

1.2 Methods

1.2.a Search methods

Peer Reviewed Literature

A search strategy was first developed in Medline and then adapted as needed across each database (see Appendix 2). The keywords set out in Table 3 were incorporated into the search along with related MeSH/subject headings; they are deliberately broad to reflect the scoping approach used to capture all of the different dimensions of the concept of vaccine hesitancy.

Table 3. Keywords applied in search strategy

vaccin*	AND	anxiety	doubt*	trust	intent*	dilemma*
		attitude*	distrust	mistrust	controvers*,	objector*
		awareness	dropout*	Perception*	misconception*	uptake
immunis*		behavi*r	exemption*	refus*	misinformation	barrier*
		belief*	fear*	rejection	opposition	choice*
immuniz*		criticis*	hesitanc*	rumo*r	delay	mandatory
		accept*	concern*	compulsory	knowledge	
		confidence	decision making	anti-vaccin*	parent* con*	

Primary studies were identified using multidisciplinary mainstream and regional database searches (Table 4). Reference lists of relevant papers and reviews were manually searched.

Table 4. Electronic databases searched

Database	Date Search Last Run (2013)
Medline	9 th October
Embase Classic & Embase	9 th October
PsychInfo	9 th October
Cochrane	9 th October
CINAHL Plus	9 th October
Web of Science	9 th October
IBSS	19 th July
LILACS	9 th October
AfricaWideInfo	9 th October
IMEMR	10 th October

Grey Literature

Search terms relating to vaccine hesitancy were applied to a database search of OpenGrey, New York Academy of Medicine and Global Health. Organisational websites searched included NICE, DFID, the Communication Initiative Network and the Polio Communication Initiative Network (Appendix 3).

In addition, direct email requests were sent to individuals/organisations identified by the WG. Requests were sent to the Developing Country Vaccine Manufacturers Network (DCVM) and the International Federation of Pharmaceutical Manufacturers & Associations (IFPMA) with results received from IFPMA.

Reproductive Health Technologies - Grey Literature

See Appendix 4 for the reproductive health search strategy.

1.2.b Selection criteria

Once retrieved, peer-reviewed articles were screened by title and abstract according to a set of inclusion and exclusion criteria (Table 5).

Table 5. Inclusion and exclusion criteria applied to peer-reviewed studies

<p>Inclusion Criteria</p> <ul style="list-style-type: none"> • Articles that include research on the following: <ul style="list-style-type: none"> ○ Vaccine hesitancy, public trust/distrust, perceptions, concerns, confidence, attitudes, beliefs about vaccines and vaccination programmes by individuals (such as parents, health care workers), groups or communities • Keywords: Strateg*, intervent*, campaign, evaluation, approach, program* in title or abstract • Suggest/describe or evaluate an intervention addressing hesitancy • Evaluated studies or reports needed to relate to primary and/or secondary outcomes of interest. Primary outcome indicated a change in behaviour (such as vaccination uptake/coverage) and secondary outcome indicated a change in knowledge/awareness or attitude • Location: Global • Publication Years: January 2007 - October 2013 • Vaccine: All vaccines and vaccination programmes of communicable diseases. • Concerns: All concerns • Populations: All • Languages: All six UN languages: Arabic, Chinese, English, French, Russian and Spanish. <p>Exclusion Criteria</p> <ul style="list-style-type: none"> • Not about vaccines • Non-Human vaccines • Vaccines not currently available, such as HIV vaccine • Non-peer reviewed papers such as editorials, letters, comment/opinion, protocol (no data), pilot studies • Research and Development; unless about public trust, confidence, concern or hesitancy <ul style="list-style-type: none"> ○ Safety research ○ Serologic investigations ○ Immunogenicity Studies ○ Efficacy trials ○ Pre-clinical trial research ○ Cost-benefit analysis or cost effectiveness trials. • Papers without abstracts

The criteria for grey literature were the same for peer-reviewed except for the following (Table 6)

Table 6. Inclusion criteria applied to grey literature studies

<p>Inclusion Criteria</p> <ul style="list-style-type: none"> • Keywords: Immunisation, vaccine, vaccination, strategy, intervention, evaluation, hesitancy, refusal, trust, confidence, acceptance, engagement, anxiety, concern, distrust, barrier, rejection, fear • Grey literature research publication years: no set range; Up to October 2013 • Languages: English only (due to time and resource constraints) • Non-peer reviewed literature.

1.2.c Data extraction

A two-part data extraction form was developed and reviewed by the WG. Part A was completed for all documents to be screened by full text. Characteristics captured in Part A included:

- Intervention/s identified (Yes/No)
- Intervention: evaluated or not (intervention suggested only)
- Validate problem being addressed as an issue of vaccine hesitancy using the SAGE WG model of determinants of vaccine hesitancy
- Brief details of intervention
- Setting (country / WHO region)
- Vaccine (s) being targeted.

Part B only applied to those papers identified as evaluated; characteristics captured in Part B included:

- Participant information
- In-depth detail of intervention (including intervention purpose and categorisation of intervention according to the SAGE WG Model of determinants of Vaccine Hesitancy)
- Outcomes measured (primary or secondary) and how evaluation was done
- Other (study funding sources, possible conflicts of interest, reference to other relevant studies/documents).

1.3 Results

1.3.a Literature identified

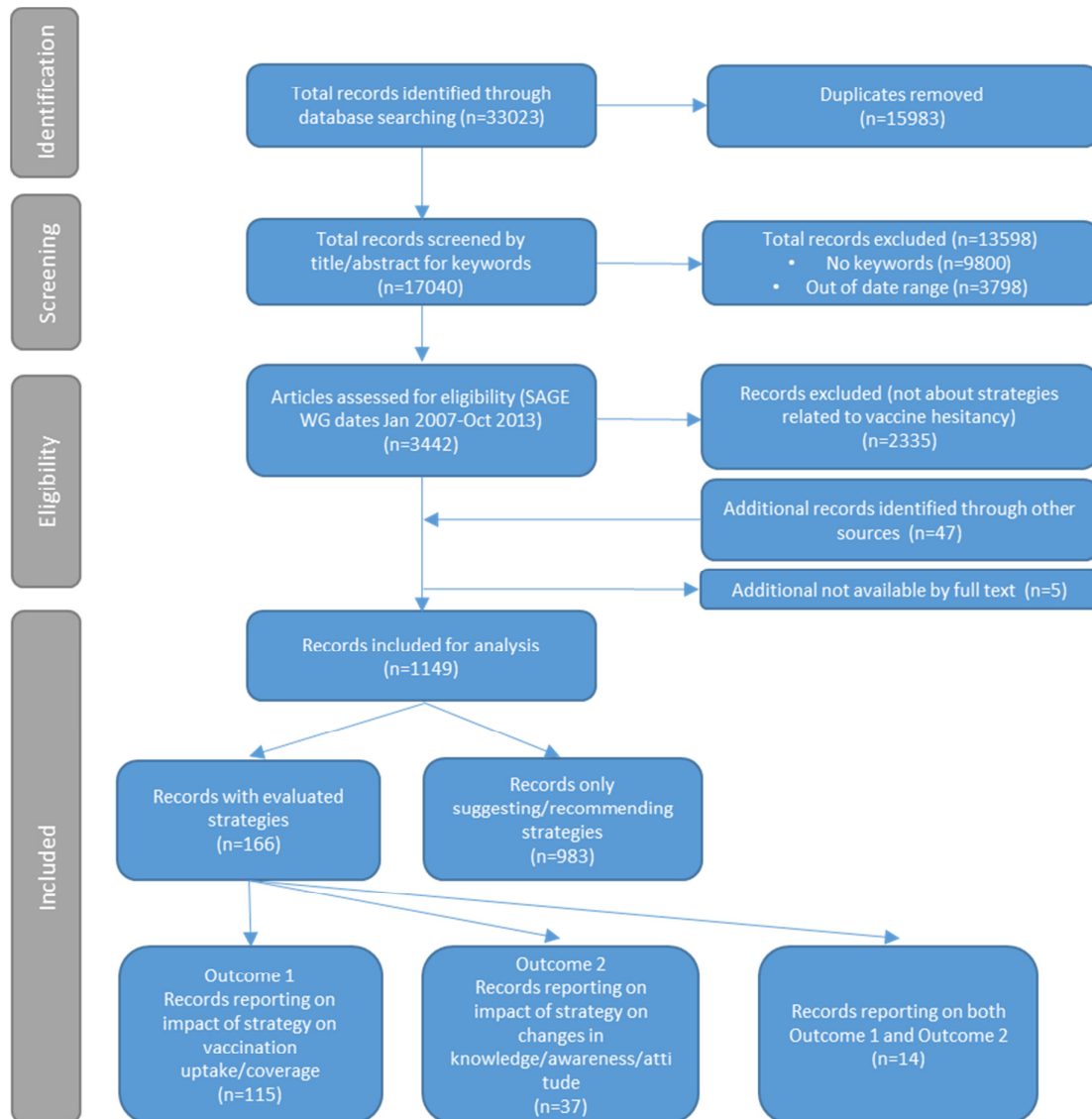
Vaccine Hesitancy

For the peer reviewed literature (Figure 1), 33023 articles were identified. After the removal of duplicates and irrelevant articles and the addition of 47 articles identified through other sources, (of which 5 articles were excluded as they were available by abstract only), 1149 articles were included for full-text review. Of the articles reviewed, 166 (5-171) were formally evaluated and 983 only suggested an intervention. Evaluated articles were then categorised by outcomes.

An article was classified as:

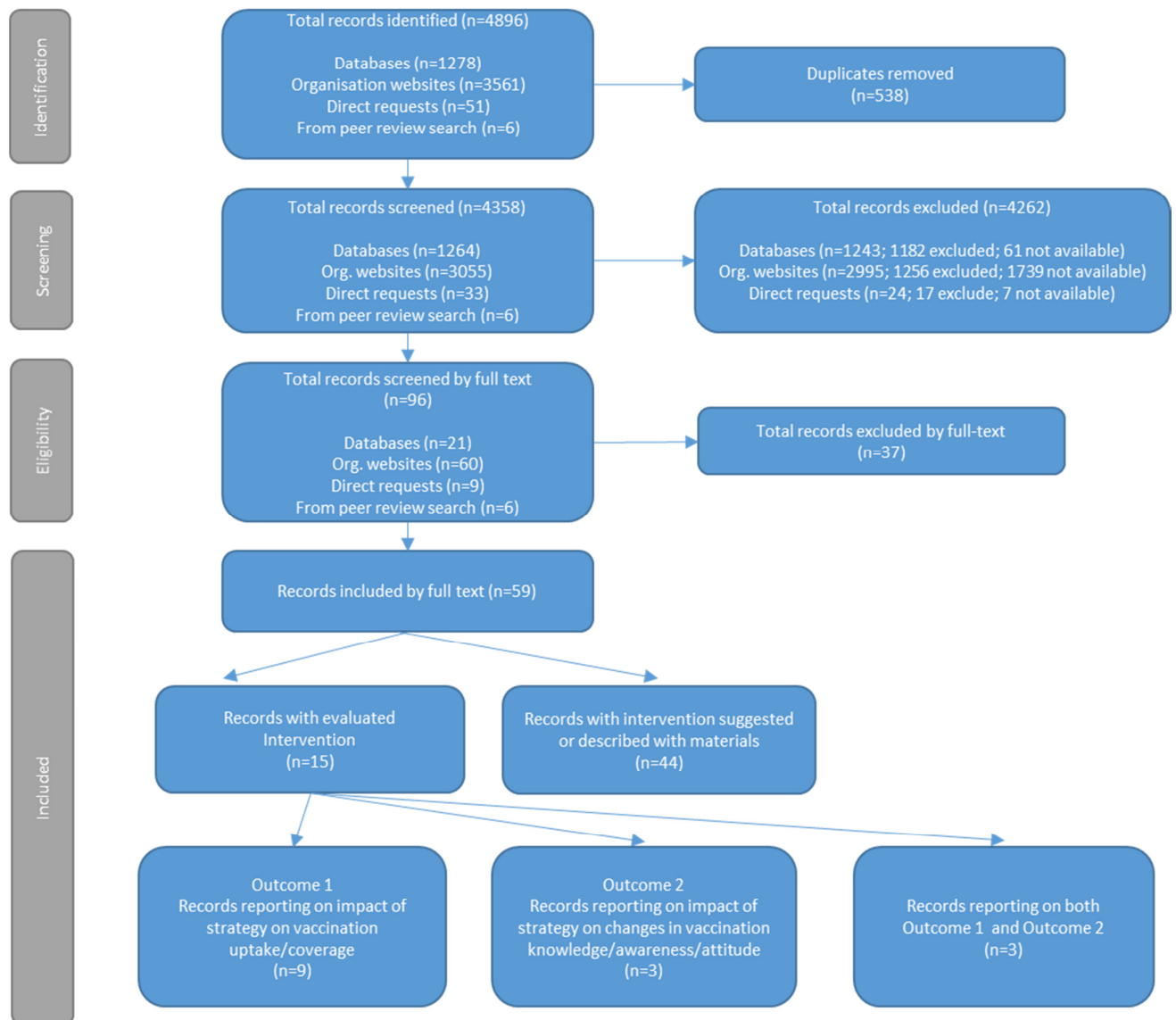
- Outcome 1 if it reported on an intervention that influenced vaccine uptake (n=115) or
- Outcome 2 if it reported on an intervention that influenced vaccine knowledge/awareness/attitude (n=37)
- 14 records reported on both outcomes.

Figure 1: Search process flow chart (peer reviewed literature) - Vaccine Hesitancy



The search for grey literature (Figure 2) commenced in July 2013 and 4896 records were identified. The search strategy was the same as for the peer reviewed literature but there was a large amount of irrelevant articles found. Therefore, the search terms were narrowed down, however most articles screened were still irrelevant. After the removal of duplicates and irrelevant articles, 59 records were included by full text. Of these articles, 15 evaluated (172-186) and 44 suggested an intervention. Nine articles reported on Outcome 1, three articles on Outcome 2, and three on both.

Figure 2: Search process flow chart (grey literature) - Vaccine Hesitancy

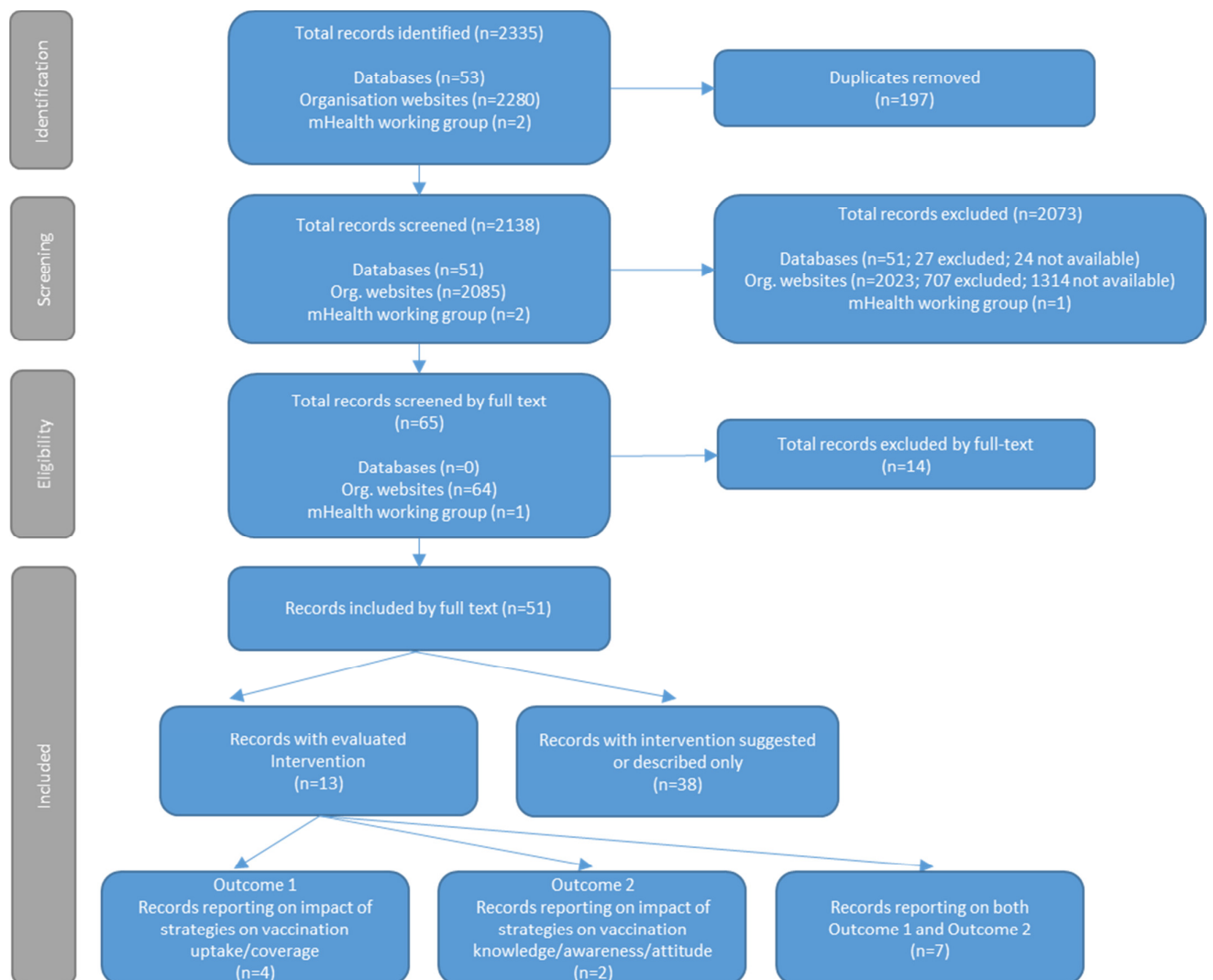


Reproductive Health Technology

Article Selection

For the reproductive health technology literature (Figure 3), 2335 articles were identified. After the removal of duplicates and irrelevant articles, 65 were included for full-text review. After excluding further irrelevant articles, 51 were included. Of these articles, 13 (25%) evaluated interventions and 38 (75%) suggested interventions. Strategies are detailed in (Appendix 5).

Figure 3: Search process flow chart (grey literature) - Reproductive Health Technologies

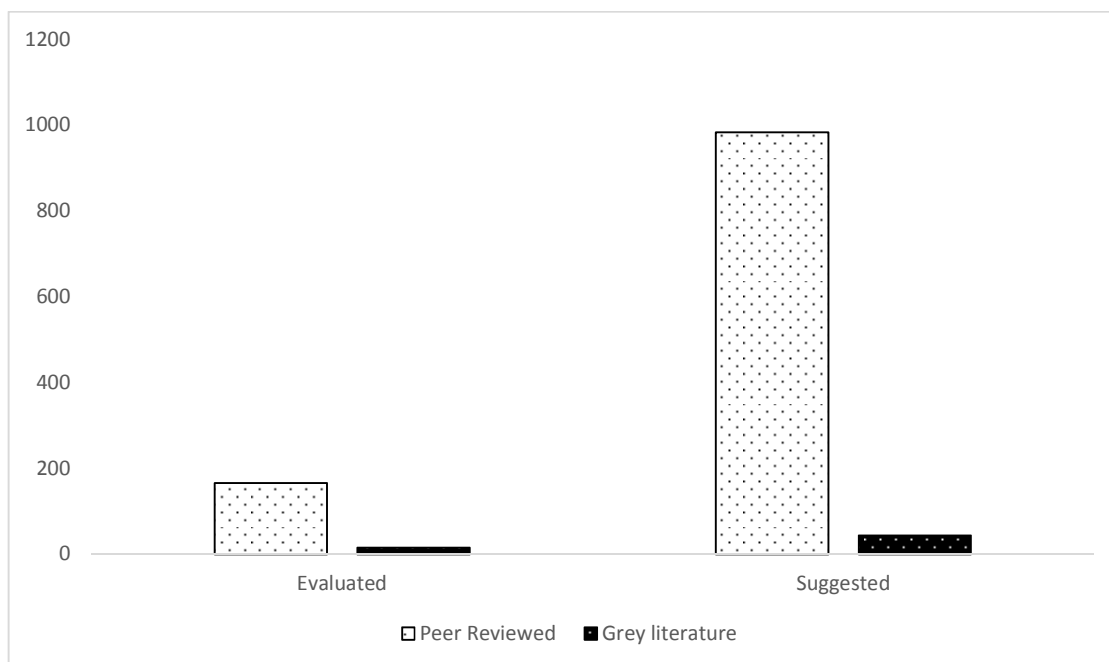


1.3.b Scope of the literature and descriptive analyses

Vaccine hesitancy

For both peer reviewed and grey literature, the majority of interventions were only suggested, 983 (86%) and 44 (75%) respectively. An evaluation component was only included in 166 (14%) of the peer reviewed studies, and 15 (25%) of the grey literature (Figure 4).

Figure 4. Evaluated and suggested peer reviewed and grey literature articles on vaccine hesitancy (n=1208)

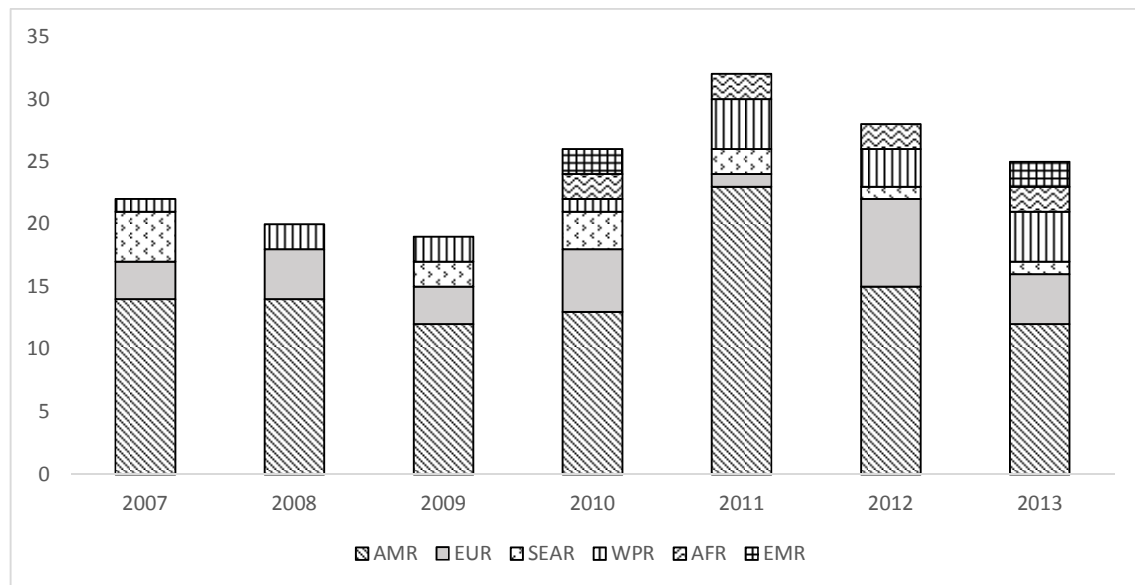


From the peer-reviewed literature, evaluated interventions which aimed to address vaccine hesitancy were found across all WHO regions but the majority were based in AMR (n=103, 60%), followed by EUR (n=27, 16%), WPR (n=17, 10%), SEAR (n=13, 8%), AFR (n=8, 5%) and EMR (n=4, 2%) regions (Figure 5). From January 2007- December 2011, apart from a slight decline in 2008 and 2009, there was a steady increase in the number of articles which aimed to address vaccine hesitancy in the peer reviewed literature. However, this number decreased, from 31 articles in 2011 (18%) to 24 articles in 2013 (14%).

In the grey literature, evaluated interventions were mostly based in AMR; (n=8; 50%), followed by AFR; (n=5, 31%), SEAR; (n=2, 13%) EMR; (n=2, 13%), with none from the WPR region. These numbers add up to more than 100% because some interventions report on more than one country. Compared to the peer-reviewed literature, very few articles evaluated an intervention to address vaccine hesitancy – none at all for the years 1997-2002, 2004, 2005, 2008 and 2010. However, the search revealed more articles relating to our search terms in 2013, with eight articles evaluating an intervention (47%) (Figure 6).

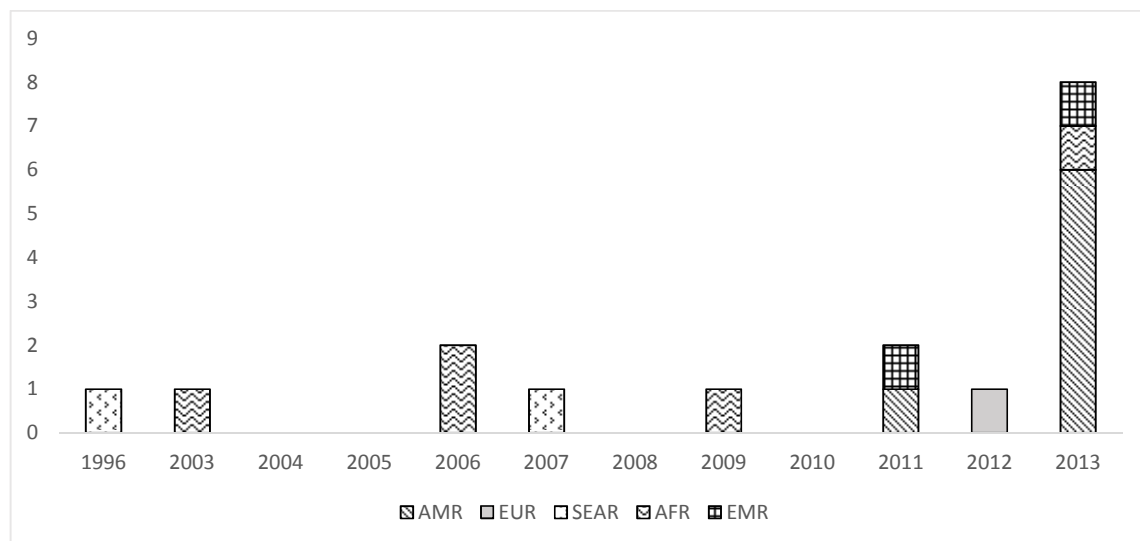
It is worth noting that across all the literature reviewed (1208 articles), only five (0.4%) used the actual term 'hesitancy' or 'hesitant' with reference to vaccines/vaccination. These were all found in the peer reviewed literature and were all published in 2013 (187), (188), (189) (190). Only one of these articles was evaluated (93). More often articles used terms such as refusal, distrust and acceptance to discuss vaccination behaviour.

Figure 5. Evaluated peer-reviewed strategies by publication year (2007-2013) and WHO region (n=172)*



*Total number of articles is more than (n=166) as some articles report on more than one WHO region

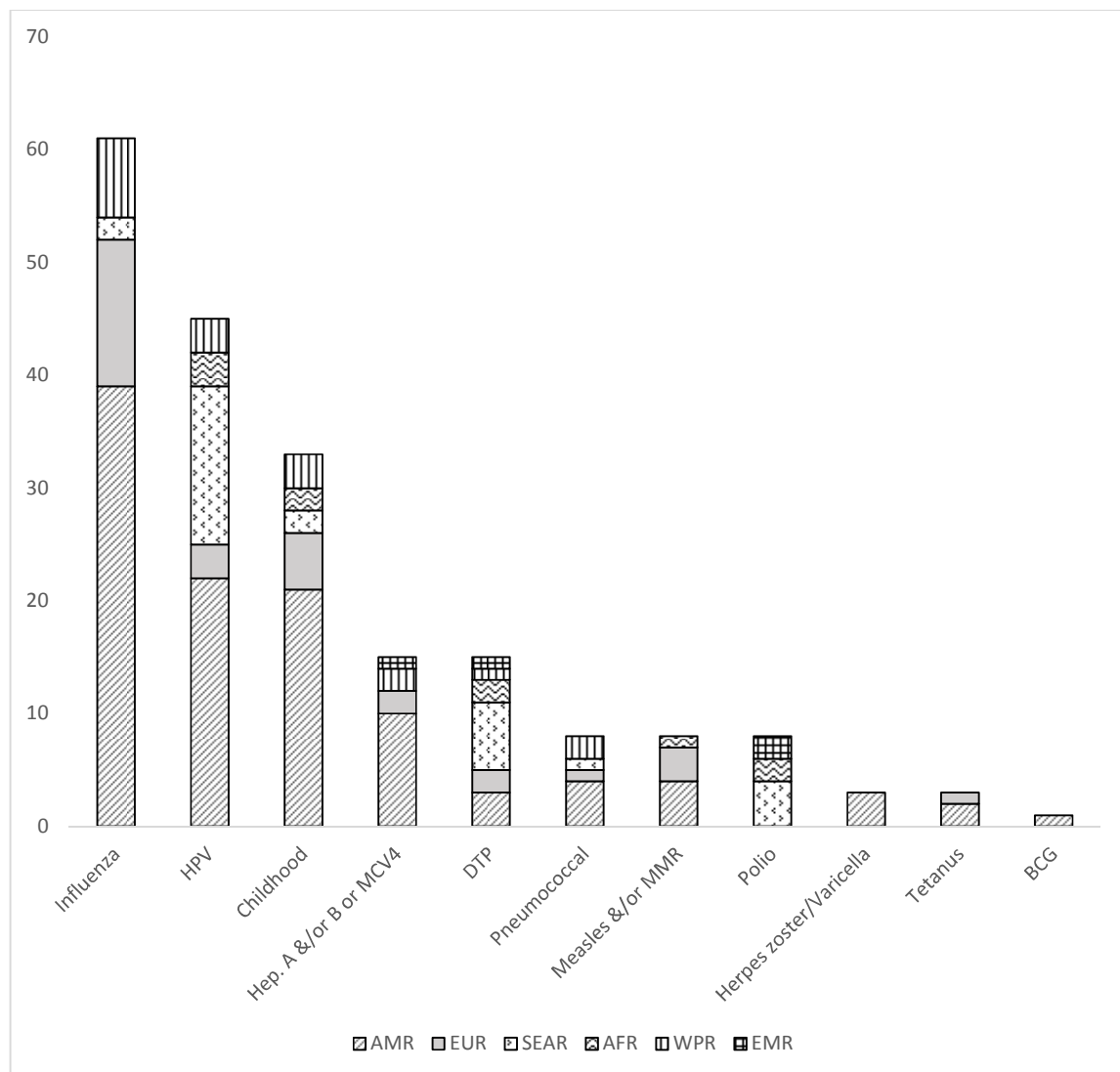
Figure 6. Evaluated grey literature strategies by publication year (1996-2013) and WHO region (n=17)*



*Total number of articles is more than (n=16) as some articles report on more than one WHO region

Within the peer reviewed literature (Figure 7), interventions relating to influenza and childhood vaccination were of primary interest in high income regions (AMR and EUR): in these regions (n=52, 48%) addressed influenza vaccination and (n=26, 24%) focused on childhood vaccines. Studies focused more on DTP and polio vaccines in low and middle income areas, particularly in the SEAR region, where (n=6, 18%) focused on strategies to increase acceptance of the DTP vaccine and (n=4, 12%) on the polio vaccine. Both high and middle-low income regions addressed the relatively newly introduced HPV vaccine.

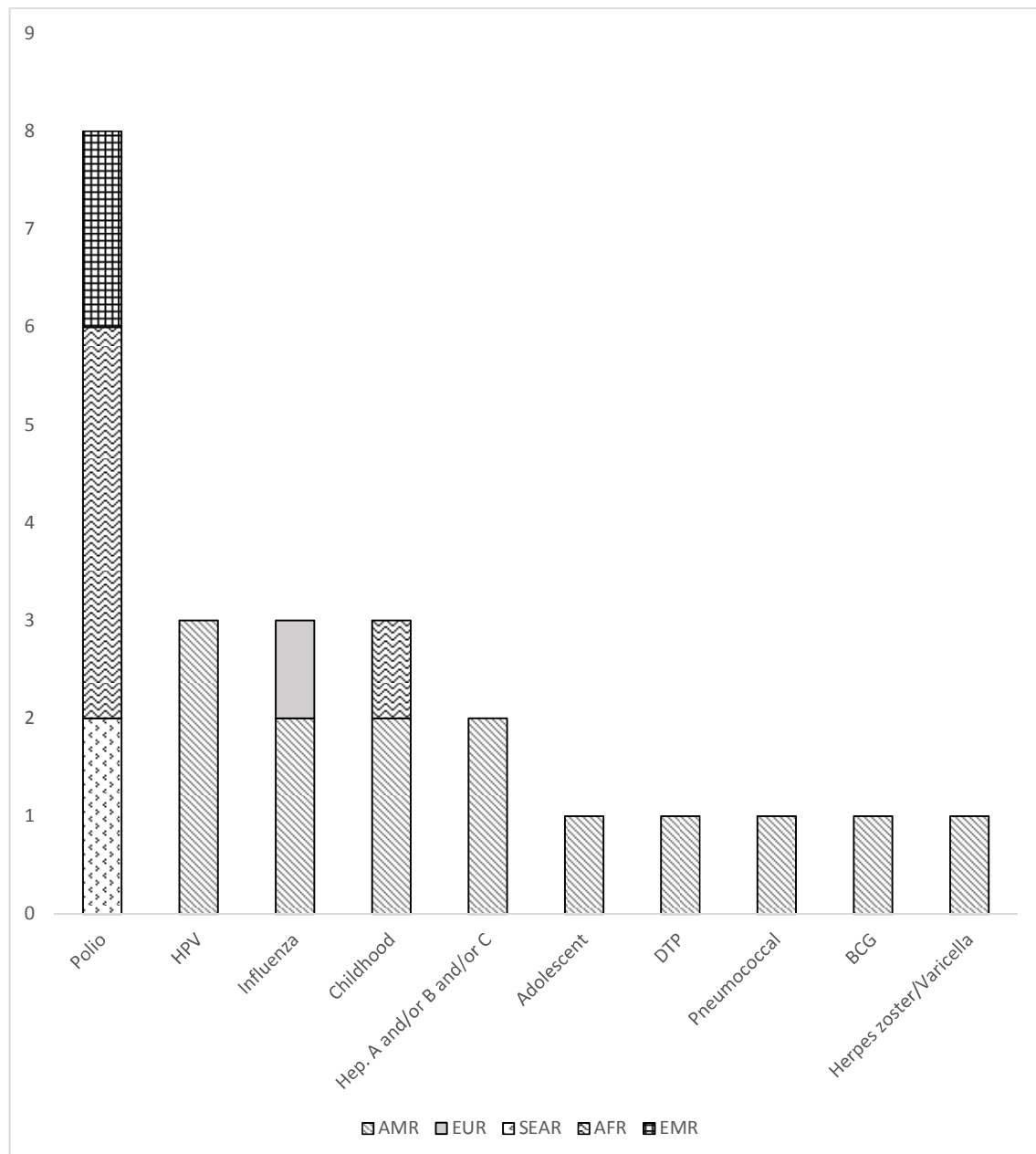
Figure 7. Evaluated peer reviewed strategies by vaccine and WHO region (2007-2013) (n=200)*



*Total number of strategies more than identified interventions (n=166) as some interventions have more than one strategy and strategies can be applied across multiple vaccines in a single intervention.

Within the grey literature (Figure 8) polio vaccine interventions were most common in low- and middle-income regions especially in AFR, SEAR and EMR regions. Of the total strategies, (n=8, 33%) focused on polio. HPV vaccine strategies were only found in the AMR region and made up (n=22, 13%) of all strategies.

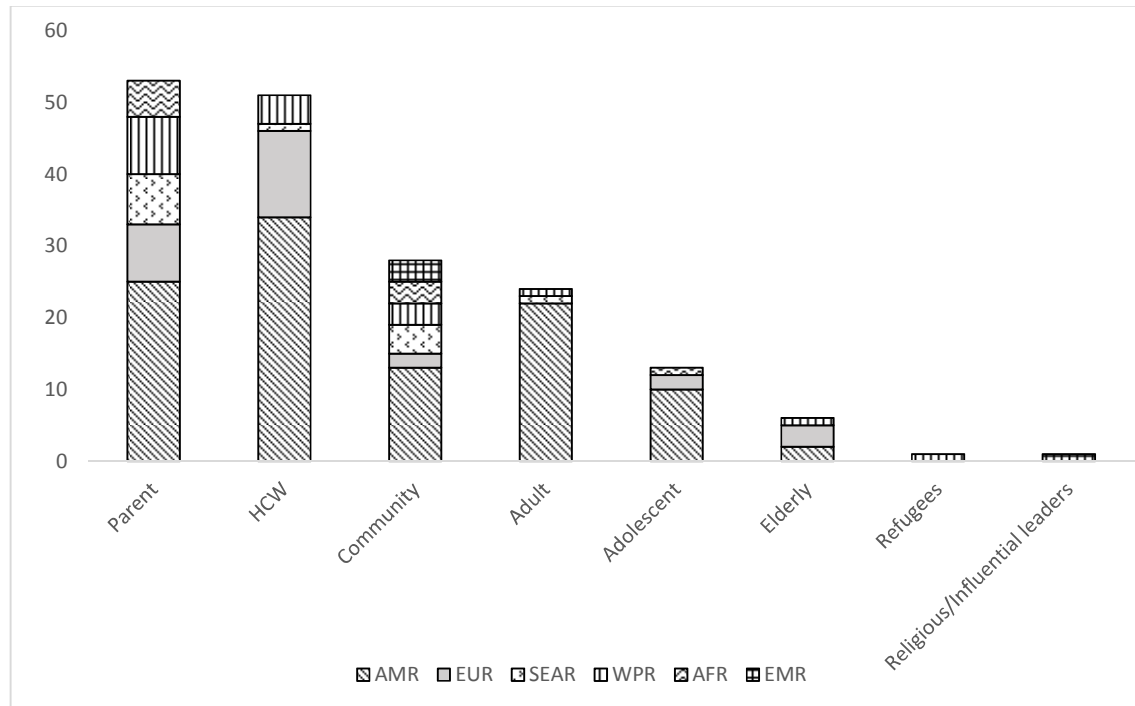
Figure 8. Evaluated grey literature strategies by vaccine and WHO region (2007-2013) (n=24)*



*Total number of strategies more than identified interventions (n=15) as some interventions have more than one strategy and strategies can be applied across multiple vaccines in a single intervention.

As evident from the peer-reviewed literature (Figure 9), strategies targeting parents, HCW and adults (patient vaccines) were most common and found mostly in high income regions such as AMR; 47% (n=25) of strategies in this area were aimed at parents, 67% (n= 34) were aimed at HCW and 92% (n=22) were aimed at adults. Strategies aimed at the local community were also common in AMR; (n=13, 46%) as well as EMR, AFR, WPR and SEAR (n=3, 11%) for each region.

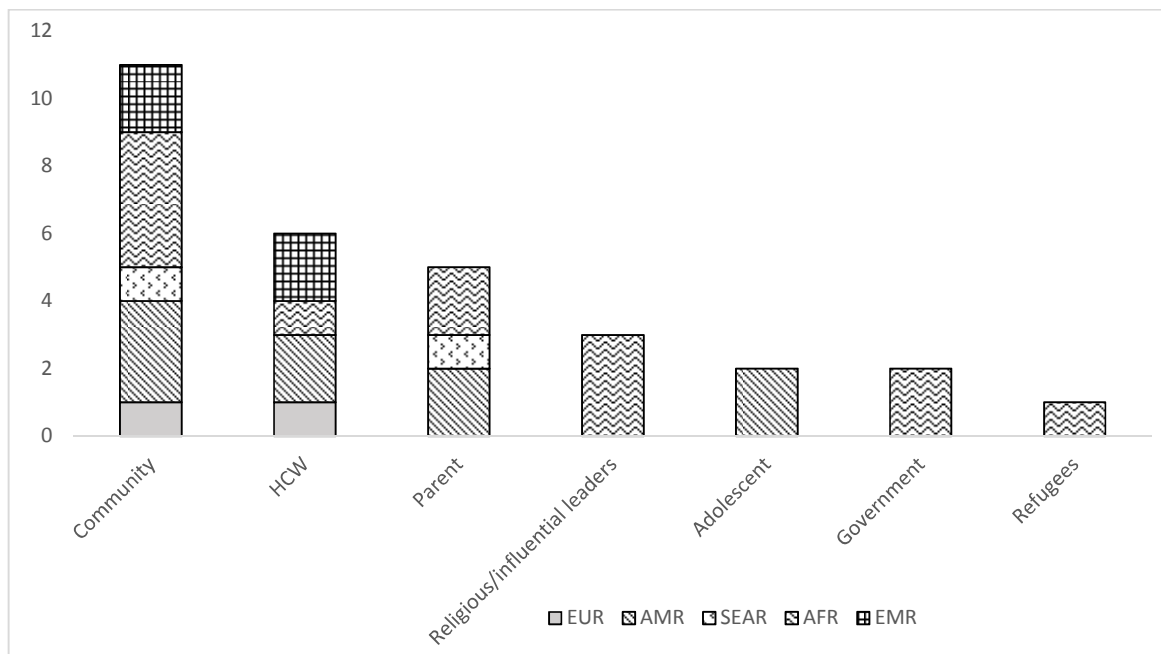
Figure 9. Evaluated peer-reviewed strategies by target population and WHO region (2007-2013) (n=177)*



*The HPV vaccine is classed as an adolescent vaccine

An analysis of the grey literature (Figure 10) demonstrates that the strategies aimed at specific populations differed from the peer reviewed literature. Most strategies were aimed at the local community (n=11, 36%), HCW (n=6, 20%) and parents (n=5, 17%), with some policy-based strategies aimed at government officials (all implemented a focus in AFR. Strategies aimed at the local community were also common in high income regions, particularly AMR (n=3, 27%) as were strategies aimed at HCWs (n=2, 33%), parents (n=2, 40%) and adolescents (n=2, 40%).

Figure 10. Evaluated grey literature strategies by target population and WHO region (n=30)*

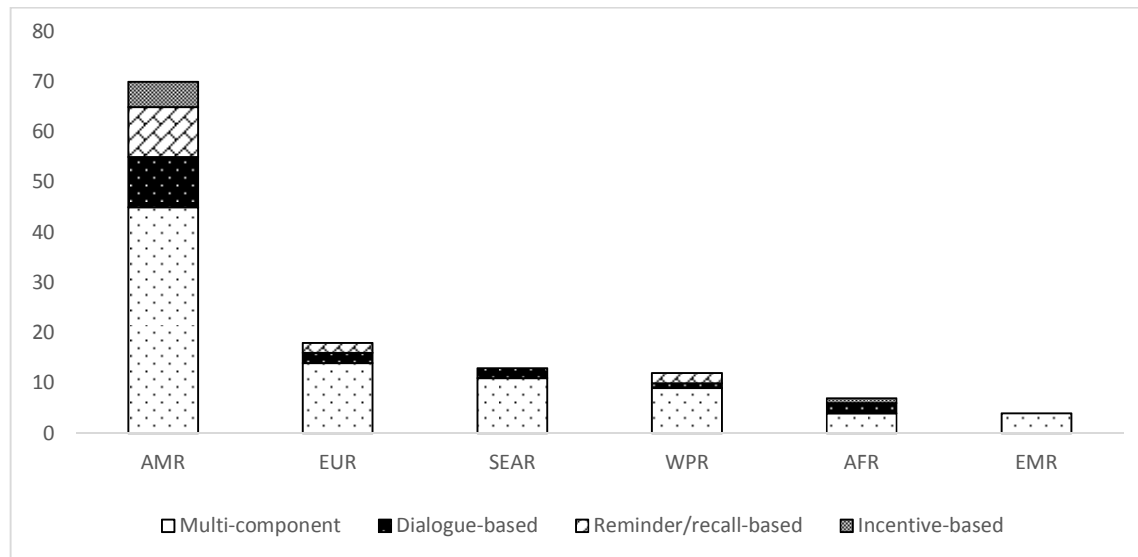


**Total number of strategies are more than identified interventions (n=15) as some interventions have more than one strategy and strategies can be applied across multiple target populations in a single intervention.*

The strategies were categorised into themes including: multi-component, dialogue-based, incentive-based and reminder/recall-based². Within the peer reviewed literature, most evaluated interventions were multi-component. Dialogue-based strategies were also popular in AMR (n=45, 14%). Incentive-based approaches were only evident in AMR (n=5, 7%) and AFR (n=1, 1%) (Figure 11).

² 1) Dialogue-based Interventions: dialogue between those implementing the intervention and the target community. In this review, we included the involvement of religious or traditional leaders, social mobilisation, social media interventions, mass media interventions, communication tool-based health care worker (HCW) training, information-based HCW training.
 2) Financial incentive-based Intervention: Financial compensation in exchange for free vaccination.
 3) Non-financial incentive-based Intervention: the provision of food or other goods to encourage vaccination.
 4) Reminder-recall based Intervention: telephone call/letter to remind the target population about vaccination. (More detail is presented in table 2, page 13).

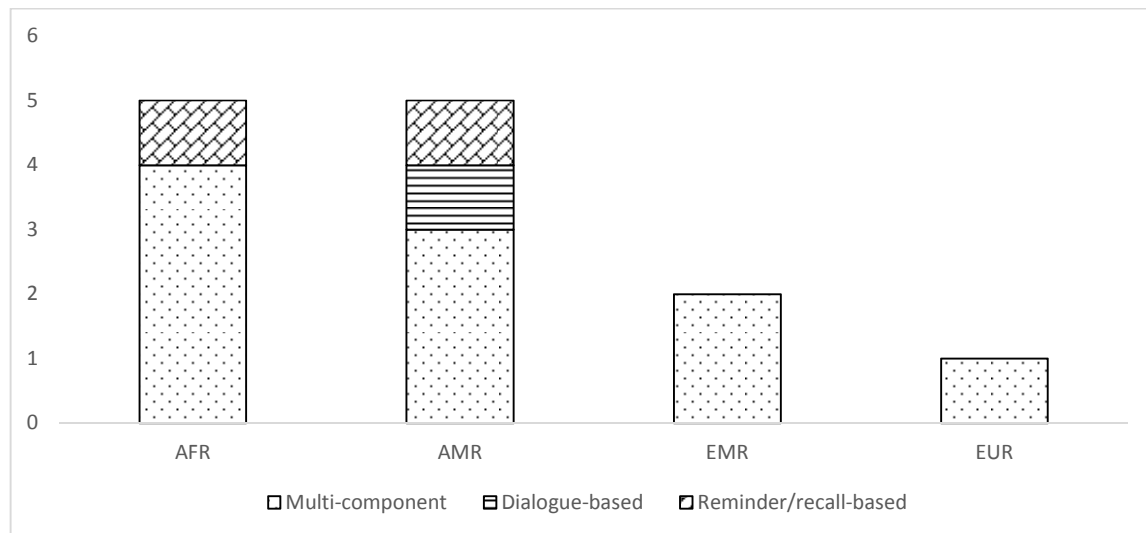
Figure 11. Evaluated peer-reviewed strategies by theme (2007-2013) (n=124)*



**Total number of strategies less than number of interventions identified (n=166) as not all strategies could be categorised into the four primary themes.*

Similarly, within the grey literature, the majority of evaluated interventions were multi-component in most regions. Reminder/recall - based interventions were also evident in AFR and AMR regions (although only one intervention fell under this theme for each region), as was a dialogue-based intervention in the AMR region (Figure 12). For characteristics of evaluated interventions for vaccine hesitancy by theme, see Appendix 5, page 154.

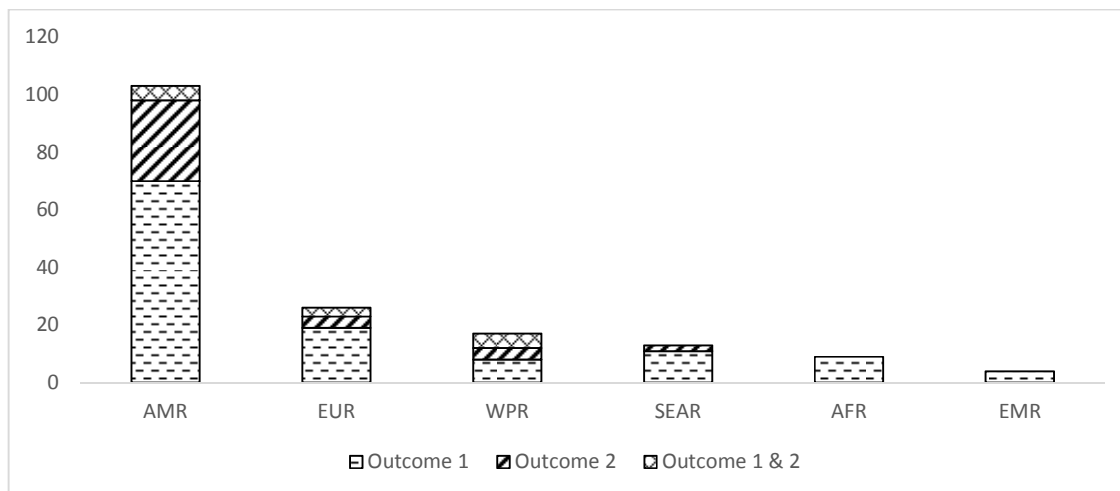
Figure 12. Evaluated grey literature interventions by theme (1996-2013) (n=13)*



**Total number of interventions less than number of interventions identified (n=15) as not all strategies could be categorised into the four primary themes.*

Most evaluated strategies (n=121, 70%) within the peer reviewed literature reported a change in vaccine uptake (Outcome 1); 22% (n=39) identified a change in knowledge/awareness about vaccination (Outcome 2); and 8% (n=13) identified strategies for both Outcome 1 and 2 (Figure 13).

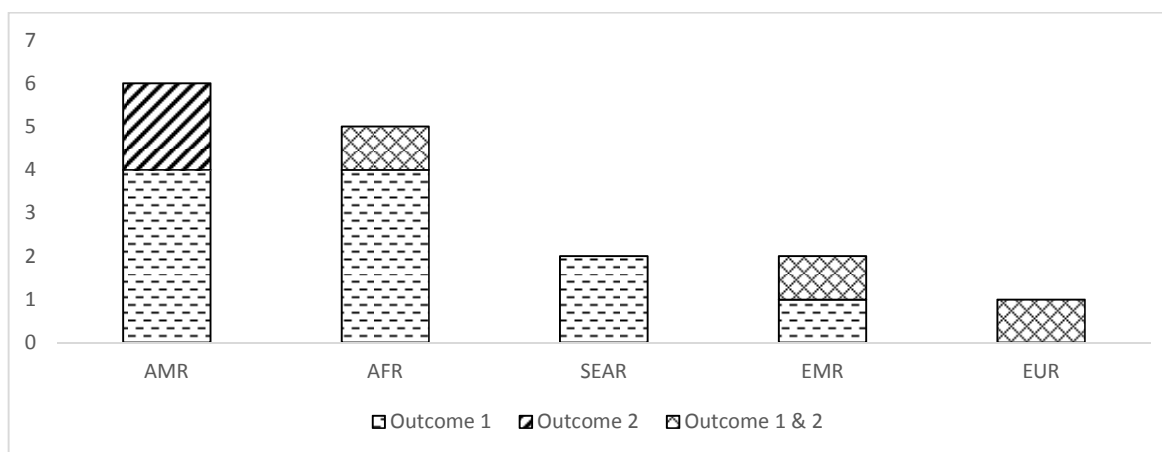
Figure 13. Evaluated peer-reviewed strategies by outcome (2007-2013) (n=172)*



*Total number of strategies are more than identified interventions (n=116) as some interventions have more than one strategy and strategies can be applied across multiple target regions in a single intervention.

Similarly to the peer reviewed literature, in the grey literature, most evaluated strategies reported a change in vaccine uptake (Outcome 1) (n=11, 69%) and (n=2, 13%) identified a change in knowledge/awareness/attitude about vaccination (Outcome 2). Strategies relating to both Outcome 1 and 2 were found in 19% (n=3) of the literature (Figure 14).

Figure 14. Evaluated grey literature strategies by outcome (1996-2013) (n=16)*

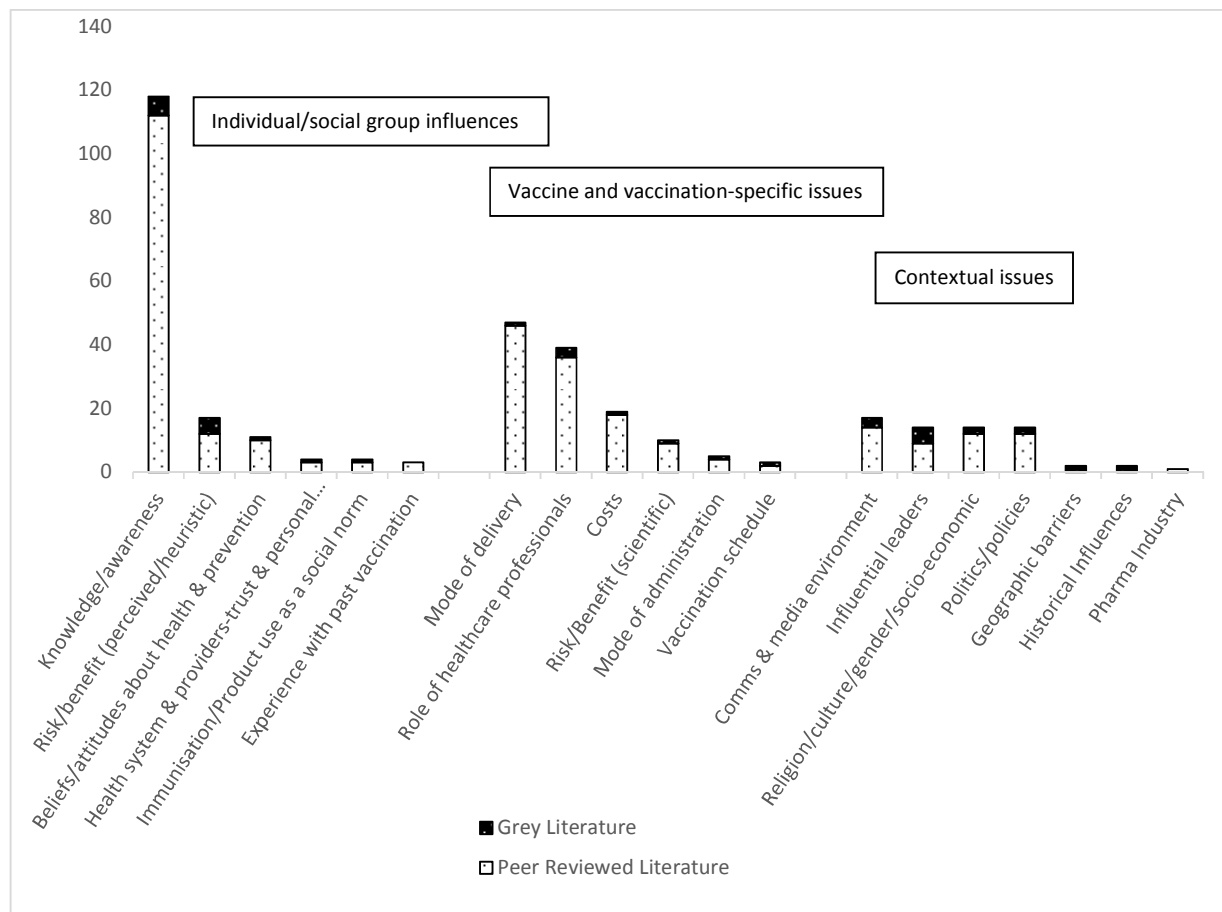


*Total number of strategies is more than number of interventions identified (n=15) as strategies could be applied across multiple WHO regions.

Mapping evaluated strategies to the SAGE WG Model of Determinants of Vaccine Hesitancy (peer reviewed and grey literature)

As evident from Figure 15, using the SAGE WG Model of determinants of Vaccine Hesitancy as the coding reference³, the most common type of intervention within the peer reviewed and grey literature sought to address individual and social group influences (n=157, 46%): many employed the use of knowledge and awareness-raising strategies aimed at the local community. Interventions focused on vaccine and vaccination-specific concerns were also common (n=123, 36%) and mainly sought to address issues relating to the mode of delivery and the role of healthcare professionals. Interventions relating to contextual influences included the engagement of religious and influential leaders in communicating about the need for vaccination through, for example, communication campaigns. Within the grey literature, there were more interventions addressing contextual issues than vaccine and vaccination-specific issues.

Figure 15. Evaluated peer reviewed and grey literature strategies by the SAGE WG model of determinants of vaccine hesitancy (n=344)



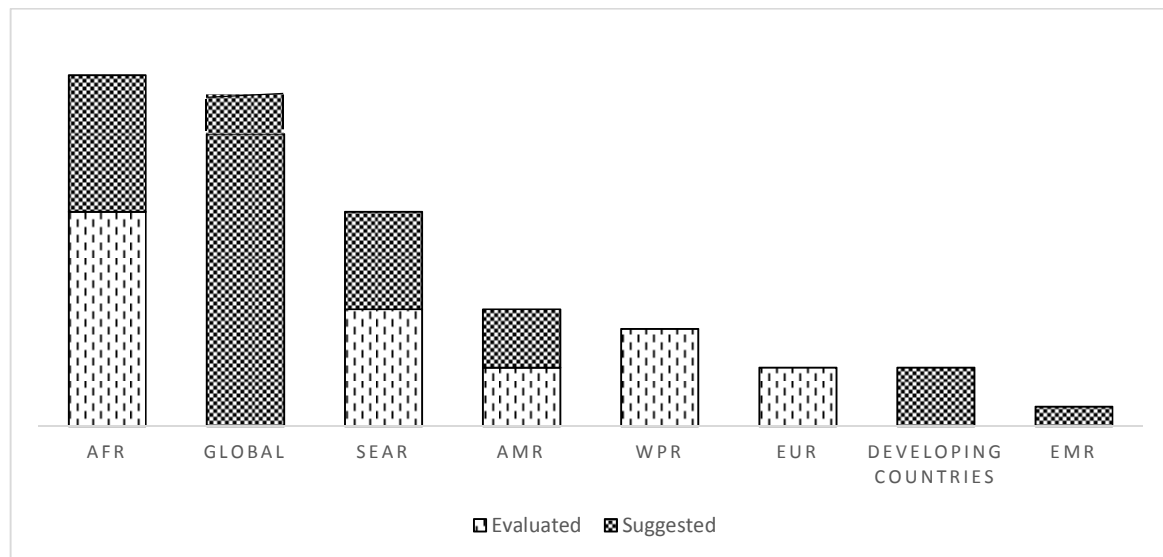
*Interventions could address more than one determinant of vaccine hesitancy

³ See Appendix 6 for guidance on coding

Reproductive health technologies (RHT) (grey literature search conducted only)

Figure 16 shows that evaluated and suggested interventions were found across all WHO regions but the majority of evaluated interventions were focused in AFR (n=11, 69%) and SEAR (n=6, 38%).

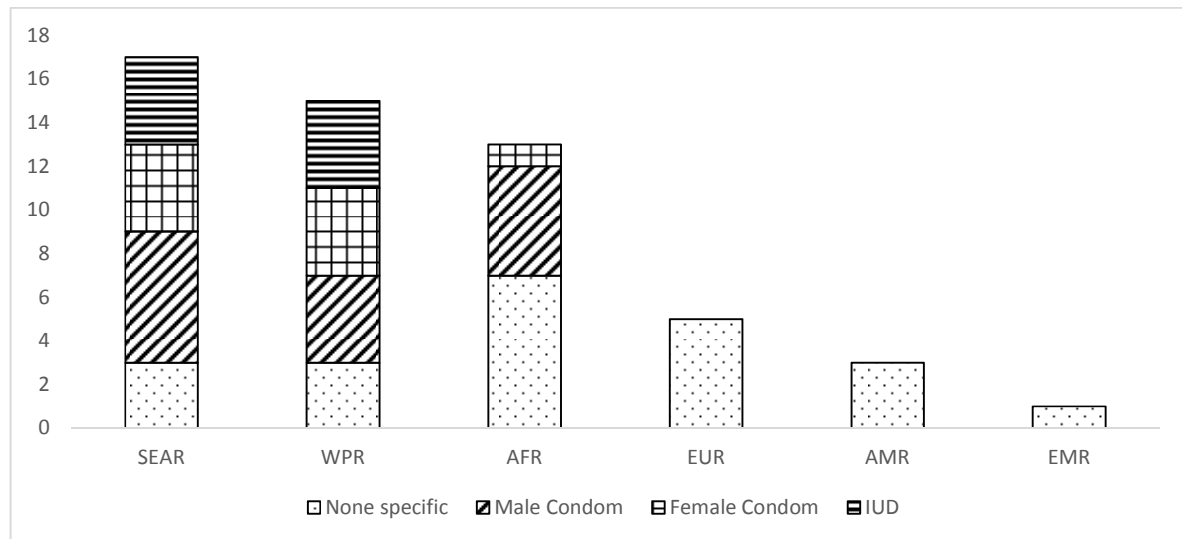
Figure 16: Evaluated and suggested strategies for RHT hesitancy (grey literature) by WHO region (n=64)*



*Total number of strategies is more than (n=51) as some articles report on more than one WHO region.

Many evaluated interventions did not focus on a specific reproductive health technology. Strategies promoting the use of male condoms featured prominently (Figure 17), especially in AFR, SEAR and WPR regions, where (n=5, 38%), (n=6, 35%) and (n=4, 27%) of interventions focused on the use of male condoms respectively.

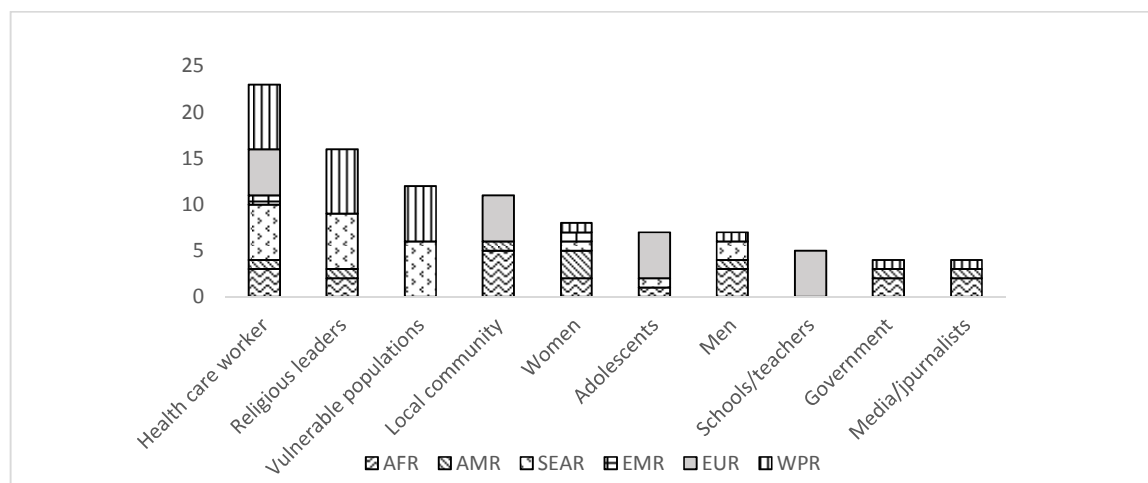
Figure 17: Evaluated strategies for RHT hesitancy (grey literature) and WHO region (n=54)



**Total number of strategies is more than (n=51) as some articles report on more than one RHT and WHO region.*

Many strategies engaged HCW and religious and influential leaders (Figure 18); 32% (n=7) and 44% (n=7) of strategies aimed at HCW and religious and influential leaders respectively took place in WPR. In SEAR, numbers were (n=6, 27%) and (n=6, 38%) respectively and AFR (n=3, 14%) and (n=2, 13%) respectively. There was a relatively high number of strategies that engaged men; 43% (n=3) of strategies aimed at men took place in AFR and (n=2, 29%) in SEAR.

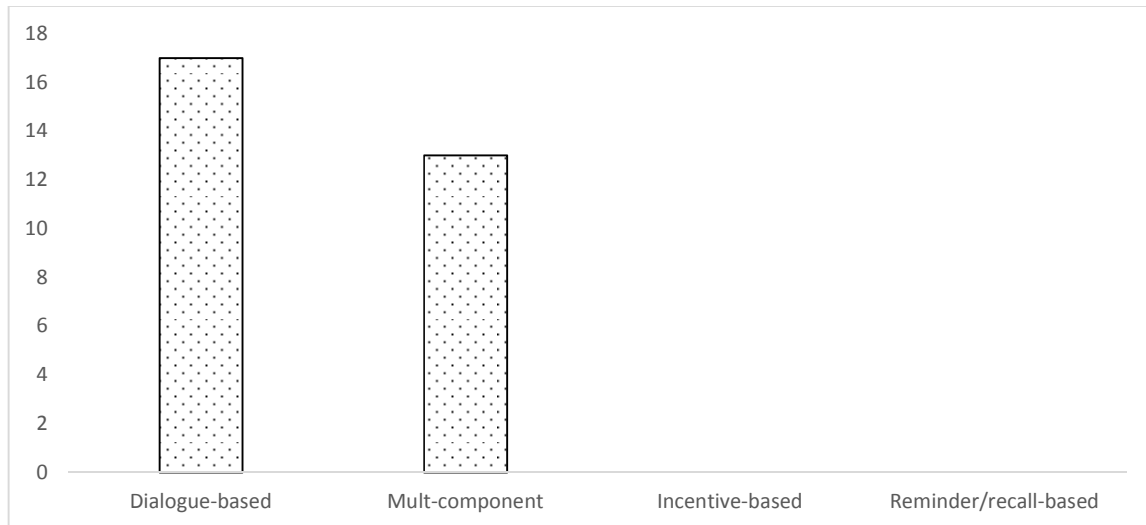
Figure 18. Evaluated strategies by target population and WHO region (n=96)*



**Total number of strategies is more than (n=51) as some articles report on more than one target population and WHO region.*

Across the reproductive health technology literature, most strategies were dialogue-based (n=17, 57%) or multi-component (n=13, 43%). There were no strategies that were solely incentive or reminder/recall based (Figure 19).

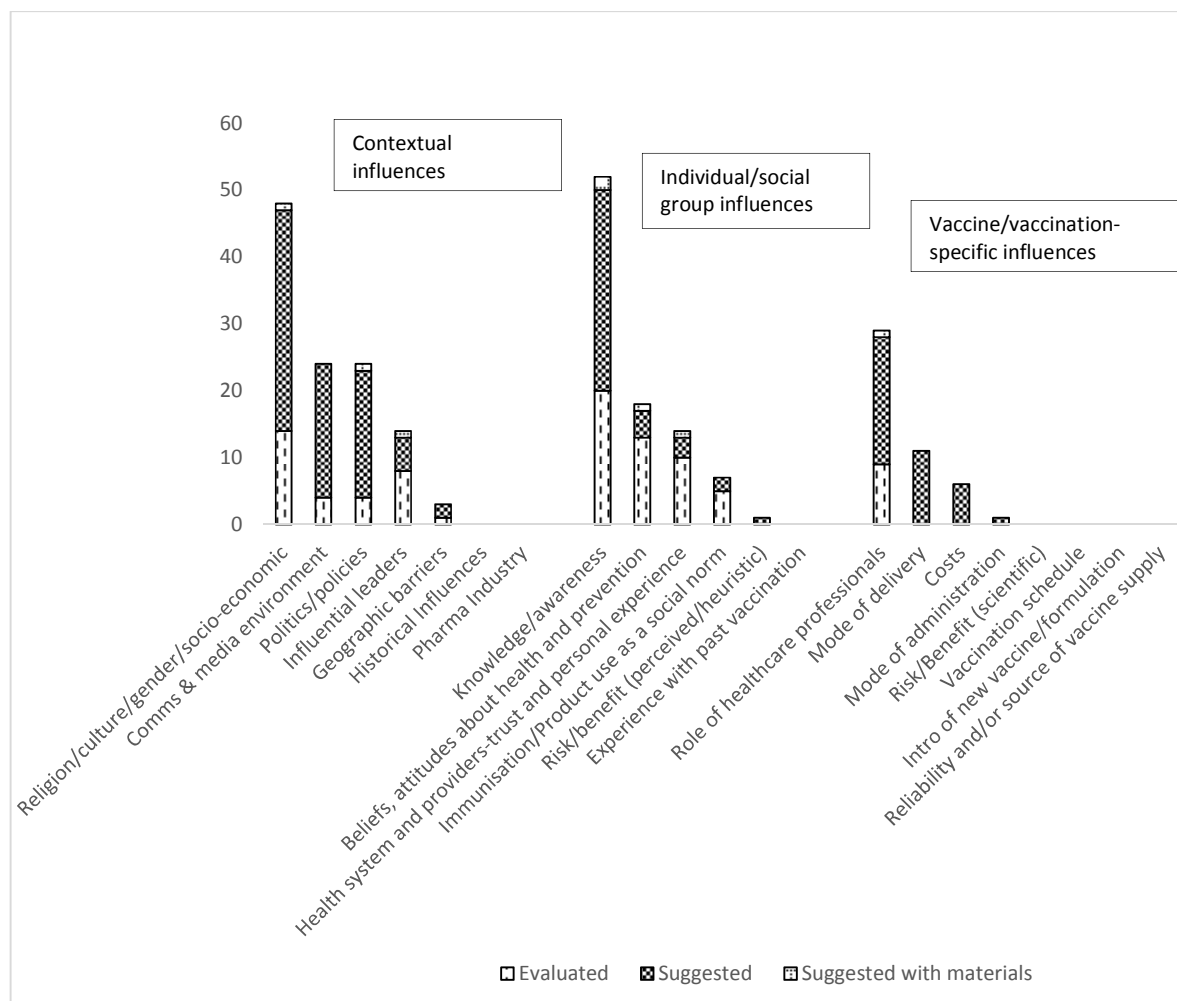
Figure 19. Evaluated strategies by theme (n=30)*



**Total number of interventions is less than number of interventions identified (n=15) as not all strategies could be categorised into the four primary themes.*

As shown in Figure 20, the majority of evaluated and suggested strategies aimed to address contextual influences (n=113, 45%) such as cultural barriers to RHTs (n=48, 19%). Many also focused on individual/social group influences (n=92, 37%), for example, employing knowledge and awareness-raising strategies (n=52, 21%). Only 19% (n=47) aimed to address vaccine/vaccine-specific issues.⁴

Figure 20. Evaluated and suggested strategies for RHT hesitancy (coded to SAGE WG model of determinants of vaccine hesitancy) (n=247)*



*Interventions could address more than one determinant of vaccine hesitancy.

⁴ A reference table is provided in Appendix 7 which defines and gives coding guidance.

1.3.c Summary of Effects

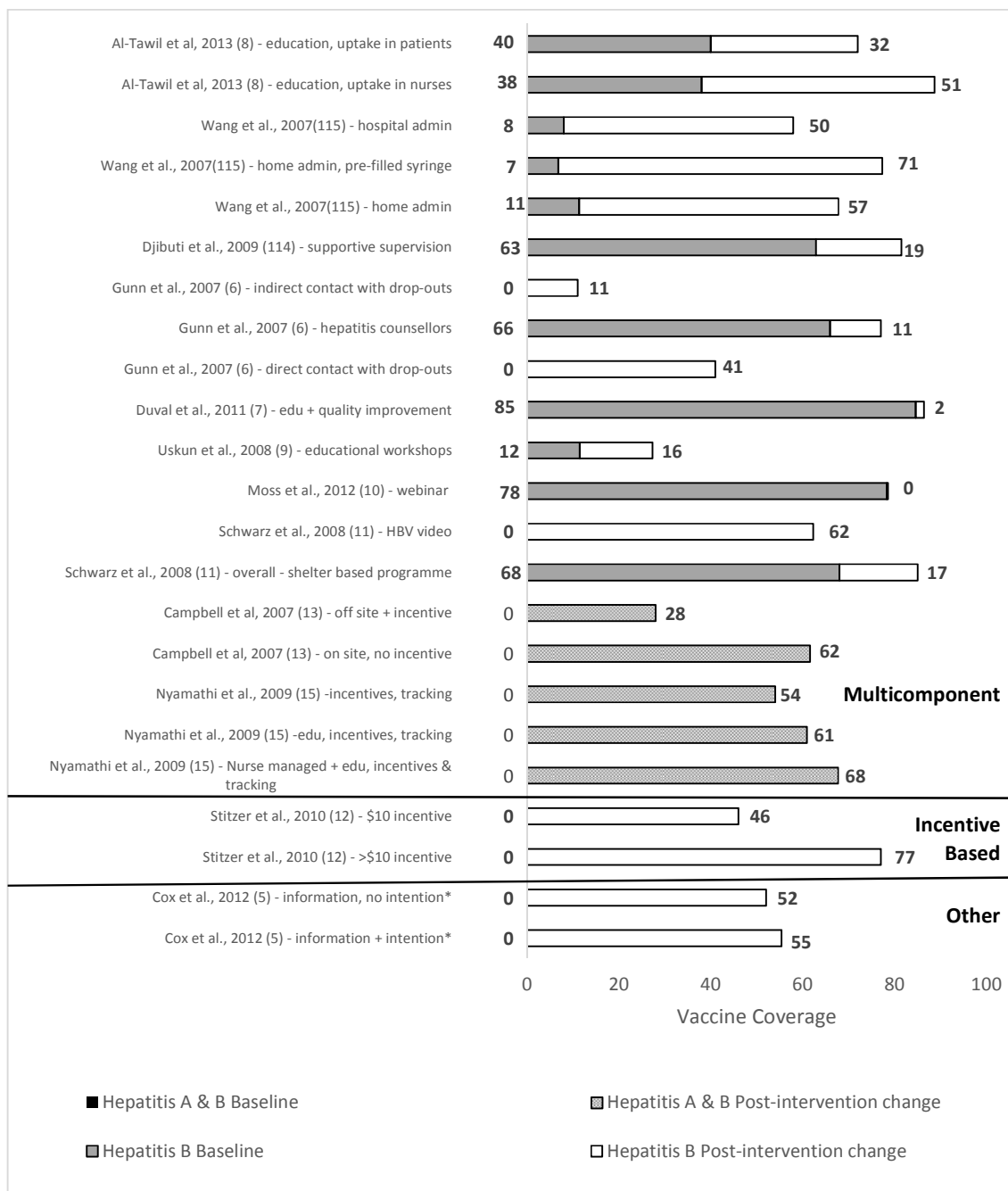
The following section provides a comprehensive overview of the impact of all evaluated strategies across the peer-reviewed and grey literature for both Outcome 1 and Outcome 2. It includes the experiences for both vaccine hesitancy and reproductive health technologies.

Vaccine Hesitancy - Outcome 1

Figures 21 to 30 illustrate the changes in vaccine uptake described in different articles, as reported in the peer-reviewed and grey literature. Many of these studies were observational in design and so we cannot assume a causal relationship between the intervention and vaccine uptake. Furthermore, some of the reported estimates of uptake are crude and are unadjusted for other factors which may confound or impact on the magnitude of the effect estimate. The changes in uptake post intervention may be influenced by other factors unaccounted for in these estimates. Finally, the heterogeneity of the different study populations, study settings, interventions and the context in which these studies were conducted limits our ability to directly compare between studies.

Twelve studies targeted vaccination with hepatitis A or B (Figure 21). Of these, ten were multi-component studies and one was incentive based. Those interventions which 1) improved the convenience of vaccination (13, 115); 2) addressed knowledge barriers to vaccination (5); or 3) undertook active follow-up of drop-outs (6) reported the biggest increases in vaccine uptake.

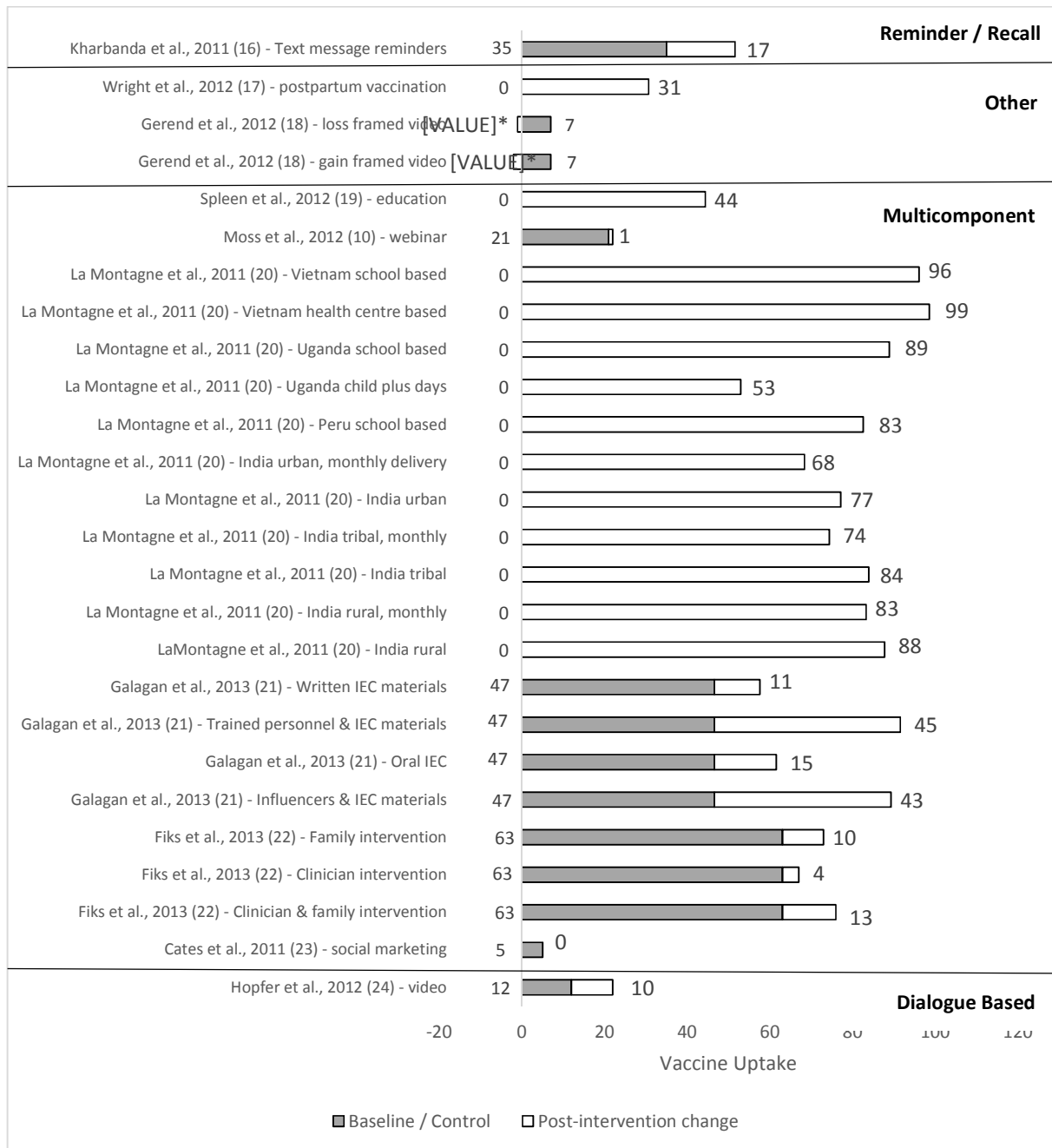
Figure 21: Effect of incentive based, multi-component and other interventions on uptake of hepatitis A and B vaccines; Evidence from the peer reviewed literature



* Hepatitis A and B baseline is zero

Of ten studies reporting changes in HPV vaccine uptake) associated with specific interventions (Figure 22), the largest changes were observed in demonstration projects in previously unvaccinated populations (20). Interventions utilising trained personnel or people in a position of influence to educate and encourage vaccination, or which improved the convenience of vaccination were also associated with substantial increases in vaccination (17, 19, 21). One study (18) reported small absolute declines in uptake post-intervention when compared to the control group; however there was little evidence that this represented a real difference between the intervention and control groups ($p=0.77$).

Figure 22: Effect of dialogue based, incentive based, multi-component, reminder / recall and other interventions on uptake of HPV vaccination; Evidence from the peer reviewed literature

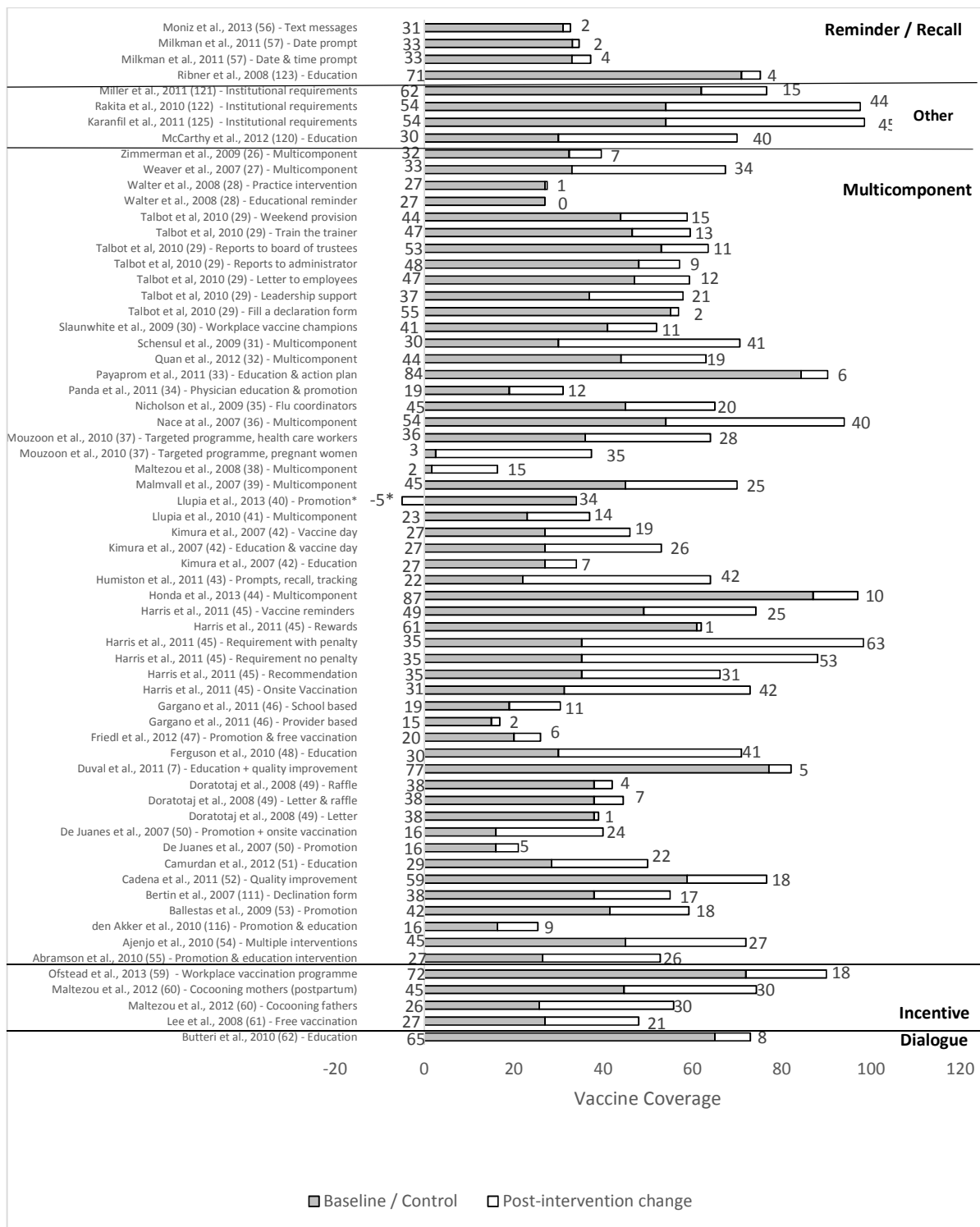


No data available for Mayne et al, 2012(25)
 * A decline in vaccine uptake was observed post intervention.

Thirty studies reported changes in influenza vaccine uptake following specific interventions; the majority were multi-component studies (Figure 23). Mandatory vaccination policies for HCW (45) and interventions improving the convenience of vaccination (45) or that actively followed up clients (43) were associated with the greatest increases in uptake. Some educational interventions (31, 36, 37, 191) were also associated with large increases, however this was not consistently the case, with some studies (28, 42, 62) reporting negligible increases in uptake following educational interventions. Promotional activities (41, 50, 116), rewards for vaccination (45, 49), reminder prompts (56-58) and self-reports of non-vaccination by health care workers (58) correlated with very small changes in uptake.

One study (40) reported lower influenza vaccine uptake rates following a hospital based educational intervention (34.0%; 95%CI: 33.8-36.4) compared to the year before the intervention (39.0%; 95%CI: 37.8-40.5). Given the observational design of the study, and the fact that these estimates of uptake are unadjusted for potential confounders it is not possible to draw any conclusions on whether the intervention caused a decline in uptake.

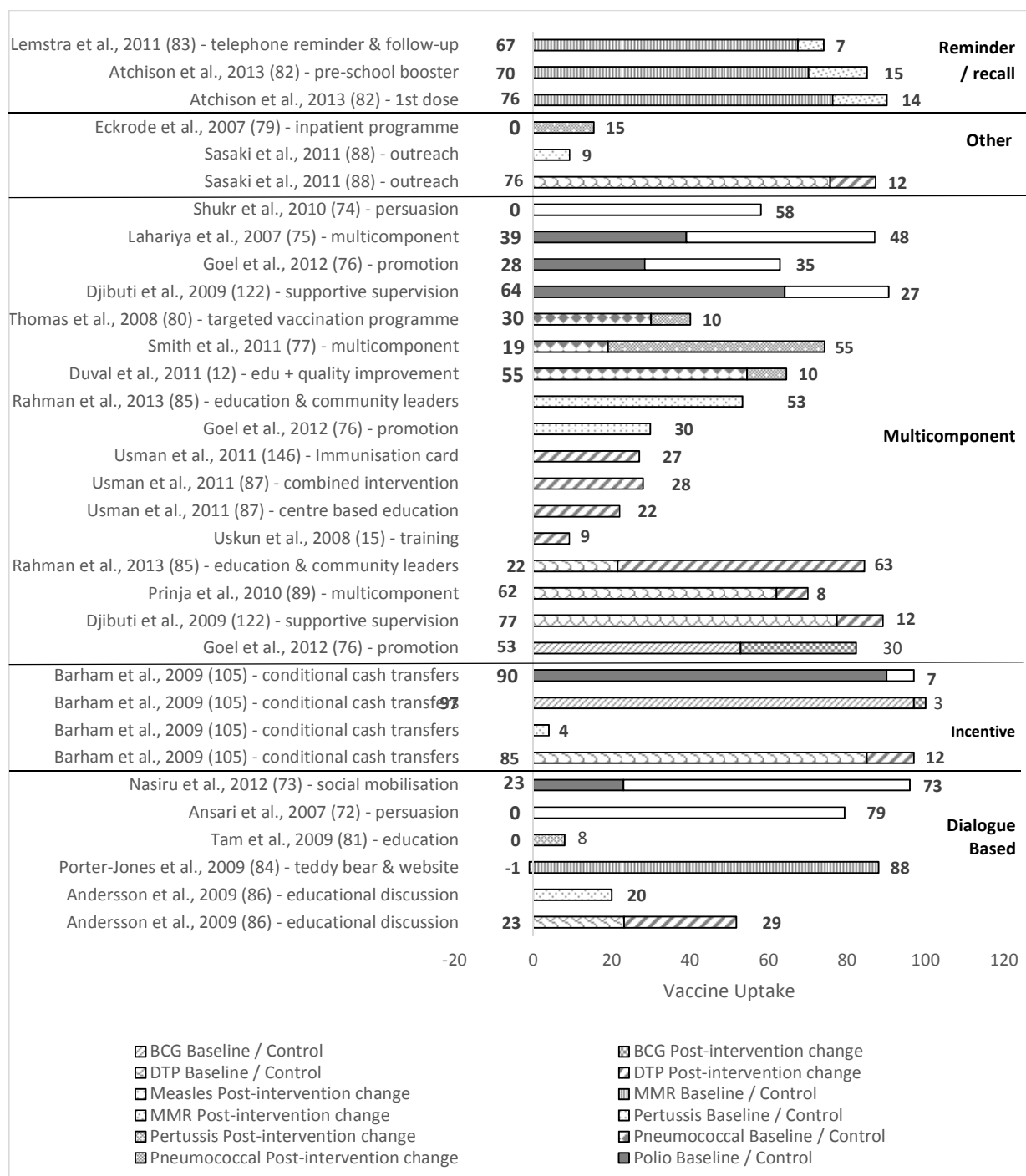
Figure 23: Effect of dialogue based, incentive based, multi-component, reminder / recall and other interventions on uptake of influenza vaccination; Evidence from the peer reviewed literature



* A decline in vaccine uptake was observed post intervention.

For childhood vaccines (Figure 24 and 25) interventions targeting those resistant to vaccination (63, 65); that engaged those with influence in the community (64, 76), that focused on individual or community level education and mobilisation (64, 66, 89) that deployed reminder systems and made vaccination more convenient (90, 192) were associated with the greatest increases in uptake. Interventions involving cash transfers (97), reminder or educational systems (74, 86) and training (9) were all associated with increases in uptake of less than ten percent.

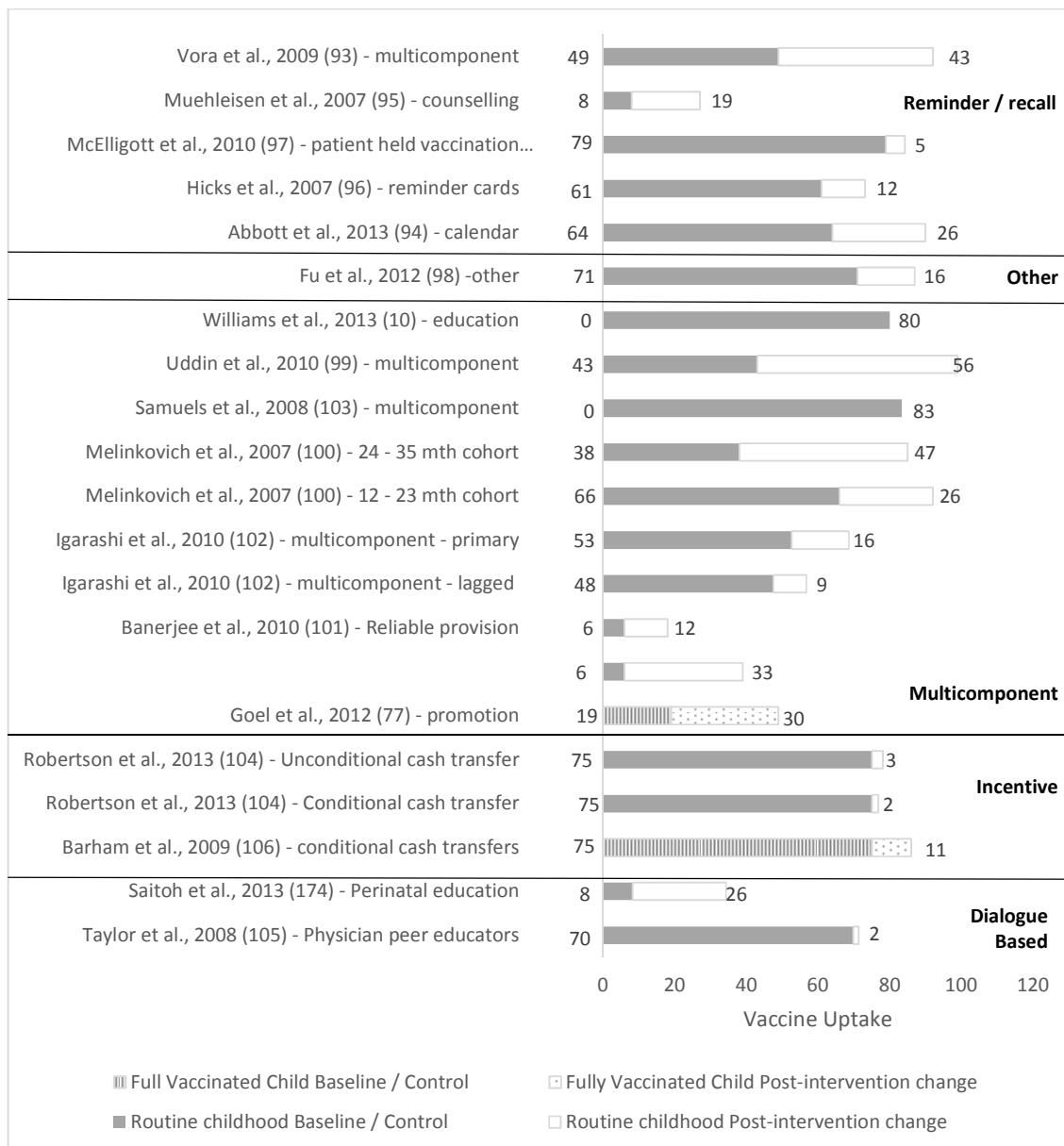
Figure 24: Effect of dialogue based, incentive based, multi-component, reminder / recall and other interventions on uptake of individual childhood vaccines; Evidence from the peer reviewed literature



No data available for the following citations: Pandey et al, 2007(81), Harari et al, 2008 (143), Girard et al, 2012 (82).

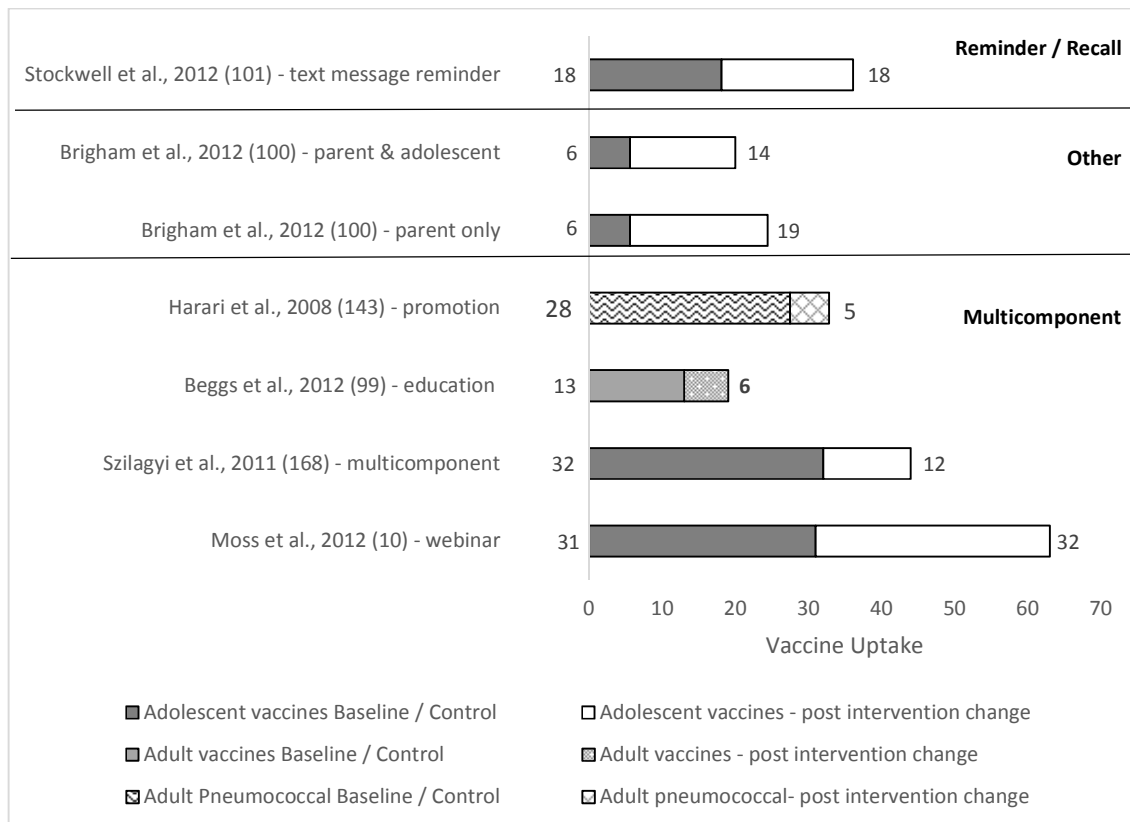
* A decline in vaccine uptake was observed post intervention.

Figure 25: Effect of dialogue based, incentive based, multi-component, reminder / recall and other interventions on uptake of combined childhood vaccines; Evidence from the peer reviewed literature



Reminder recall interventions (100, 101, 168) and educational interventions (10) were associated with the greatest increases in uptake among the six evaluated interventions targeting adolescent or adult vaccination (Figure 26).

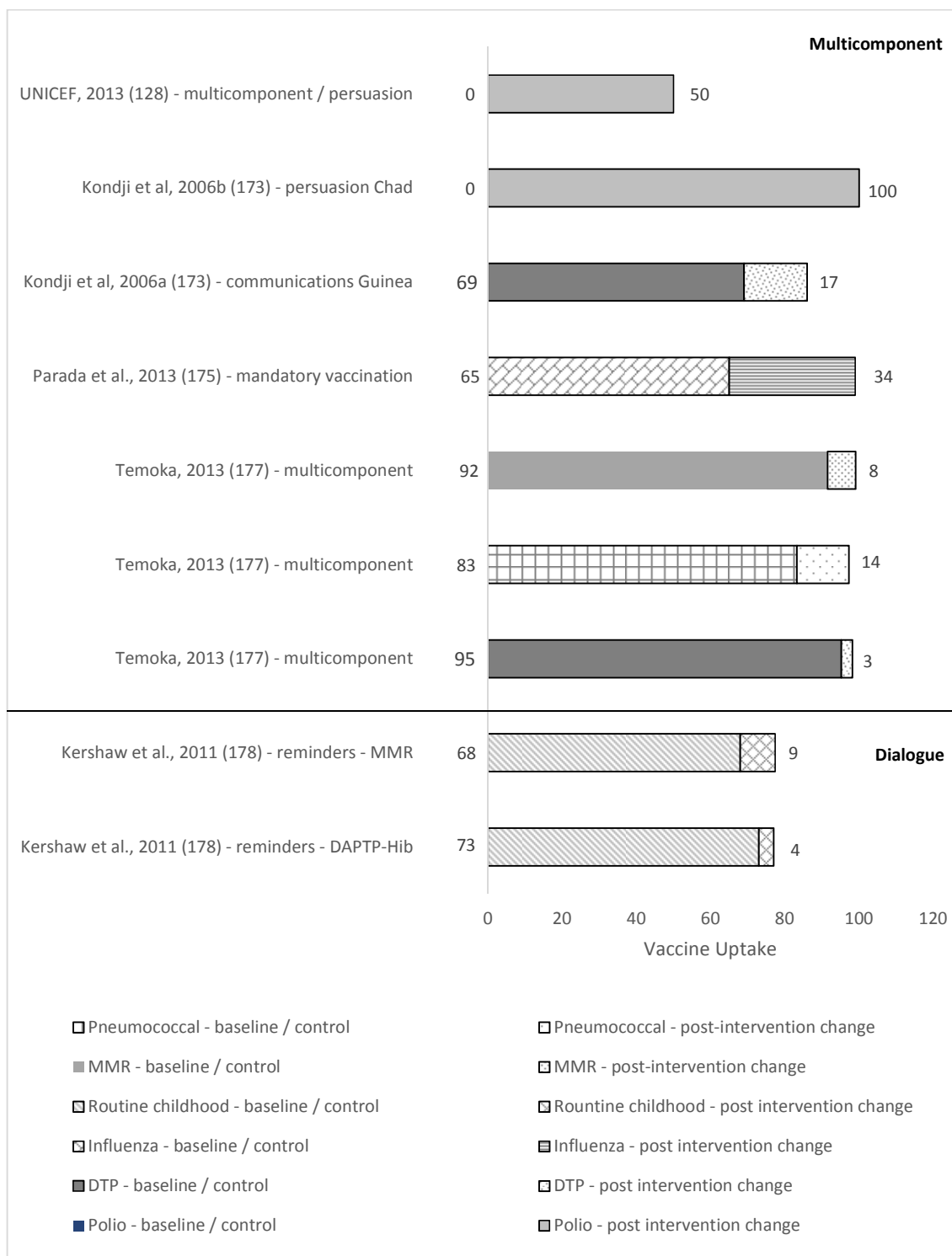
Figure 26: Effect of dialogue based, incentive based, multi-component, reminder / recall and other interventions on uptake of adult and adolescent vaccines; Evidence from the peer reviewed literature.



No data available for the following citations: Swenson et al, 2012(98), Wallace et al, 2008 (69).

Similarly, evidence from the grey literature (Figure 27) indicates that interventions targeting vaccine decliners (173, 193) and that mandated vaccination (175) were associated with the greatest increases in vaccination.

Figure 27: Effect of dialogue based and multi-component interventions on vaccine uptake; Evidence from the grey literature

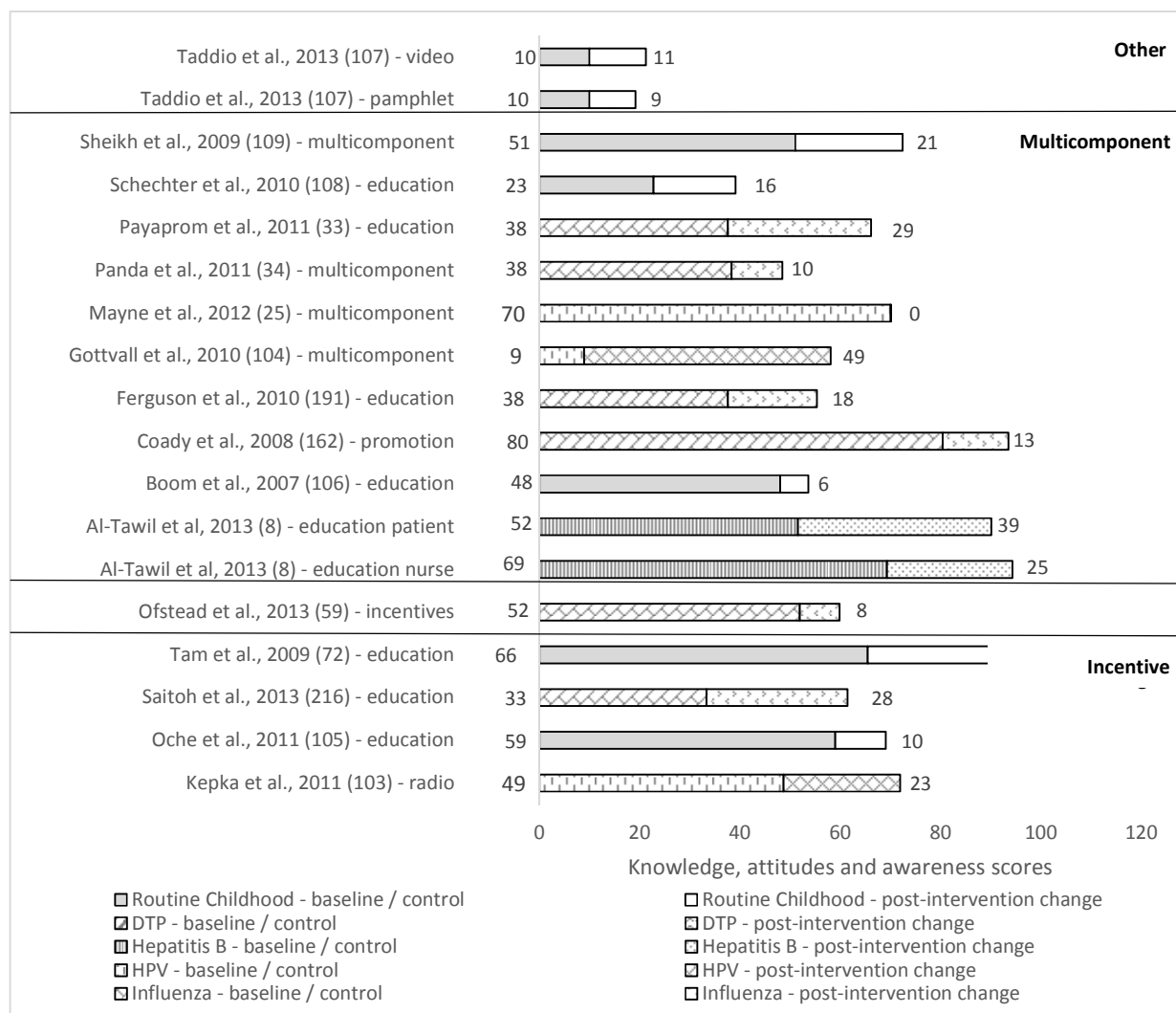


No data available for the following citations: Gage et al, 2003 (183), UNICEF, 2011(184), Rakek and Van Eerden, 2010 (186) and Archer and Cottingham, 1996 (185).

Vaccine Hesitancy - Outcome 2

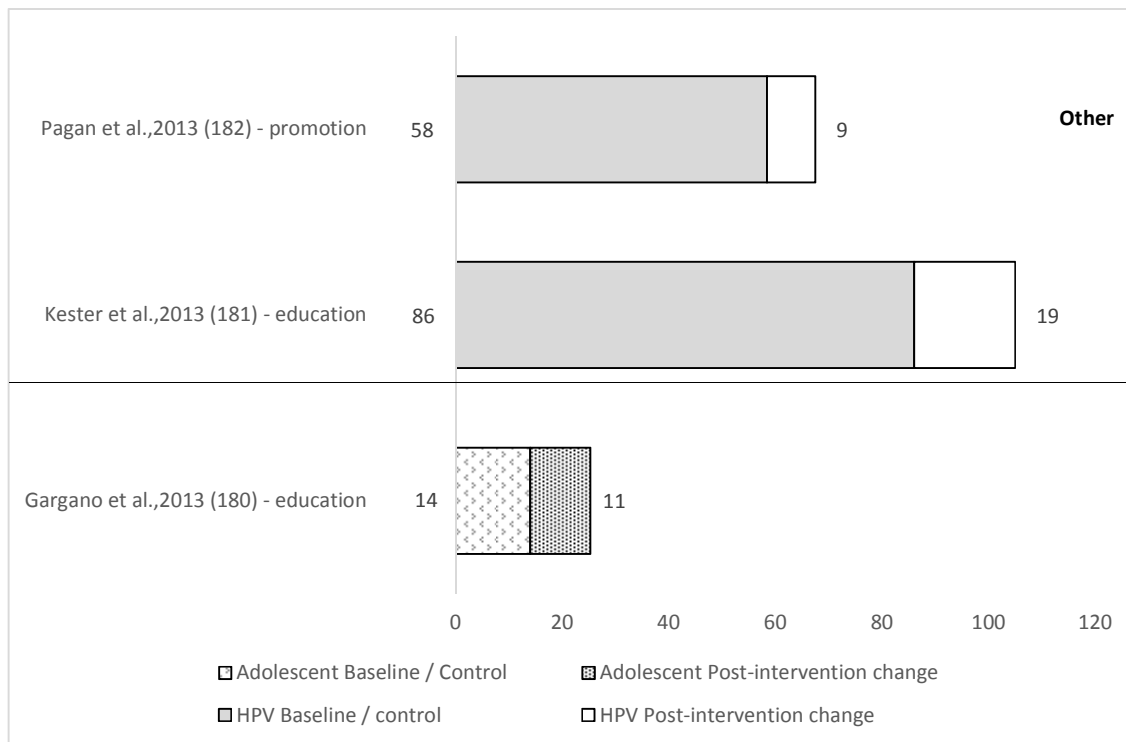
Sixteen articles from the peer-reviewed literature and three from the grey literature quantified the impact of interventions on knowledge, awareness and attitudes to vaccination (Figure 28 and 29). Twelve of these were multi-component interventions. There was considerable variation in the associated change in knowledge, attitudes and awareness, with some interventions reporting little or no effect (25, 34, 59, 106, 107) and others (50, 54, 61, 93, 103) associated with substantial increases in knowledge, attitudes and awareness. This reflects the wide variation in the study populations and settings targeted by these interventions and in the design and execution of these interventions.

Figure 28: Effect of dialogue based, multi-component and other interventions on knowledge, awareness and attitudes to vaccination; Evidence from the peer reviewed literature



No data available for the following citations: Pandey et al, 2007 (81), Hsu et al, 2010 (110), Schensul et al, 2009 (31), Spleen et al, 2012 (31), Schwarz et al, 2008 (11), Ballestas et al, 2009 (53), Bertin et al, 2007(53), Hopfer et al, 2012 (24), Crosby et al, 2008 (101) (112), Kennedy et al, 2008 (113), Wright et al, 2012 (17).

Figure 29: Effect of multi-component and other intervention types on knowledge, awareness and attitudes to vaccination; Evidence from the grey literature

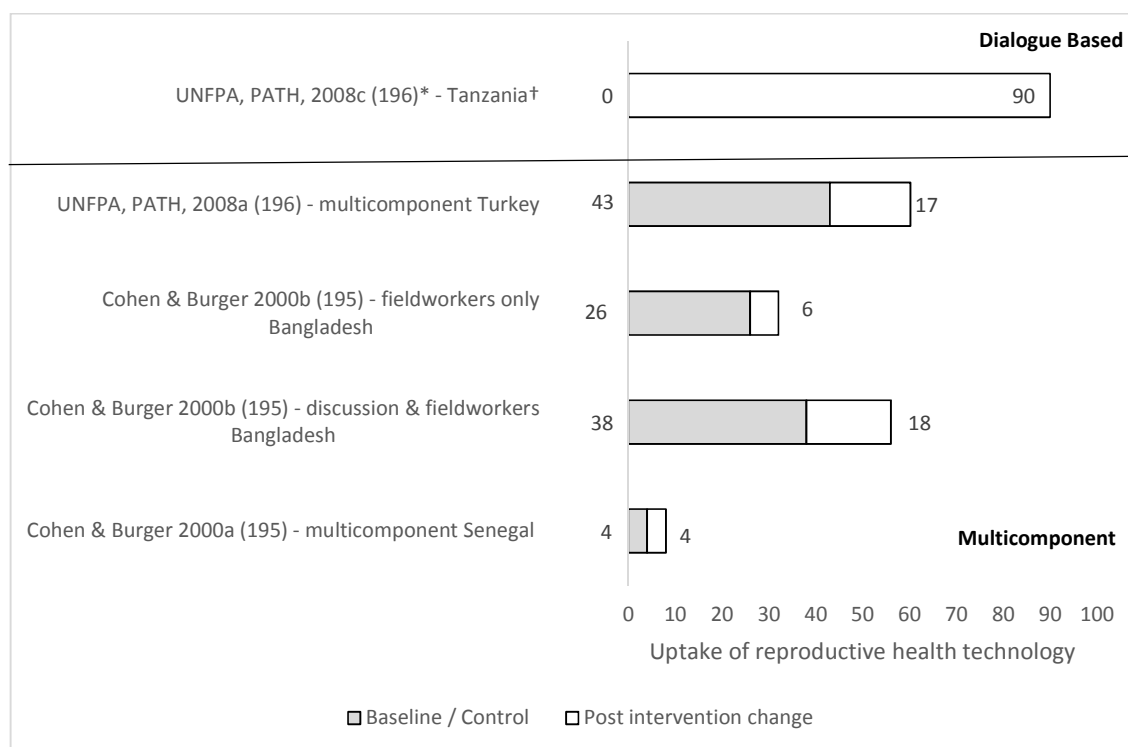


No data available for the following citations: Gage, 2003 (183), UNICEF, 2011 (184), and ECDC 2012 (176).

Reproductive Health – Outcome 1

Of the 13 articles (194-204) reporting behavioural change associated with RHT, only five quantified the change in uptake (Figure 30). Interventions engaging community and religious leaders and directly targeting women (173) were associated with the greatest increase in uptake of reproductive health technology. Although nine publications in the grey literature reported changes in knowledge, awareness and attitudes to RHTs, the magnitude of these changes were not quantified in any of the reports and so they have not been presented graphically.

Figure 30: Effect of dialogue based and multi-component interventions on the use of reproductive health technology; Evidence from the grey literature



No data available for the following citations: UNFPA, 2008 C & D (196); UNFPA, 2007A (199); UNFPA, 2005A (197) (170); MEMA kwa Vijana, 2008 a & b (201); UNFPA, 2010 (198); Jones et al, 2008 (202); UNFPA, 2010 (200); Khanya-African Institute for Community Driven Development, 2007 (203); UNFPA, 2008d (196); FHI360 (204).

1.4 Section summary

Vaccine Hesitancy

From January 2007- December 2011, there was an increase in the number of peer reviewed articles evaluating interventions which aimed to address vaccine hesitancy. However, this number decreased from 2011 to 2013. In the grey literature, vaccine hesitancy only started to feature more in 2013, rising from one or two reports annually in previous years to eight in 2013. Whilst the terms 'vaccine hesitancy/hesitant' are very new (only five articles were identified that actually used these terms), the literature indicates a growing interest and relevance of the concept, even though it may be discussed using slightly different terminology. The later appearance of the concept in the grey literature could be attributed to 1) the newness of the concept of vaccine hesitancy in the field, and 2) the limitations of current search options for grey literature, which has a much weaker indexing structure than the peer-reviewed literature.

Across both the peer reviewed and grey literature, the evaluated interventions which aimed to address vaccine hesitancy were mostly based in the AMR region (n=103, 60%) and (n=8, 50%)

respectively). In high income regions (AMR), the main focus was on influenza or childhood vaccine uptake. In the lower income regions of SEAR and AFR, interventions primarily focused on DTP or polio vaccines. In both high and middle-income regions, (n=48, 21%) of interventions focused on the more recently introduced HPV vaccine.

Strategies targeting parents (to influence childhood vaccinations), HCW and adults (for patient vaccines) were most frequently addressed, especially in the higher income regions such as AMR. Strategies aimed at the local community were common in AMR, EMR, AFR and SEAR regions. Within the grey literature, the focus (principally in AFR), was on strategies aimed at the local community and religious/traditional leaders.

Within both the peer reviewed and grey literature and across all regions, the most typical theme for interventions was multi-component. In the peer reviewed literature, dialogue and incentive-based interventions were common in AMR and AFR regions and reminder/recall-based interventions were more common in EUR and WPR regions. In the grey literature, dialogue-based interventions were also common in the SEAR region and reminder/recall-based interventions featured in the AMR region.

In the context of the SAGE WG Model of determinants of Vaccine Hesitancy, interventions most frequently targeted the model category “Individual/social group influences” with many employing the use of knowledge and awareness-raising strategies aimed at the local community. “Vaccine and vaccination-specific” interventions were also common and addressed issues relating to the mode of delivery and the role of healthcare professionals. Interventions relating to “Contextual influences” primarily included the engagement of religious and influential members of the community through, for example, communication campaigns (especially for polio vaccination).

Which interventions have been most successful? (Outcome 1 and 2)

Overall it appears that the interventions with the greatest effect size are those that (not in order of importance); 1) directly target unvaccinated or under-vaccinated populations; 2) aim to increase knowledge and awareness surrounding vaccination; 3) improve convenience and access to vaccination; 4) target specific populations such as the local community and HCW; 5) mandate vaccinations or impose some type of sanction for non-vaccination; 6) employ reminder and follow-up and 7) engage religious or other influential leaders to promote vaccination in the community. The most effective interventions employed a number of these strategies (multi-component interventions) to increase vaccine uptake, knowledge and awareness.

Which interventions have been least successful?

In general, interventions that focused on quality improvement strategies (e.g., standing orders, improved data collection and monitoring, extended clinic hours) at clinics did not reap great changes in vaccine uptake. Similarly, interventions that adopted interventions that were only applicable to the individual from a distance (e.g., posters, websites, media releases, radio announcements) brought little benefit. Incentive-based interventions using either conditional or non-conditional cash transfers were not successful, although these interventions were usually targeting general

preventive health engagement and not just vaccination. Lastly, while reminder-recall interventions have been shown to be effective, they can also be ineffective. These findings highlight the importance of not generalising interventions before understanding the different target audiences, vaccine of interest and setting.

RHT

Interventions were found across all WHO regions but the majority were focused in AFR and SEAR regions. Most interventions did not focus on a specific reproductive health technology but male and female condoms featured prominently.

Many interventions aimed to address contextual issues such as religious, cultural and gender norms (often aimed at men). A high proportion also aimed to address individual/social group influence-based determinants of hesitancy such as beliefs and attitudes about health and prevention. These interventions engaged HCW as well as religious and influential leaders and were common in low income regions.

Which interventions have been most successful? (Outcome 1)

The interventions with the largest effect estimates on uptake of RHT focused on leaders having dialogue with their communities. Leaders included those from government, religious institutions, and the local community (both male and female). These interventions centred on the interpretation of local religious and cultural norms, particularly around the understanding and perceptions of men, and sought to create an environment to support pro-RHT decision-making. At a broader contextual level, group sessions with journalists and mass media campaigns were also used to positive effect to support message consistency. As found for vaccine hesitancy, multicomponent interventions proved most effective.

Which interventions have been least successful?

There are not as many examples to draw more general statements from for RHT however, the interventions that were less successful were those that did not engage closely with the individual. Specifically, the use of field workers instead of local opinion leaders was not as effective as employing both in community group discussions. Familiarity and trust with the messenger seems to be a key feature in these instances.

Comparative insights – Vaccine and RHT hesitancy

The findings of the reproductive health search were similar to the vaccine hesitancy search, in that in low-income areas, religious and influential leaders were the main target of strategies. They were encouraged to engage the local community in the strategy's efforts. However, there were also many differences between the findings of the vaccine hesitancy and the RHT search. It was evident from the RHT search that in *low-income* settings, HCW were often targeted for strategies, whereas in the vaccine hesitancy search, HCW were mostly only targeted in *high income* regions. In the vaccine hesitancy search, the most common type of intervention was multi-component followed by dialogue based and aimed to address individual/social group influences whereas in the RHT search, the most

common type of intervention was dialogue-based and aimed to address contextual influences to uptake.

It may be beneficial for interventions aiming to address vaccine hesitancy to engage HCW in both high *and* low income areas; and to involve the male community, as in many of the reproductive health interventions. Involving men in interventions has been shown to be extremely effective. For example, in a study conducted by Cohen et al., 2000 (195), religious leaders interpreted the Quran and its precepts regarding sexuality, family planning and reproductive health and developed audiocassettes on reproductive health based on Islamic beliefs and then addressed family planning and sexuality in their sermons, particularly with men. This approach increased contraceptive use. The success of involving the male community in such interventions is relevant to households where the local religious and cultural norms imply that the male head of household ultimately makes the decisions and has the final say regarding the uptake of health interventions (202), including vaccines and contraceptives.

Section 2 – evaluation of vaccine hesitancy research (pico & grade)

(Addresses objective 3)

The following evidence profiles (EP) detail the impact of interventions and quality of evidence for each PICO question where direct evidence was identified. The questions were proposed *a priori* by the SAGE WG in an effort to examine population features that are likely to influence the effect estimate of different interventions.

For this review, segmentation focuses on baseline coverage rates and income level against several target population groups. Future analyses could look to extend and diversify segmentation as the body of evidence about vaccine hesitancy grows.

For five questions (of the original 15), no directly applicable studies could be identified. All of the proposed questions are outlined in Table 2, page 13.

Some important assumptions were applied to the following quality assessment categories:

Indirectness	Single studies were all downgraded by one based on the assumption that while the population targeted in the study is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.
Other considerations	The interpretation of the size of the effect estimate was generally not upgraded, even where it would normally be considered large. The rationale for this assumption leads from the issue of indirectness, whereby we might expect different relative effect estimates in different settings and can therefore not generalise. However, for the population targeted in the study, the evidence is direct and we would expect the estimated effect to apply.

Evaluation of the evidence: Interventions relating to vaccine hesitancy (PICO & GRADE)

Table A. GRADE evidence profile: PICO 1 (Dialogue-based)

Question: Should religious leaders vs control group/no intervention be used for vaccine hesitancy?

Settings: Populations with low baseline coverage ($\leq 50\%$)

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Religious leaders	Control group/no intervention	Relative (95% CI)	Absolute		
Uptake of polio vaccine¹												
1	observational studies	no serious risk of bias ²	no serious inconsistency	serious ³	no serious imprecision	none ⁴	11364/11847 (95.9%)	2755/11847 (23.3%)	RR 4.12 (3.99 to 4.26)	726 more per 1000 (from 695 more to 758 more)	⊕○○○ VERY LOW	
								0%		-		

¹ Grey literature: Three studies focused on polio vaccination: in the Republic of Niger (AFR) (183); Chad (AFR) (173); and Afghanistan (EMR) (184), and one study on both polio and routine childhood immunisation in India (SEAR) (172). None of the studies used religious leaders as a stand-alone strategy but their involvement in the overall intervention was primary. Respective outcomes were as follows: a perceived reduction in the number of new cases of AFO and a change in attitude towards recognising polio immunisation as important for promoting children's health; full conversion of all cases of polio vaccine refusal (n=154); community mobilisers are well received and play a critical role in converting refusals (not quantified) but turnover of staff due to achievement of high coverage or movement to better paid roles means that coverage rates change from month-to-month and resistance is allowed to grow in between immunisation rounds; increased immunisation by 5% (vaccines not specified) and full conversion of all cases of polio refusal (19 households).

² Global rating EPHPP tool: Strong.

³ Downgraded by 1. Single country study: Nigeria (AFR) (64). The rationale for downgrading is based on the assumption that while this Nigerian sub-population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect. Also of note, the intervention was not exclusively focused on religious leaders - special attention was also given to political and traditional leaders. Other groups also included were: traditional healers, birth attendants, town criers, and traditional surgeons. Not downgraded further on this point.

⁴ Despite large effect estimate - RR 4.12 [3.99, 4.26], not upgraded because of aforementioned issue of indirectness whereby we might expect different relative effect estimates in different settings. However, for this Nigerian sub-population, the evidence is direct and we would expect this large effect to apply.

Table B. GRADE evidence profile: PICO 3 (Dialogue-based)

Question: Should traditional leaders vs control group/no intervention be used for vaccine hesitancy?

Settings: Populations with low baseline vaccination coverage ($\leq 50\%$)

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Traditional leaders	Control group/no intervention	Relative (95% CI)	Absolute		
Uptake of polio vaccine												
1	observational studies	no serious risk of bias ¹	no serious inconsistency	serious ²	no serious imprecision	none ³	11364/11847 (95.9%)	2755/11847 (23.3%)	RR 4.12 (3.99 to 4.26)	726 more per 1000 (from 695 more to 758 more)	⊕○○○ VERY LOW	
								0%		-		

¹ Global rating using EPHPP tool: Strong.

² Downgraded by 1. Single country study: Nigeria (AFR) (64) - The rationale for downgrading is based on the assumption that while this Nigerian sub-population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect. Also of note, the intervention does not focus exclusively on traditional leaders; special focus was also given to religious and political leaders; further assistance provided by traditional healers, birth attendants, town criers, and traditional surgeons. Not downgraded further on this point.

³ Despite large effect estimate - RR 4.12 [3.99, 4.26], not upgraded because of aforementioned issue of indirectness whereby we might expect different relative effect estimates in different settings. However, for this Nigerian sub-population, the evidence is direct and we would expect this large effect to apply.

Table C. GRADE evidence profile: PICO 5 (Dialogue-based)

Question: Should social mobilisation vs control group/no intervention be used for vaccine hesitancy?

Settings: parents in low-income settings

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Social mobilisation	Control group/no intervention	Relative (95% CI)	Absolute		
Uptake of measles vaccine												
1	randomised trials	no serious risk of bias ¹	no serious inconsistency	serious ²	no serious imprecision	none	283/536 (52.8%)	136/420 (32.4%)	RR 1.63 (1.39 to 1.91)	204 more per 1000 (from 126 more to 295 more)	⊕⊕⊕O	MODERATE
								0%		-		
Uptake of DTP3³												
1	randomised trials	no serious risk of bias ⁴	no serious inconsistency	serious ⁵	no serious imprecision	none ⁶	283/535 (52.9%)	103/422 (24.4%)	RR 2.17 (1.8 to 2.61)	286 more per 1000 (from 195 more to 393 more)	⊕⊕⊕O	MODERATE
								0%		-		
Uptake of DTP1												
1	observational studies	very serious ⁷	no serious inconsistency	serious ⁸	serious ⁹	none	63/179 (35.2%)	45/179 (25.1%)	RR 1.54 (1.1 to 2.15)	136 more per 1000 (from 25 more to 289 more)	⊕OOO	VERY LOW
								0%		-		
Uptake of polio vaccine¹⁰												
2	observational studies	no serious risk of bias ¹¹	no serious inconsistency ¹²	serious ¹³	no serious imprecision	strong association ¹⁴	1049/1429 (73.4%)	0/1429 (0%)	RR 1050.00 (147.96 to 7451.4)	-	⊕⊕OO	LOW
								0%		-		

¹ Global rating using EPHPP tool: Strong.

² Downgraded by 1. Single country study: Pakistan (EMR) (77). The rationale for downgrading is based on the assumption that while this study population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.

³ Supporting study: One observational (two-group cohort) study (Nigeria, AFR) (105) indicated a positive effect of using social mobilisation for DTP3 uptake (RR 1.55 [1.09, 2.21]), however, it presented serious issues with confounding and withdrawals/dropouts.

⁴ Global rating using EPHPP tool: Strong.

⁵ Downgraded by 1. Single country study: Pakistan (EMR) (77). See footnote 2 for rationale.

⁶ Despite large effect estimate (RR 2.17 [1.80, 2.61]), not upgraded because of aforementioned issue of indirectness whereby we might expect different relative effect estimates in different settings. However, for this Pakistani sub-population, the evidence is direct and we would expect this large effect to apply.

⁷ Downgraded by 2. Global rating using EPHPP tool: Weak; Issues predominantly around confounding and withdrawals/dropout.

⁸ Downgraded by 1. Single country study: Nigeria (AFR) (105). See footnote 2 for rationale.

⁹ Downgraded by 1. Sample size (n=358); Small number of events (n=104); Wide 95% CI [1.10, 2.15]. Number of participants are borderline to detect true effect estimate (n=358) and does not meet 'optimal information size' criteria for sample size (n=646).

¹⁰ Grey literature: Two studies focused on polio vaccination: In the Republic of Niger (AFR) (183) and Afghanistan (EMR) (184), one study on both polio and routine childhood immunisation in India (SEAR) (172), and one study on both polio and DTP3 in Chad and Guinea (AFR) (173). None of the studies used social mobilisation as a stand-alone strategy. Respective outcomes were as follows: perceived reduction in the number of new cases of AFO and a change in attitude towards recognising polio immunisation as important for promoting children's health; community mobilisers are well received and play a critical role in converting refusals (not quantified) but turnover of staff due to achievement of high coverage or movement to better paid roles means that coverage rates change from month-to-month and resistance is allowed to grow in between immunisation rounds; immunisation (vaccines not specified) increased by 5%; full conversion for polio vaccination - 19 households (all previous refusals); in Chad, all 154 cases of refusals were converted and in Guinea, DTP3 vaccination coverage increased from 69% (2004) to 86% (2005).

¹¹ Global rating using EPHPP tool: Strong (both studies).

¹² No issue of heterogeneity (I² = 0%).

¹³ Downgraded by 1. Studies related only to Pakistan (EMR) (65) and India (SEAR) (63). See footnote 2 for rationale.

¹⁴ Despite very large effect estimate (RR 1050.00 [147.96, 7451.40]), only upgraded by 1. In these two, single group before-and-after studies, the target population were all identified as vaccine refusers, and all received the intervention. In this way, the 'control' group never had the opportunity to accept vaccination outside of the intervention, and as such, the intervention appears to carry a very large effect. These studies highlight two challenges for the overall assessment of evidence, 1) the composition of denominator groups - who exactly has been identified and where are they on the vaccine hesitancy continuum, and 2) study design/intervention delivery.

Table D. GRADE evidence profile: PICO 6 (Dialogue-based)

Question: Should social media interventions vs control group/no intervention be used for vaccine hesitancy?

Settings: Parents in high-income settings

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Social media interventions	Control group/no intervention	Relative (95% CI)	Absolute		
Uptake of MCV4/Tdap (Adolescent)												
1	observational studies	serious ¹	no serious inconsistency	serious ²	no serious imprecision ³	none ⁴	71/195 (36.4%)	30/166 (18.1%)	RR 2.01 (1.39 to 2.93)	183 more per 1000 (from 70 more to 349 more)	⊕○○○ VERY LOW	
								0%		-		
Uptake of seasonal influenza (Adults)⁵												
1	randomised trials	no serious risk of bias ⁶	no serious inconsistency	serious ⁷	serious ⁸	none ⁹	26/224 (11.6%)	12/246 (4.9%)	RR 2.38 (1.23 to 4.6)	67 more per 1000 (from 11 more to 176 more)	⊕⊕○○ LOW	
								0%		-		

¹ Downgraded by 1. Global rating on EPHPP tool: Moderate. Primary issue with selection bias and to a lesser extent, study design and blinding.

² Downgraded by 1. Single country study: USA (AMR) (101). The rationale for downgrading is based on the assumption that while this study population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.

³ Despite small number of events (n=101) and wide 95% CI [1.39, 2.93], not downgraded as sample size easily meets 'optimal information size' criteria for sample size (n=184 required; n=361 achieved).

⁴ Not upgraded as 1) borderline effect estimate RR 2.01 [1.39, 2.93] and 2) downgraded for aforementioned indirectness whereby we might expect different relative effect estimates in different settings. However, for this USA sub-population, the evidence is direct and we would expect this large effect to apply.

⁵ Grey literature: One study in Slovenia (EUR) (176) used social media as part of a multi-component intervention targeting the general public for influenza A(H1N1) vaccination. Results indicated that although the overall intervention achieved >60% for the introduction of this new vaccine, the impact of the social media component was not independently measured, it achieved low utilisation and became a source of negative social media rumours.

⁶ Global rating using EPHPP tool: Strong.

⁷ Downgraded by 1. Single country study: Australia (WPR) (156). See footnote 2 for rationale.

⁸ Downgraded by 1. Small number of events (n=36); Wide 95% CI [1.23, 4.60].

⁹ Despite large effect estimate RR 2.38 [1.23, 4.60], not upgraded because of aforementioned issue of indirectness whereby we might expect different relative effect estimates in different settings. However, for this Australian sub-population, the evidence is direct and we would expect this large effect to apply.

Table E. GRADE evidence profile: PICO 7 (Dialogue-based)

Question: Should mass media interventions vs control group/no intervention be used for vaccine hesitancy?

Settings: Parents

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Mass media interventions	Control group/no intervention	Relative (95% CI)	Absolute		
Uptake of all vaccines included in primary routine immunisation¹												
1	randomised trials	no serious risk of bias ²	no serious inconsistency	serious ³	no serious imprecision	none	386/536 (72%)	225/489 (46%)	RR 1.57 (1.4 to 1.75)	262 more per 1000 (from 184 more to 345 more)	⊕⊕⊕○	MODERATE
								0%		-		

¹ Grey literature: Three studies used mass media strategies but none as a stand-alone strategy in Slovenia (high income) (EUR, AH1N1) (176); India (SEAR, routine childhood & polio) (172); and Afghanistan (EMR, routine childhood & polio) (184). Respective outcomes were as follows: overall intervention achieved >60% for the introduction of this new vaccine, the impact of the mass media component was not independently measured; increased vaccination (not clear which ones) by 5%; impact on vaccination coverage not quantified; consistency of application was an issue.

² Global rating using EPHPP tool: Strong.

³ Downgraded by 1. Single country study: India (SEAR) (81). The rationale for downgrading is based on the assumption that while this study's population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.

Table F. GRADE evidence profile: PICO 8 (Dialogue-based)

Question: Should communication tool-based health care worker (HCW) training vs control group/no intervention be used for vaccine hesitancy?

Settings: Patients (rostered)

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Communication tool-based health care worker (HCW) training	Control group/no intervention	Relative (95% CI)	Absolute		
Uptake of EPI vaccines												
1	randomised trials	no serious risk of bias ¹	no serious inconsistency	serious ²	no serious imprecision ³	none ⁴	68/379 (17.9%)	50/860 (5.8%)	RR 3.09 (2.19 to 4.36)	122 more per 1000 (from 69 more to 195 more)	⊕⊕⊕O MODERATE	
								0%		-		
Uptake of DTP3												
1	randomised trials	serious ⁵	no serious inconsistency	serious ⁵	no serious imprecision	none	228/376 (60.6%)	149/378 (39.4%)	RR 1.54 (1.33 to 1.79)	213 more per 1000 (from 130 more to 311 more)	⊕⊕OO LOW	
								0%		-		

¹ Global rating using EPHPP tool: Strong.

² Downgraded by 1. Single country study: India (SEAR) (91). The rationale for downgrading is based on the assumption that while this study's population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.

³ Despite small number of events (n=118) and wide 95% CI [2.19, 4.36], not downgraded as sample size meets 'optimal information size' criteria (n=222 required; n=1239 achieved).

⁴ Despite large effect estimate - RR 3.09 [2.19, 4.36], not upgraded because of aforementioned issue of indirectness whereby we might expect different relative effect estimates in different settings. However, for this Indian sub-population, the evidence is direct and we would expect this large effect to apply.

⁵ Downgraded by 1. Global rating using EPHPP tool: Moderate. Primary issue with confounding.

⁶ Downgraded by 1. Single country study: Pakistan (EMR) (78). For rationale see footnote 2.

Table G. GRADE evidence profile: PICO 9 (Dialogue-based)

Question: Should information-based HCW training vs control group/no intervention be used for vaccine hesitancy?

Settings: Patients (rostered)

Quality assessment	No of patients	Effect	Quality	Importance
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No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Information-based HCW training	Control group/no intervention	Relative (95% CI)	Absolute		
HepB-1												
1	observational studies	no serious risk of bias ¹	no serious inconsistency	serious ²	no serious imprecision	none ³	1681/5020 (33.5%)	598/5057 (11.8%)	RR 2.83 (2.6 to 3.08)	216 more per 1000 (from 189 more to 246 more)	⊕○○○	VERY LOW
								0%		-		
HepB-2												
1	observational studies	no serious risk of bias	no serious inconsistency	serious ⁴	no serious imprecision	none	1026/5020 (20.4%)	633/5057 (12.5%)	RR 1.63 (1.49 to 1.79)	79 more per 1000 (from 61 more to 99 more)	⊕○○○	VERY LOW
								0%		-		
HepB-3												
1	observational studies	no serious risk of bias	no serious inconsistency	serious ⁵	no serious imprecision	none	1372/5020 (27.3%)	733/5057 (14.5%)	RR 1.89 (1.74 to 2.04)	129 more per 1000 (from 107 more to 151 more)	⊕○○○	VERY LOW
								0%		-		
DTP/OPV (Dose 1)												
1	observational studies	no serious risk of bias	no serious inconsistency	serious ⁶	no serious imprecision	none	1252/5020 (24.9%)	1273/5057 (25.2%)	RR 0.99 (0.93 to 1.06)	3 fewer per 1000 (from 18 fewer to 15 more)	⊕○○○	VERY LOW
								0%		-		
DTP/OPV (Dose 2)												
1	observational studies	no serious risk of bias	no serious inconsistency	serious ⁷	no serious imprecision	none	1236/5020 (24.6%)	1192/5057 (23.6%)	RR 1.04 (0.97 to 1.12)	9 more per 1000 (from 7 fewer to 28 more)	⊕○○○	VERY

								0%		-	LOW	
DTP/OPV - Dose 3												
1	observational studies	no serious risk of bias	no serious inconsistency	serious ⁸	no serious imprecision	none	1575/5020 (31.4%)	1121/5057 (22.2%)	RR 1.42 (1.33 to 1.51)	93 more per 1000 (from 73 more to 113 more)	⊕○○○ VERY LOW	
								0%		-		
BCG												
1	observational studies	no serious risk of bias	no serious inconsistency	serious ⁹	no serious imprecision	none	1294/5020 (25.8%)	1287/5057 (25.4%)	RR 1.01 (0.95 to 1.08)	3 more per 1000 (from 13 fewer to 20 more)	⊕○○○ VERY LOW	
								0%		-		
Measles												
1	observational studies	no serious risk of bias	no serious inconsistency	serious ¹⁰	no serious imprecision	none	1373/5020 (27.4%)	1354/5057 (26.8%)	RR 1.02 (0.96 to 1.09)	5 more per 1000 (from 11 fewer to 24 more)	⊕○○○ VERY LOW	
								0%		-		

¹ Global rating EPHPP tool: Strong (same for all outcomes in this section).

² Downgraded by 1. Single country study: India (SEAR) (9). The rationale for downgrading is based on the assumption that while this study's population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.

³ Despite large effect estimate - RR 2.83 [2.60, 3.08], not upgraded because of aforementioned issue of indirectness whereby we might expect different relative effect estimates in different settings. However, for this Indian sub-population, the evidence is direct and we would expect this large effect to apply.

⁴ As for footnote 2.

⁵ As for footnote 2.

⁶ As for footnote 2.

⁷ As for footnote 2.

⁸ As for footnote 2.

⁹ As for footnote 2.

¹⁰ As for footnote 2.

Table H. GRADE evidence profile: PICO 2 (Non-financial incentive-based)

Question: Should non-financial incentives vs control group/no intervention be used for vaccine hesitancy?

Settings: Parents/communities located in low-income settings

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Non-financial incentives	Control group/no intervention	Relative (95% CI)	Absolute		
Uptake of EPI vaccines												
1	randomised trials	no serious risk of bias ¹	no serious inconsistency	serious ²	no serious imprecision ³	none ⁴	148/382 (38.7%)	68/379 (17.9%)	RR 2.16 (1.68 to 2.77)	208 more per 1000 (from 122 more to 318 more)	⊕⊕⊕O	MODERATE
								0%		-		

¹ Global rating using EPHPP tool: Strong.

² Downgraded by 1. Single country study: India (SEAR) (91). The rationale for downgrading is based on the assumption that while this study's population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.

³ Despite small number of events (n=216) and wide 95% CI [1.68, 2.77], not downgraded as sample size meets OIS criteria (n=146 required; n=761 achieved).

⁴ Despite large effect estimate: RR 2.16 [1.68, 2.77], not upgraded because of aforementioned issue of indirectness whereby we might expect different relative effect estimates in different settings. However, for this Indian sub-population, the evidence is direct and we would expect this large effect to apply.

Table I. GRADE evidence profile: PICO 1 (Reminder/recall-based)

Question: Should reminder-recall interventions vs control group/no intervention be used for vaccine hesitancy?

Settings: Parents or communities located in low-income settings

Quality assessment							No of patients		Effect		Quality	Importance
No of	Design	Risk of	Inconsistency	Indirectness	Imprecision	Other	Reminder-recall	Control group/no	Relative	Absolute		

studies	bias					considerations	interventions	intervention	(95% CI)			
Uptake of DTP3												
1	randomised trials	no serious risk of bias ¹	no serious inconsistency	serious ²	no serious imprecision	none	259/375 (69.1%)	205/375 (54.7%)	RR 1.26 (1.13 to 1.42)	142 more per 1000 (from 71 more to 230 more)	⊕⊕⊕O	MODERATE
								0%		-		

¹ Global rating using EPHPP tool: Strong.

² Downgraded by 1. Single country study: Pakistan (EMR) (145). The rationale for downgrading is based on the assumption that while this study's population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.

Table J. GRADE evidence profile: PICO 2 (Reminder/recall-based)

Question: Should reminder-recall interventions vs control group/no intervention be used for vaccine hesitancy?

Settings: Populations with low baseline vaccination coverage (≤50%)

Quality assessment	No of patients	Effect	Quality	Importance
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No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Reminder-recall interventions	Control group/no intervention	Relative (95% CI)	Absolute		
Uptake of childhood vaccines (all scheduled)¹												
1	observational studies	very serious ²	no serious inconsistency	serious ³	serious ⁴	none ⁵	26/95 (27.4%)	9/106 (8.5%)	RR 3.22 (1.59 to 6.53)	188 more per 1000 (from 50 more to 470 more)	⊕○○○ VERY LOW	
								0%		-		

¹ Grey literature: One study in Canada (AMR, all childhood) (178) applied a reminder-recall intervention targeting the community with low baseline coverage of childhood vaccination; Impact: Increase in vaccination was <10%.

² Downgraded by 2. Global rating using EPHPP tool: Weak. Primary issues were study design and confounders.

³ Downgraded by 1. Single country study: Switzerland (EUR) (85). The rationale for downgrading is based on the assumption that while this study's population is a direct representation of our population of interest, there is indirectness with regard to other populations of interest where we might see a different relative effect.

⁴ Downgraded by 1. Very few events (n=35); Wide 95% CI [1.59, 6.53].

⁵ Large effect estimate - RR 3.22 [1.59, 6.53] but not upgraded due to aforementioned issues.

2.1 Objectives

To evaluate the quality of evidence regarding the effectiveness of intervention strategies to deal with issues of vaccine hesitancy and ultimately increase uptake of all vaccines included in routinely recommended programmes.

2.2 Methods

2.2.a Criteria for considering studies for this review

After the initial screening of the peer-reviewed and grey literature to identify evaluated strategies relating to vaccine hesitancy (see Section 1), a series of PICO questions were defined *a priori* by the SAGE WG to further refine the assessment of studies and ensure that focus was given to areas considered the most important by the experts. This series was used to define the following criteria:

2.2.b Types of studies

All study types were included providing data was available for comparison groups (i.e., intervention versus control).

2.2.c Types of participants

Participants include:

- Populations with high ($\geq 80\%$) or low ($\leq 50\%$) baseline vaccination uptake
- Parents/communities in low or high income settings
- Rostered patients
- Populations targeted by vaccination campaigns
- Health care workers (HCW).

2.2.d Types of interventions

Interventions

Single interventions aligned with the following core themes set out by the SAGE WG for dealing with Vaccine Hesitancy:

1. Dialogue-based interventions, for example:
 - Involvement of religious or traditional leaders
 - Social mobilisation
 - Social media interventions
 - Mass media interventions
 - Communication tool-based health care worker (HCW) training
 - Information-based HCW training
2. Non-financial incentive-based interventions (e.g., food or other goods)
3. Reminder-recall based interventions (e.g., telephone call or letter).

Exclusion

Multi-component interventions where data did not support interpretation of the effect of individual components; interventions that only reported on a change in knowledge, attitude or awareness (i.e., not behavioural); and interventions that did not relate to specific PICO questions.

Comparisons

- Control group / no intervention (e.g., routine immunisation practice in the study setting)

2.2.e Types of outcome measures**Primary outcome**

- Uptake of all vaccines included in routinely recommended immunisation

2.2.f Search methods for identification of studies

- Described in Section 1 (page 22)

2.2.g Data collection and analysis**Selection of studies**

All evaluated studies identified in earlier screening (see Section 1, Results page 22) were reviewed for eligibility regarding the GRADE assessment of interventions. Reasons for excluding studies are presented in Characteristics of excluded studies (page 125).

Data extraction and management

A data extraction form was developed and reviewed by the LSHTM review team. Risk of bias assessment and data extraction was carried out independently by two reviewers. Data points captured in an Excel spreadsheet included the following:

1. Type of study
2. Setting
3. Type of participants
4. Type of intervention
5. Type of outcomes measured

Assessment of risk of bias in included studies

The Effective Public Health Practice Project (EPHPP) quality assessment tool for quantitative studies (205) was applied to determine the risk of bias of all eligible studies. Two reviewers applied the criteria and disagreements were settled in discussion together.

Criteria for all studies were:

1. Selection bias
2. Design
3. Confounders
4. Blinding
5. Data collection methods
6. Withdrawals and drop-outs.

Each criteria was scored 'strong', 'moderate', or 'weak'. The methodological quality of each included study is presented in Table 7.

Table 7. Methodological quality summary: Author's judgements about methodological quality for each included study for PICO

	SELECTION BIAS	STUDY DESIGN	CONFOUNDERS	BLINDING	DATA COLLECTION	WITHDRAWALS / DROPOUTS	Global Rating
Nasiru 2012 (64)	Strong	Moderate	Strong	Moderate	Strong	Strong	Strong
Andersson 2009 (77)	Strong	Strong	Strong	Moderate	Strong	Strong	Strong
Pandey 2007 (81)	Strong	Strong	Strong	Strong	Strong	Strong	Strong
Usman 2011(78)	Moderate	Strong	Weak	Moderate	Strong	Strong	Moderate
Uskun 2008 (9) ^a	Strong	Moderate	Strong	Moderate	Strong	Strong	Strong
Banerjee 2010 (91)	Strong	Strong	Strong	Moderate	Strong	Moderate	Strong
Muehleisen 2007 (85) ^b	Moderate	Weak	Weak	Moderate	Moderate	Strong	Weak
Oche 2011(105) ^c	Moderate	Moderate	Weak	Moderate	Strong	Weak	Weak
Usman 2009 (145)	Moderate	Strong	Strong	Moderate	Strong	Strong	Strong
Lau 2012(156) ^d	Moderate	Strong	Strong	Moderate	Strong	Strong	Strong
Shukr 2010 (65)	Strong	Moderate	Strong	Moderate	Strong	Strong	Strong
Ansari 2007 (63)	Strong	Moderate	Strong	Moderate	Strong	Strong	Strong
Stockwell 2012 (101)	Weak	Moderate	Strong	Moderate	Strong	Strong	Moderate

a Statistical analysis was not well documented and the method of regression was improperly used and not checked for the assumption Coded: Can't tell (for Section H – Analyses: were the statistical methods applied appropriate for the study design)

b Statistical methods are not documented at all but the analysis was very simple. Coded: Can't tell (for Section H)

c Statistical analysis is largely descriptive and univariable; no adjustment is made for clustering. Coded: No (for Section H)

d Only a descriptive analysis of the data using chi-squared tests to test the association between the exposure and the outcome were provided; this is not adequate given that this study was a RCT. In the methods, it states that logistical regression analyses were undertaken, none of the results were presented. Coded: No (for Section H).

Measures of treatment effect

Risk ratio was used in our analysis of dichotomous data. Outcomes reported varied between studies so the available data were entered into RevMan as individual studies. The risk ratio between intervention and control groups for individual studies is discussed. The fixed-effects model was used as the default procedure in the analysis.

Data synthesis

For almost all comparisons and/or outcomes, only one study provided data and as such, data are only presented descriptively and not pooled. Only one comparison and outcome (PICO 5/polio vaccine uptake) had two studies providing data; these data were pooled using a fixed-effects model for analysis.

2.3 Assessment of data quality

Quality of evidence was further assessed using GRADE (Grading of Recommendations, Assessment, Development, and Evaluation) (206). Data for key interventions were entered into the Grade Profiler and the quality of evidence for the outcomes was graded as 'high', 'moderate', 'low', and 'very low', defined as follows.

High quality: We are very confident that the true effect lies close to that of the estimate of the effect.

Moderate quality: We are moderately confident in the effect estimate: The true effect is likely to be close to the estimate of the effect, but there is a possibility that it is substantially different.

Low quality: Our confidence in the effect estimate is limited: The true effect may be substantially different from the estimate of the effect.

Very low quality: We have very little confidence in the effect estimate: The true effect is likely to be substantially different from the estimate of effect.

2.4 Results

2.4.a Description of studies

See Characteristics of included studies (see page 94) and Characteristics of excluded studies (page 125).

2.4.b Results of the search

The initial search retrieved 33023 articles. After the removal of duplicates and irrelevant articles and the addition of 47 articles identified through other sources, (five articles were not available by full text), 1149 articles were included for full-text review. Of the articles included, 166 formally evaluated and 983 suggested an intervention. 129 articles reported on vaccination uptake, which was the primary outcome of interest; the remaining 37 studies reported on changes in non-behavioural outcomes including knowledge, awareness and attitude, and were not included in this review.

The 129 eligible studies were then screened for relevance in accordance with the set of PICO questions that had been articulated *a priori* by the SAGE working group. A final set of 13 studies was eligible for inclusion in the review. Reasons for exclusion are given in the table Characteristics of excluded studies (see page 125).

2.4.c Included studies

Thirteen studies met the inclusion criteria. Details of location of study, participants, sampling and study design are presented in Table 8, followed by a description of each intervention and the associated results. Over half of the included studies were observational studies. Almost all (12/13) targeted childhood vaccination and over half (8/13) were conducted in the SEAR and EMR regions. Five of the 13 studies involved community level interventions.

Table 8: Included Studies for PICO Analysis

Reference, year and country	Study Design, target population & type of intervention	Sampling to measure outcome	Target Vaccine	Outcome measure
Andersson et al, 2009 (77) Pakistan LMIC Low baseline vaccination rates (58% DTP3 in 2006 / 2007)	Community based cluster RCT – parents Dialogue based intervention	Random selection of 32 enumeration areas of four to five villages. 18 EAs randomised to intervention (3166 children < 5 years) and 14 to control group (2475 children). 538 children aged 12-23 months in intervention and 373 in control surveyed at baseline. 536 in intervention and 420 in control surveyed post-intervention.	Routine childhood vaccines	Full DTP and measles vaccination at 12-23 months old
Pandey et al, 2007 (81) India LMIC Low baseline vaccination rates (80% of children < 2 years not fully immunised)	Community based cluster RCT – parents Dialogue based intervention	Multistage sampling of a) 21 conveniently sampled districts (assigned randomly to intervention or control arms); b) 1 randomly selected block (out of 14) within each district; c) 5 village clusters (out of 65) within each block (with on average 409 households and 2343 persons per village) and d) sequential sampling of 10 households per village cluster (5 low-caste, 5 middle / high-caste). 536/548 intervention households and 489/498 control households completed follow-up.	Routine childhood vaccines	Vaccine uptake in children
Banerjee et al, 2010 (91) India LMIC Low baseline vaccination rates (60% in control arm; 45% & 80% in each trial arm at baseline)	Community based cluster RCT – parents Incentive-based & dialogue-based	Random selection of 134 villages, 30 received intervention A, 30 intervention B and 74 control villages. Within villages 30 households of children aged 0 to 5 years sampled at baseline and post-intervention; 379 children in intervention arm A, 382 in intervention arm B & 860 controls.	Routine childhood vaccines	Vaccine uptake in children

<p>Usman et al, 2011 (78) Pakistan LMIC Low baseline vaccination rates (DTP3 65-72% between 2002 & 2005)</p>	<p>Individual RCT - Resident mothers and children attending for DTP1 vaccination at six EPI centres in outskirts of Karachi Dialogue based intervention</p>	<p>Centre-based education arm – 376 mother child pairs, control arm – 378 pairs (two other intervention arms excluded from review).</p>	<p>DTP 1-3</p>	<p>DTP3 completion in children at 90d post-intervention</p>
<p>Usman et al, 2009 (145) Pakistan LMIC Low baseline vaccination rate (Between 2000-2004, 11-13% of children did not complete DTP vaccination)</p>	<p>Individual RCT - Resident mother and child pairs attending for DTP1 at one EPI centre from each of five administrative units in urban Karachi Reminder recall intervention</p>	<p>All children attending centre on study day assessed for eligibility. 375 mother child pairs in each of redesigned vaccination card and standard care arms (two other intervention arms not assessed).</p>	<p>DTP 1-3</p>	<p>DTP3 completion in children at 90d post-intervention</p>
<p>Lau et al, 2012 (156) Australia HIC Baseline vaccination rate not specified</p>	<p>Individual RCT - University staff and students Dialogue-based</p>	<p>372 randomised to control and 370 to intervention.</p>	<p>Influenza</p>	<p>Influenza vaccination status</p>
<p>Nasiru et al, 2012 (64) Nigeria LMIC Low baseline vaccination rate (not specified)</p>	<p>Community based intervention / prospective cohort study – adults [Single group cohort].</p>	<p>Convenience sample of four villages (total population = 11847) with low polio vaccine uptake and high number of reported cases. Vaccine uptake in children under five from these villages was measured before and after intervention.</p>	<p>Polio</p>	<p>Polio vaccine uptake in children</p>

	Dialogue based intervention			
Shukr et al, 2010 (65) Pakistan LMIC Low baseline vaccination rate (not specified)	Cross-sectional survey with follow up of parents declining vaccination [Single group cohort]. Dialogue based intervention	All parents who declined vaccination were given additional counselling and health education (n=404).	Polio	Acceptance of polio vaccine
Ansari et al, 2007 (63) India LMIC Low baseline vaccination rate (not specified)	Cross-sectional survey with follow up of parents declining vaccination [Single group cohort]. Dialogue based intervention	Purposive sample of areas resistant to polio vaccination. Families declining vaccination followed up for additional counselling and health education (n=1025).	Polio	Acceptance of polio vaccine
Stockwell et al, 2012 (101) USA HIC Baseline vaccination rate not given	Intervention study - Parents of children aged 11 to 18 years due MCV4 or Tdap vaccination [Single group cohort]. Dialogue based intervention	Random sample 195 parents in intervention arm and 166 age and gender matched controls	MCV4, Tdap 1-3	Uptake of MCV4 and Tdap at 4, 12 & 24 weeks
Oche et al, 2011 (105) Nigeria	Controlled community trial - Mothers of	Random sample of 179 mothers in each of intervention and control communities.	DTP 1-3	DTP3 vaccine uptake in children 9 months

LMIC Low baseline vaccination rate (21% in intervention & 26% in control at baseline)	children aged 0 to 23 months [Two-group cohort]. Dialogue based intervention			after intervention
Muehleisen et al, 2007 (85)Switzerland HIC Low baseline vaccination rate (51% of control & 46% of intervention group were under-immunised)	Intervention study - Hospitalised under-immunised children aged 61d - 17 years with available immunisation records [Two-group cohort]. Reminder recall	95 participants in intervention arm, 106 in control arm.	Routine childhood vaccines	Individual's vaccination status within one and nine months of discharge
Uskun et al, 2008 (9)Turkey LMIC Low baseline uptake (below EPI target: 88% for DTP at 1 year of age).	Repeat cross-sectional survey – vaccine providers and general population [Two-group cohort]. Dialogue based intervention.	Vaccination uptake data in 5057 children aged less than 12 months attending health centres in the study area for vaccination collected pre-intervention & in 5020 children attending health in the study area for vaccination post-intervention. 229 HCW sampled and surveyed pre and post-intervention.	Routine childhood vaccines.	Vaccine uptake in children.

2.4.d Data Analysis

Other than for two studies (one outcome), meta-analysis was not feasible due to the lack of available data and the variability of study design and outcomes reported in the included studies. Data from individual studies were presented based on the type of intervention used and grouped under one of the core themes as specified by the SAGE WG.

For studies which included pre- and post-control and intervention groups, only the post-data were used in order to more accurately represent the effect of the intervention.

Interventions

Theme 1: Dialogue-based

Dialogue-based interventions included: an information and community forum campaign supported by political, religious and traditional leaders, that involved educational films accompanied by question and answer sessions and group discussion (64); evidence based discussion in the community on the prevalence of measles among children, conversations on the cost-benefit of the vaccine, and the development of local community action plans (9); village-based information campaign consisting of two to three meetings including an audiotaped presentation, question and answer sessions, and the distribution of leaflets (81). In the Usman 2011 (78) study, the intervention arm provided health education in the health centre in the form of a two-three minute conversation with the mother to highlight the importance of completing the immunisation schedule with particular reference to potential adverse impact on their child's health should it not be completed.

For the Uskun 2008 (9) study, participants attended instructive lectures and took part in interactive workshops, designed specifically to elicit discussion about various aspects of vaccines and vaccination. Oche 2011 (105) organised advocacy visits to work with community and opinion leaders in a participatory decision-making process to address the identified problems of immunisation in the community (e.g., misconceptions, refusal, dropouts). Ten literate community members were then nominated to act as volunteers in social mobilisation and sensitisation activities including dialogue with leaders and more interpersonal communication with the target population. Ansari 2007 (63) engaged two teams of medical interns to visit families resistant to vaccination; Team A visited one day after the campaign and HCW identified families as being resistant. Team B revisited those remaining resistant several days later. Similar visits were organised by Shukr 2010 (65), where identified reluctant parents received counselling from the WHO team. Social media was adopted by Stockwell 2012 (101), where parents received a series of automated text messages notifying them of their child's need for vaccination; these messages had been developed with community input and were personalised accordingly.

Theme 2: Non-financial incentive

Non-financial incentive interventions included: offering 1kg raw lentils per immunisation administered and a set of thalis (metal plates used for meals) on completion of a child's full immunisation (91).

Theme 3: Reminder-recall

In the Muehleisen 2007 (85) study, parents of children admitted to hospital who were under-immunised were informed about missing immunisation before discharge and encouraged to contact their primary care physician. Individual physicians were also informed by letter about missing vaccinations and encouraged to administer catch-up vaccinations. New and simpler immunisation cards were designed to specifically address the needs of a low literacy population in the Usman 2009 (145) study; it's most important function was to act as a constant reminder to mothers for the next immunisation visit.

Control

The control groups received routine care/standard process in eight studies(105), (145), (101). In two studies (63), (65), the control groups were exposed to regular polio campaign activities. Two studies used pre-exposure rates as their control (65), (9) In the Banerjee 2010 (91) study, one of the three intervention arms was used as the control – this intervention included improvements in both quantity and regularity of 'immunisation camps' – which was also one of two component parts of the primary intervention of interest.

Outcome

Nine of the studies (105), (145), (156), (63), (65), (64), (9), (91), (78) provided data on the proportion of the target population that was fully immunized by the recommended vaccine. Four studies (101), (81), (9), (85) reported on the proportion of the target population that had received one or more of the recommended vaccine/s. All studies measured outcomes at an individual level except for Pandey 2007 (81), who measured the outcome at the household level.

Follow-up

The period of follow-up varied between studies from immediate recording to two years. Six studies had no loss to follow-up (64), (78), (63), (65), (145), (101). Four studies (81), (85), (91), (156) had loss to follow-up rates of 2.2%, 4%, 15.2% and 19% respectively. Two studies (77), (9) had two independent samples for pre- and post- follow up, while the loss to follow up in one study could not be confirmed (105).

Excluded studies

157 studies were excluded from the review. Reasons for exclusion were as follows: not about primary outcome of interest (35 studies); multi-component intervention without independent data for each component (64 studies); not relevant to any of the specified PICO questions (45 studies); or unclear data (nine studies). Five studies were not available in full text; they feature in the list for reference only but are not counted as part of the total 166 evaluated studies.

Risk of bias in included studies (Scale: Strong = No major issue; Moderate = Acceptable; Weak = Major issue)

The risk of bias in relation to selection and study design was generally assessed as moderate or strong, apart from two studies (101), (85), where selection bias and study design were respectively

weak. Three studies were rated weak for issues of confounding but all other studies were rated strong. Blinding across all studies was predominantly moderate and no studies were weak. Similarly, for data collection, all studies were rated as strong apart from one study (85), which was rated moderate. For withdrawals/dropouts, one study was rated as moderate (91) and one weak (105); the remainder were all rated as strong.

Theme 1: Dialogue-based

Impact of religious or traditional leader involvement

There was very low quality evidence that the involvement of religious leaders or traditional leaders in populations with low baseline vaccination uptake ($\leq 50\%$) may assist in addressing vaccine hesitancy for polio (RR 4.12; 95% CI 3.99, 4.26) (Figures 31, 32) (64). However, the grey literature on polio and other childhood vaccinations indicates that religious and traditional leader involvement as a component part of an intervention can have a positive impact.

Impact of social mobilisation

The quality of evidence that social mobilisation could help address issues of vaccine hesitancy among parents in low income settings for: measles (RR 1.63; 95% CI 1.39, 1.91) was moderate (77); DTP1 (RR 1.54; CI 95% 1.1, 2.15) was very low (105); polio (RR 1050.00; CI 95% 147.96, 7451.4) was low (65) (63); and DTP3 was moderate (RR 2.17; 95% CI 1.8, 2.61) (77) (Figure 33). In the grey literature, which covered polio, routine childhood immunisation and DTP3, inclusion of social mobilisation as a component of an intervention appeared to have a positive but variable impact and was not always quantified.

Impact of social media

For social media as a strategy for addressing vaccine hesitancy in high income settings, the quality of the evidence for: MCV4/Tdap (RR 2.01, 95% CI 1.39, 2.93) was very low (101); and seasonal influenza (Adults) (RR 2.38, 95% CI 1.23, 4.6) was low (156) (Figure 34). In the grey literature, one study (176) in Slovenia reported on the use of social media amongst other intervention components for A(H1N1), however, its impact was not independently measured and overall it achieved low utilisation and became a source of negative social media rumours.

Impact of mass media

Pandey 2007 (81) provided moderate quality evidence for mass media as an approach to vaccine hesitancy among parents for all routinely recommended (RR 1.57, 95% CI 1.4, 1.75) (Figure 35). Three studies reported on the use of mass media for addressing hesitancy in the grey literature for A(H1N1) (176) (high income setting), routine childhood immunisation and polio (low income setting) (172) (184) but its true impact could not be obtained as it was not independently measured from other intervention components.

Impact of communication tool-based training for health care workers

The evidence for the use of communication tool-based training for health care workers to address vaccine hesitancy among rostered patients for: EPI (RR 3.09, 95% CI 2.19, 4.36) was moderate (91); DTP3 (RR 1.54; 95% CI 1.33, 1.79) was low (78) (Figure 36).

Impact of information-based healthcare worker training

Uskun 2008 (9) provided very low evidence for the use of information-based HCW training across several vaccines including: HepB-1 (RR 2.83, 2.60, 3.08), (HepB-2 (RR 1.63; 95% CI 1.49, 1.79); HepB-3 (RR 1.89; 95% CI 1.74, 2.04); DTP/OPV-1 (RR 0.99; 95% CI 0.93, 1.06); DTP/OPV-2 (RR 1.04; 95% CI 0.97, 1.12); DTP/OPV-3 (RR 1.42; 95% CI 1.33, 1.51); BCG (RR 1.01; 95% CI 0.95, 1.08); and measles (RR 1.02; 95% CI 0.96, 1.09) (Figure 37).

Figure 31 – PICO 1. Forest plot of comparison: 1 Dialogue/religious leader vs control/no intervention, outcome: 1.2 Vaccination uptake /uptake of polio in populations with low baseline uptake ($\leq 50\%$)

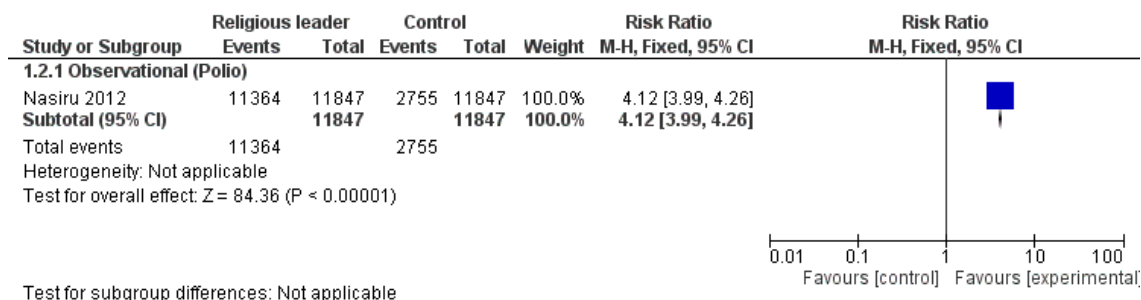


Figure 32– PICO 3. Forest plot of comparison: 2 Dialogue/Traditional leader vs control/no intervention, outcome: 2.1 Vaccination uptake /uptake of polio (OPV) in populations with low baseline uptake ($\leq 50\%$)

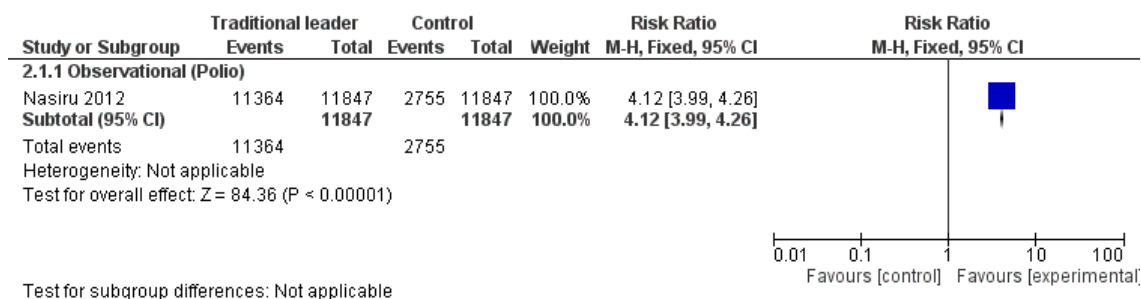
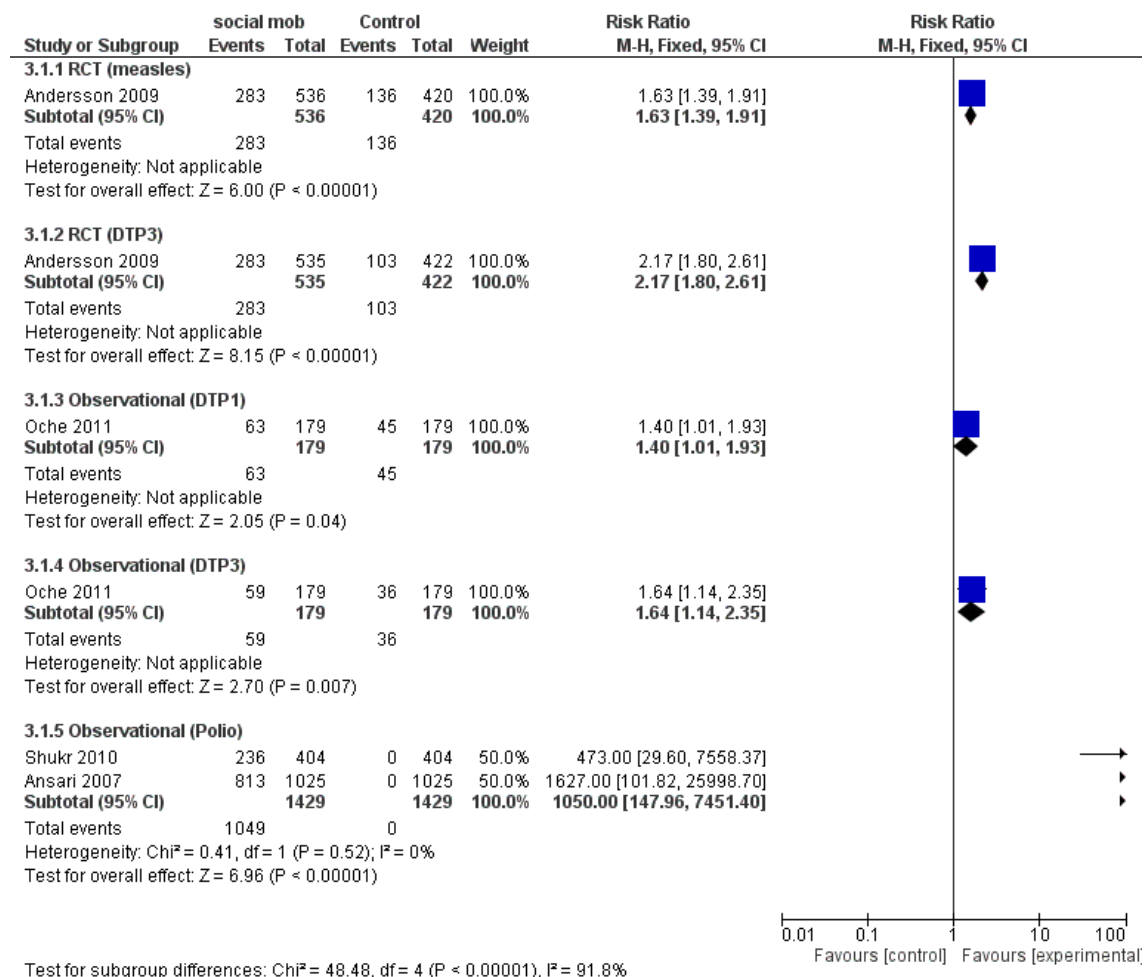
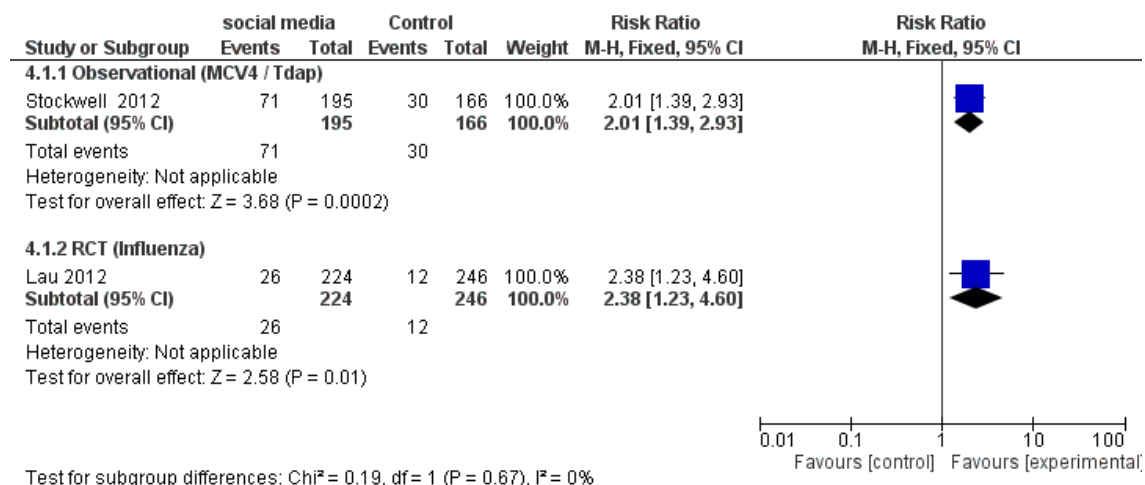


Figure 33 – PICO 5. Forest plot of comparison: 3 Dialogue/social mob vs control/no intervention, outcome: 3.1 Vaccination uptake /uptake of measles, DTP1, DTP3, or polio (OPV) by parents in low income settings*



*Figure depicts different outcomes from multiple studies

Figure 34 – PICO 6. Forest plot of comparison: 4 Dialogue/social media vs control/no intervention, outcome: 4.1 Vaccination uptake /uptake of MCV4/Tdap or Influenza by parents in high-income settings*



*Figure depicts different outcomes from multiple studies

Figure 35 – PICO 7. Forest plot of comparison: 5 Dialogue/mass media vs control/no intervention, outcome: 5.1 Vaccination uptake /uptake of all scheduled childhood vaccines by parents in high income settings

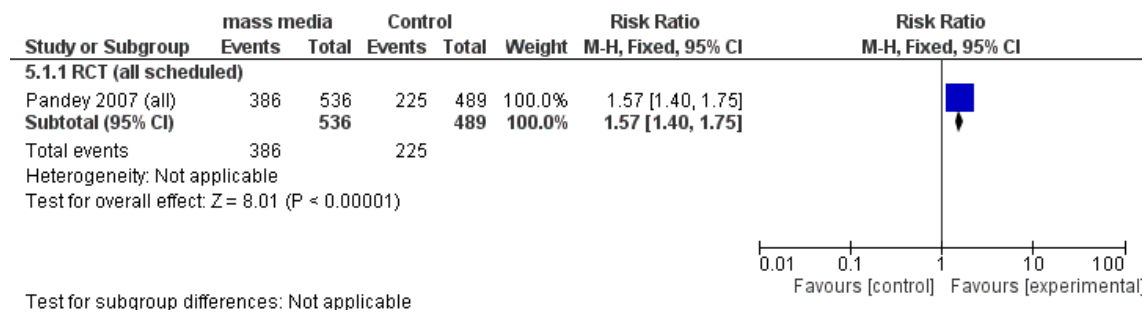
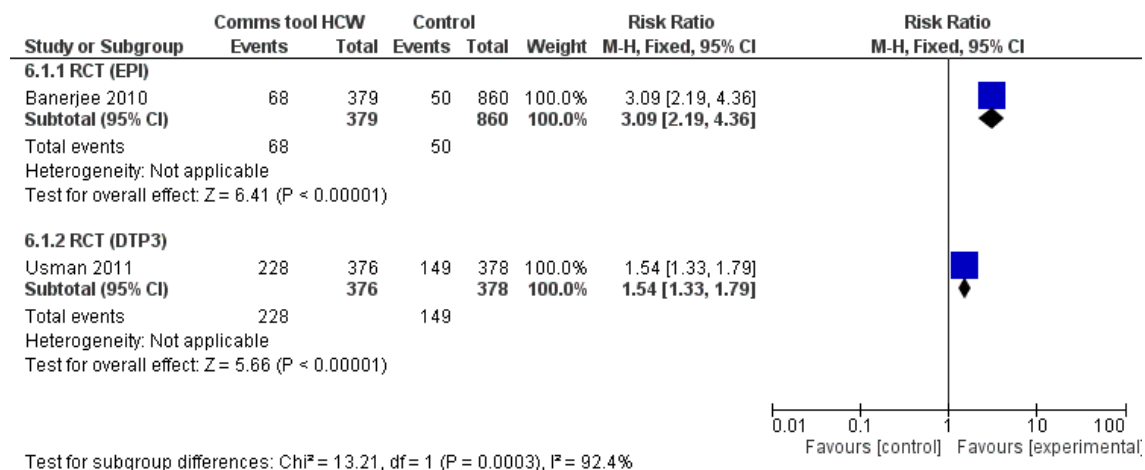
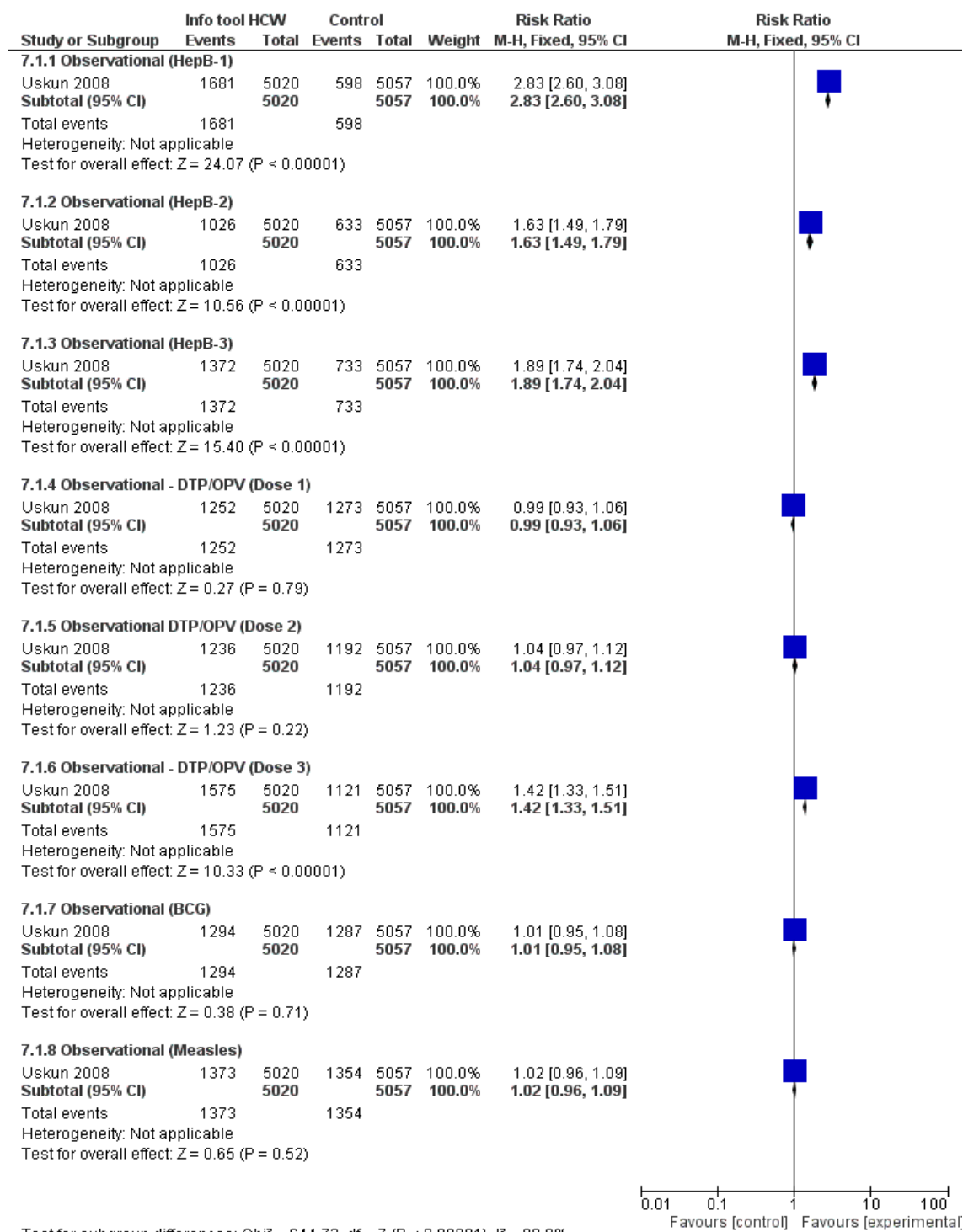


Figure 36 – PICO 8. Forest plot of comparison: 6 Dialogue/Communications tool for HCW vs control/no intervention, outcome: 6.1 Vaccination uptake /uptake of EPI or DTP3 by (rostered) patients*



*Figure depicts different outcomes from multiple studies

Figure 37 – PICO 9. Forest plot of comparison: 7 Dialogue/information tool HCW vs control/no intervention, outcome: 7.1 Vaccination uptake /uptake of HepB (all doses), DTP/OPV (all doses), BCG, or measles by (rostered) patients*



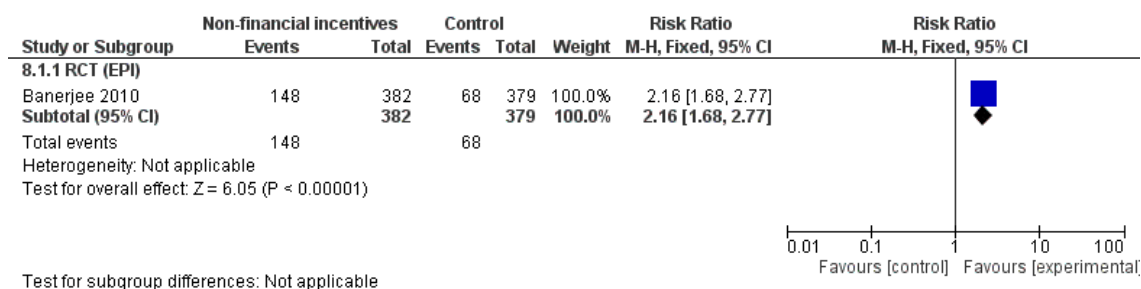
*Figure depicts different outcomes from a single study

Theme 2: Non-financial incentive-based

Impact of non-financial incentives

There was moderate quality evidence for the consideration of non-financial incentives to overcome vaccine hesitancy towards EPI vaccines (RR 2.16, 95% CI 1.68, 2.77) among parents/communities located in low-income settings (91) (Figure 38).

Figure 38 – PICO 2B. Forest plot of comparison: 8 Non-financial incentives vs control/no intervention, outcome: 8.1 Vaccination uptake /uptake of EPI in parents/communities located in low-income settings



Theme 3: Reminder/recall based

Impact of reminder-recall-based interventions (low-income settings)

Usman 2009 (145) provided moderate quality evidence that reminder-recall interventions among parents/communities located in low-income settings could positively influence experiences of vaccine hesitancy towards DTP3 (RR 1.26, 95% CI 1.13, 1.42) (Figure 39).

Impact of reminder-recall-based interventions (low baseline uptake, ≤50%)

For use of reminder-recall to overcome vaccine hesitancy towards all scheduled childhood vaccines (RR 3.22, 95% CI 1.59, 6.53) in populations with low baseline vaccination uptake (≤50%), the quality of evidence was very low (Muehleisen 2007) (85) (Figure 40).

Figure 39 – PICO 3A. Forest plot of comparison: 10 Reminder-recall vs control/no intervention, outcome: 10.1 Vaccination uptake /uptake of DTP3 in parents/communities located in low-income settings

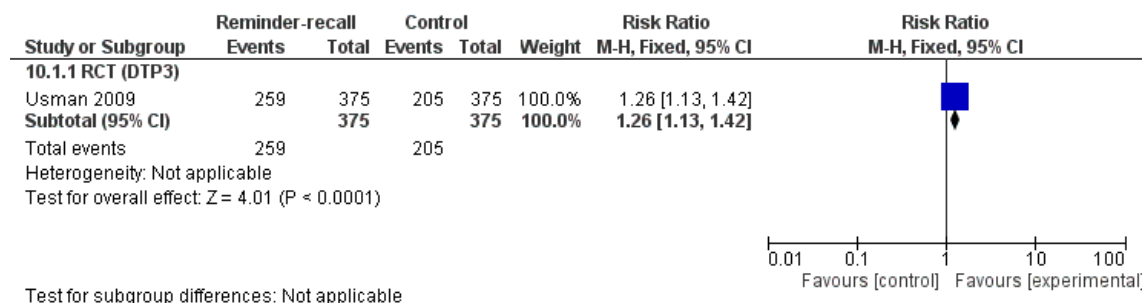
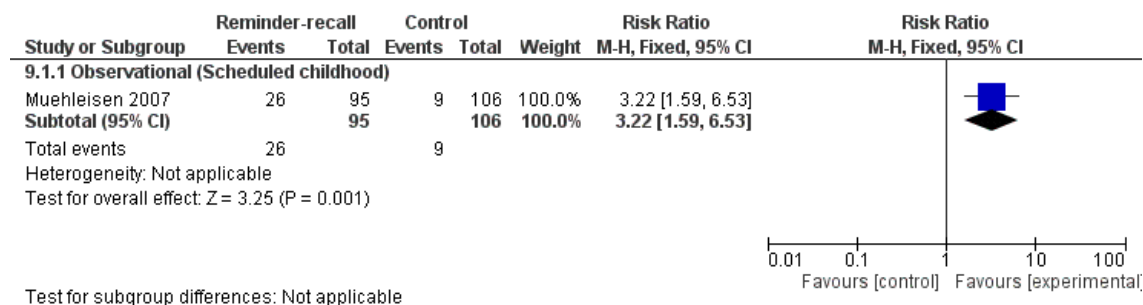


Figure 40 – PICO 3B – Forest plot of comparison: 9 Reminder-recall vs control/no intervention, outcome: 9.1 Vaccination uptake /uptake of all scheduled childhood vaccines in populations with low baseline vaccination uptake ($\leq 50\%$)



2.5 Section summary

Dialogue-based interventions

For polio, the **involvement of religious or traditional leaders** in populations with low baseline uptake indicated a very large and positive effect on vaccine uptake but the evidence quality was assessed as very low. Despite the low quality of the evidence, the strength of the intervention's impact deserves exploration. This intervention is interesting because it worked with the more difficult determinants of vaccine hesitancy, namely misconceptions and community distrust. It attempted to address these using a variety of communication and engagement channels and gave attention to all aspects of community life that might influence vaccination decisions irrespective of age. This intervention also appears to align itself with natural community processes – seeking out community leaders; and encouraging dialogue across multiple levels in order to both inform and influence. In essence, the success of the intervention could be attributed to the efforts made to seek understanding of the target audience, facilitate open dialogue and integrate activities with familiar processes and systems.

The use of **social mobilisation** among parents in low-income settings had a positive effect on uptake of measles, DTP1, DTP3 and polio vaccines. The effect on polio vaccine uptake was extremely large but the evidence quality was low. The evidence quality for DTP1 was very low, and moderate for measles and DTP3. In the two studies on polio, target populations were very clearly identified as polio vaccine refusers, and the intervention was very specific to this concern. This clear target identification and focused intervention may have contributed to the success of the intervention. However, the denominator population used for analysis was different to other studies in that the control group never had the opportunity to accept vaccination outside of the intervention, which therefore augments the effect estimate of the intervention. Nonetheless, by comparison, the other two social mobilisation interventions were much less targeted – Andersson (77) attempted to influence declining vaccination rates without a clear understanding of what the issue really was at the start, but it had a positive impact; this was possibly due to the dialogic-basis of the intervention, which revealed underlying issues as part of the process; it is also reported that the intervention group were better informed about vaccine-preventable illness and indicated a greater willingness to travel to get vaccinations despite inherent cost, which suggests that the value of vaccination is appreciated. The intervention designed by Oche (105) addressed two of the four determinants identified in the target population as having an effect on their vaccination choices. Given the limited evidence due to bias, it is difficult to propose potential attributes of success but it would seem that meaningful dialogue at both the group and individual level can encourage a more positive outcome.

Social media had a large, positive effect on uptake for MCV4/Tdap and seasonal influenza; respectively, the evidence was assessed as very low. Stockwell (101) was addressing a population that had already started their vaccination schedule and focused on adolescents – arguably, this group were at the more accepting end of the vaccine hesitancy continuum and therefore potentially more amenable to reminders using social media. In the Lau (156) study, the design of the web-based intervention was built on operating systems frequently used by staff and students at the university and therefore was more easily integrated and acceptable to the target audience. Of note, the grey literature provides important evidence that social media interventions need to be managed carefully otherwise there is a risk of exploitation by dissenting voices and loss of control of communication messages.

For all routinely recommended vaccines, the use of **mass media** for parents had a positive impact and the quality of evidence was moderate. Again, paucity of evidence limits the analysis, but as an intervention directed at a clearly identified issue (lack of awareness of health services) this approach rendered successful results. The limited impact, however, is worth noting; on the one hand, this example presents good potential for a true positive effect across a larger population, but on the other, there may be other underlying issues affecting low impact that need investigation and subsequent tailoring of more-specific strategies in response.

The provision of **communication tool-based training for health care workers** had a large, positive impact on uptake of EPI among rostered patients; evidence quality was assessed as moderate. For DTP3, the evidence quality was low but the effect size was positive. The observations about these examples and mass media suggests that interventions that adopt a unidirectional (top down) approach to communication, may be successful among some individuals and groups, but not all; success is dependent on the nature and degree of hesitancy.

The impact of **information-based training for health care workers** on uptake for rostered patients was positive for HepB-1, HepB-2, HepB-3 and DTP/OPV-3 but the evidence quality was very low for all. Zero to very low impact was indicated for DTP/OPV-1, DTP/OPV-2, BCG and measles; evidence quality was also very low for all studies. A possible explanation for these generally poor results is that there was no clear understanding of the underlying reasons for the low vaccination uptake and as such, the intervention was not appropriately targeted. Nonetheless, the intervention did achieve good success with Hepatitis (all doses) and DTP/OPV (dose 3); one possible reason for this is that the health workers exhibited greater confidence but it is not clear whether this was an issue prior to the intervention.

Non-financial incentives

The evidence for non-financial incentives for parents/communities located in low-income settings was moderate for a large, positive effect on uptake of EPI vaccines. Given that the target group is identified as being very disadvantaged, it seems plausible that any incentive, particularly one so closely linked with basic survival such as food, would be readily received. Furthermore, the baseline vaccination rates were very low (2%), which suggests that this target group were underserved and more likely to show greater outcome changes with an intervention. In this instance, it is possible that by addressing basic needs, this intervention simultaneously built confidence and reduced vaccine hesitancy because the target population felt that their other critical needs were being recognised and not superseded by vaccines alone. This symbiotic approach could be particularly important for more marginalised groups.

Reminder-recall interventions

The impact of reminder-recall interventions in low-income settings was positive for DTP3 with moderate quality evidence. As with other interventions, a complex set of issues was identified but the intervention only addressed one of them; this could be the reason why the impact was relatively low. Reminder-recall on its own is clearly not enough to tackle contexts where there are multiple determinants at play. For settings with low baseline uptake, the effects were large and positive for scheduled childhood vaccines but the quality of evidence was very low. There are a couple of

potential effect moderators of this intervention. Firstly, the target group had just experienced a health scare (not specified) which resulted in hospitalisation, which may have made them more motivated. Secondly, the target group received reminders from both the hospital and their personal physicians – the latter being recognised as holding significant influence over vaccination decision-making.

Overall completeness and applicability of evidence

Despite the low number of studies, there is some opportunity to be moderately confident in several of the interventions including: social mobilisation, mass media, communication tool-based training for HCW, non-financial incentives, and reminder-recall activities. However, none of these interventions were without shortcomings and given the additional caveats around indirectness and the variability in content, setting, delivery method, target population composition and effect estimates across outcomes, the success, and potential application of these interventions must be cautiously considered when looking to deliver them in different circumstances.

Quality of the evidence

Thirteen studies were included in the review. Apart from two, the studies could not be pooled for meta-analysis due to the small number of eligible studies and variations in study design and outcomes.

Two studies were at major risk of bias primarily due to issues of confounding, study design and withdrawals/dropouts. Of the remaining studies, two were at moderate, and nine were at low, risk of bias.

Characteristics of included studies (peer reviewed; ordered alphabetically)

Andersson 2009 (77)	
Methods	Cluster randomised controlled trial (community-based)
Participants	<p><i>Vaccine hesitancy:</i> Reasons for the declining vaccination rates are uncertain but may relate to cost-benefit perceptions - where household resources are scarce and little public attention is paid to vaccine preventable diseases, the present cost of vaccinating easily outweighs the costs of the possible future disease.</p> <p><i>Country:</i> Pakistan</p> <p><i>Intervention theme:</i> Dialogue-based</p> <p><i>Participants:</i> 180 mixed-gender community groups, each of eight-ten people. Each participant was recognised as a trusted member of the community.</p> <p>Outcome was measured in children aged 12-23 months (n=911 pre-intervention; n=956 post-intervention).</p>

Interventions	<p><i>Target vaccine:</i> Measles and DTP</p> <p>INTERVENTION: Nine field teams, comprising specially trained local men and women, were formed to carry out three phases of discussion. Field teams met with community leaders to explain the purpose of the intervention and seek permission to work in the community.</p> <p>Across 94 villages, 180 mixed-gender community groups, each of 8-10 people, participated in the intervention (18 intervention sites). Those who were selected to be part of the discussions were trusted within their community and able to convince others about important issues.</p> <p>Phase 1: Community groups critically analysed the state of child vaccination in their union council (the smallest administrative unit within the local government system). Groups discussed the prevalence of measles among children, the proportion of children getting vaccinated in their own community, the importance of childhood vaccinations and risks of not vaccinating.</p> <p>Phase 2: Community groups discussed evidence on costs and benefits of vaccination as well as the complications and adverse effects of measles vaccination.</p> <p>Phase 3: Community groups identified specific barriers to child vaccination in their own communities and developed plans for action they could take to address some of these barriers (e.g., sharing content of discussions with other community members, sharing transport, help with childcare).</p> <p>CONTROL: Routine immunisation (14 control sites)</p>
Outcomes	<p><u>Outcome 1:</u> Measles uptake doubled in intervention clusters (OR 2.20, 95% CI 1.24-3.88). Intervention trebled odds of full DPT vaccination (OR 3.36, 95% CI 2.03-5.56).</p>
Duration of intervention	<p>August 2006 to March 2007 (7 months).</p>
Notes	<p>Follow-up after one year (baseline conducted in spring 2005; follow-up spring 2007). Estimate of effect used in forest plots unadjusted for baseline difference. At baseline, intervention groups were significantly more willing to travel to vaccinate and approaching significance on knowledge about vaccine preventable illness. Authors made adjustments within study and report findings - effect remained high (ORs).</p>

Ansari 2007 (63)	
Methods	Cohort (one group pre + post)
Participants	<p><i>Vaccine hesitancy:</i> Resistant families refusing to give polio drops to their children.</p> <p><i>Country:</i> India</p> <p><i>Intervention theme:</i> Dialogue-based</p> <p><i>Participants:</i> Within five highly resistant (to polio drops) areas of Aligarh, India, (measured by those who refused to give polio drops to their children) a total of 1025 resistant families who were part of the Muslim community were identified to receive the intervention. A second round was conducted with 515 houses who had remained resistant. Outcome was measured by households receiving polio drops (n = 0 pre-intervention; n = 813 post-intervention).</p>
Interventions	<p><i>Intervention name:</i> No name</p> <p><i>Target vaccine:</i> Polio</p> <p>INTERVENTION: Teams of HCW operating on a house-to-house schedule as part of one round of the polio immunisation campaign identified resistant families. On the second day of house-to-house activity, medical interns (A-team) visited the resistant families and this continued on subsequent days, where they imparted correct health education in a friendly atmosphere. The effort was to try and convince the resistant families that polio drops did not have any side effects and did not cause sterility. If successfully convinced, polio drops were given to their children.</p> <p>Families that remained resistant were revisited by a second team (B-team) of interns two to three days after the completion of A-Team activity. All efforts were made to convince these families.</p> <p>CONTROL: Regular polio immunisation campaign (house-to-house) by health worker teams.</p>
Outcomes	<p><u>Outcome 1:</u> Out of 1025 resistant houses, 510 (49.76%) houses were converted (gave polio drops to their children). 515 (50.24%) houses remained resistant even after social mobilisation by A-Team members. These most resistant houses were again visited by B-team members. Out of these 515 houses, polio drops were administered in 303 (58.83%). The overall number of converted houses was 813 (79.32%) after A and B-team activities. 20.68% of families remained resistant and their children could not be given polio drops.</p>
Duration of intervention	One round of polio immunisation campaign
Notes	

Banerjee 2010 (91)	
Methods	Cluster randomised controlled study (community-based)
Participants	<p><i>Vaccine hesitancy:</i> Indication of mistrust that surrounds immunisation programmes in India. Compared to a national average of 44% of children aged one-two years having received the basic EPI package, only 22% have in rural Rajasthan. This is less than 2% in the study area (a disadvantaged population in rural Udaipur).</p> <p><i>Country:</i> India</p> <p><i>Intervention theme:</i> Dialogue-based; Non-financial incentives</p> <p><i>Participants:</i> 134 villages including 1640 children aged 1-3 at end point.</p>
Interventions	<p><i>Target vaccine:</i> Full EPI schedule (by age of one year).</p> <p>INTERVENTION: The dialogue-based intervention was delivered on as an independent intervention in one study group and in conjunction with the non-financial incentive in another study group.</p> <p><u>Dialogue-based:</u> This component included setting up "immunisation camps" to establish regular availability of immunisation services in an area where 45% of health staff were typically absent from their immunisation posts on any given workday. The camps consisted of a mobile immunisation team, including a nurse and assistant, and were conducted monthly on a fixed date every month at a fixed time (11am-2pm). In each village, a social worker was also made responsible for identifying children, informing mothers about the availability of the immunisation camps, and educating them about the benefits of immunisation.</p> <p><u>Non-financial incentive:</u> This component comprised offering parents 1kg raw lentils per immunisation administered and a set of thalis (metal plates used for meals) on completion of a child's full immunisation. The value of the lentils was about 40 rupees (about \$1), equivalent to three quarters of one day's wage, and the value of the thalis was about 75 rupees. The amount roughly corresponds to the opportunity cost of time for the mother. The thalis were chosen as a tangible sign of achievement, while also being of immediate use.</p> <p>CONTROL:</p> <p><u>Dialogue-based comparison:</u> Control group (no intervention)</p> <p><u>Non-financial incentive:</u> The intervention arm that only received the dialogue-based intervention. Note: Not compared against study control as needed to</p>

	separate non-financial incentive intervention effects.
Outcomes	<u>Outcome 1</u> : Addressing supply (A - 18%) and incentives (B - 39%) both increased full vaccination rates vs control (C - 6%). Incentives had highest impact. [RR B vs C was 6.7 (4.5-8.8) and RR B vs. A was 2.2 (1.5 to 2.8)]. Neighbouring villages of B were more likely to be fully immunised than those of A (1.9, 1.1 to 2.8).
Duration of intervention	June 2004 to February 2005 (baseline survey); end point survey (July 2006 to February 2007); intervention started after the baseline investigations were completed in each geographical block.
Notes	Despite success of intervention, highest rates still only reached 40% uptake. The initial baseline uptake was extremely low (2%) so impact of intervention where baseline is higher may not be as dramatic.

Lau 2012 (156)	
Methods	Randomised controlled trial (Individual)
Participants	<p><i>Vaccine hesitancy</i>: Intervention seeks to minimise knowledge-based (e.g., lack of awareness) and system-based (e.g., inconvenience) barriers associated with accessing health services, making consumers more likely to engage in preventive health measures such as influenza vaccination.</p> <p><i>Country</i>: Australia</p> <p><i>Intervention theme</i>: Dialogue-based</p> <p><i>Participants</i>: University staff and students (n=855 recruited; n=742 met inclusion criteria; n=372 to intervention group; n=370 to control group) were identified using mailing lists and advertisements in online print publications and completed an online pre-study survey prior to intervention allocation. Primary outcome (proportion obtaining influenza vaccination during the study) was measured in a total of 470 individuals (n=246 in control group; n=224 in intervention group).</p>

Interventions	<p><i>Intervention name:</i> Healthy.me</p> <p><i>Target vaccine:</i> Influenza (seasonal).</p> <p>INTERVENTION: Web-based personally controlled health management system (PCHMS). The central feature of the system’s design are consumer specific care pathways called ‘journeys’ that provide disease or task specific knowledge in an actionable way. For example, at the point that a consumer encounters advice to seek influenza vaccination, they can immediately book an appointment with a doctor from the journey page, or set themselves a reminder to do so.</p> <p>Journeys are computationally active and can personalise other PCHMS elements like the personal health record (PHR) to reflect the specific content of the journey. For example, commencing a vaccination journey can trigger the creation of a vaccination record in the PHR.</p> <p>The influenza vaccine journey in <i>Healthy.me</i> contained two elements:</p> <ul style="list-style-type: none"> • A consumer vaccination care pathway, which described (i) the types of influenza vaccine currently available (ii) steps to obtain vaccination at the University Health Service (UHS; the university primary care service) or elsewhere, and (iii) vaccine costs, adverse effects, and contraindications; • Online appointment booking, whereby participants could click a ‘Book now’ button on the journey page, thus sending an email to the UHS to book an appointment for influenza vaccination or other medical issues. A dedicated UHS administrative staff member would telephone participants by the next working day to confirm appointments. <p>The journey was designed in consultation with UHS primary care physicians, utilizing government-endorsed evidence-based consumer education material, and was tested in the previous year for seasonal and pandemic H1N1 influenza.</p> <p>Participants allocated to the intervention group completed a five minute mandatory online tutorial about <i>Healthy.me</i> prior to using the site.</p> <p>CONTROL: Allocated to a six-month waitlist</p> <p>A researcher was available via a dedicated telephone line and email to answer participant concerns and address any unintended effects during the study. Participants could also provide feedback via the monthly surveys (see ‘Notes’)</p>
Outcomes	<p><u>Outcome 1:</u> PCHMS users were 6.7% (95% CI: 1.46 to 12.30) more likely than the waitlist to receive an influenza vaccine (waitlist: 4.9% (12/246, 95% CI 2.8 to 8.3) vs PCHMS: 11.6% (26/224, 95% CI 8.0 to 16.5); $\chi(2)=7.1$, $p=0.008$).</p>

	PCHMS participants were also 11.6% (95% CI 3.6 to 19.5) more likely to visit the health service provider (waitlist: 17.9% (44/246, 95% CI 13.6 to 23.2) vs PCHMS: 29.5% (66/224, 95% CI: 23.9 to 35.7); $\chi^2=8.8$, $p=0.003$). A dose-response effect was detected, where greater use of the PCHMS was associated with higher rates of vaccination ($p=0.001$) and health service provider visits ($p=0.003$). There were also other secondary and ancillary outcomes but they are not detailed here as not relevant to this review.
Duration of intervention	May - October 2010
Notes	<p><u>Follow-up (both intervention and control groups):</u> All participants received an email in the first week of each month inviting them to complete a one minute survey (four questions) about influenza-like illness symptoms and health activities.</p> <p>At study completion, all participants received an email asking them to complete a post-study survey (20 questions). Two follow-up emails five days apart were sent to non-completers and those who completed all surveys were entered into a draw for one \$A500 prize.</p>

Muehleisen 2007 (85)	
Methods	Two-group cohort (prospective, intervention-control)
Participants	<p><i>Vaccine hesitancy:</i> Significant delays and overall under-immunisation in preschool and school-aged children (49% in this study sample).</p> <p><i>Country:</i> Switzerland</p> <p><i>Intervention theme:</i> Reminder-recall</p> <p><i>Participants:</i> Parents of children (aged 61 days to 17 years) admitted to hospital (excluding chronic diseases) who were considered under-immunised (one or more immunisations missing). Outcome was measured in children; 106 in control and 95 in intervention.</p>
Interventions	<p><i>Target vaccine:</i> All scheduled childhood (up to 15 years)</p> <p>INTERVENTION: Parents of children admitted to hospital (excluding chronic disease) were informed about missing immunisations before discharge and were encouraged to contact their primary care physician for necessary catch-up immunisations. Individual physicians were also informed by letter (within one week after discharge) about missing vaccinations and were encouraged to administer catch-up immunisations.</p>

	CONTROL: Standard care
Outcomes	<u>Outcome 1:</u> Increased vaccination rates (at 1-month post-discharge) (27% vs 8% control; p<.001).
Duration of intervention	1 January to 25 March, 2003 (control cohort recruitment); 26 April to 31 July, 2003 (Intervention cohort recruitment).
Notes	Follow-up was at one month and nine months post-discharge. This intervention may not have targeted the more staunch vaccine hesitant parents as the study notes that parents did oppose immunisation in a similar measure across the cohorts (4.7% in control group; 6.3% in intervention). It is also noted that the reasons for the lack of remaining catch-up immunisations remained unclear.

Nasiru 2012 (64)	
Methods	Cohort (one group pre + post intervention; community –based)
Participants	<p><i>Vaccine hesitancy:</i> Large numbers of children are left unvaccinated because of community misconceptions and distrust regarding the cause of the disease and the safety of the polio vaccine.</p> <p><i>Country:</i> Nigeria (northern)</p> <p><i>Intervention theme:</i> Dialogue-based</p> <p><i>Participants:</i> Four settlements (Danladi B, Sararin Gezawa, Tsamiyar Kara, and Jogana) within Gezawa local council (Kano state) which had been identified as having the lowest uptake and highest number of reported cases of polio disease. Community leaders supported community mobilisation; all community members, including community leaders, at delivery of complete intervention. Outcome was measured in children aged under-five.</p>
Interventions	<p><i>Intervention name:</i> Majigi campaign</p> <p><i>Target vaccine:</i> Polio</p> <p>INTERVENTION: Majigi, is a Hausa (native language) word meaning a roadside film show conducted in communities by mobile vans. The Majigi educational intervention targeted the beliefs about the cause of polio disease (e.g., evil</p>

	<p>spirit or demon) and the negative attitude towards polio vaccination.</p> <p>The campaign sought the support of different community gatekeepers with a special focus on political, traditional, and religious leaderships. Other groups included traditional healers, birth attendants, town criers, and traditional surgeons. Each leadership group was approached separately; their perceptions and feelings were acknowledged and addressed and polio clips were shown to them first, after which their support to mobilise subjects was solicited.</p> <p>Participation of the community leaders was critical in getting their subjects to attend the campaign venue, particularly Muslim religious leaders (Imams), who were the most distrustful of the polio vaccination program. Their attendance boosted the subjects' morale and their active participation was encouraged by polio vaccination campaign messages and asking questions.</p> <p>Venues were organised to culturally accommodate the entire community, including opinion leaders, advocates, men, women, youth, and children. The entire community watched the show from beginning to end.</p> <p>Films were shown in the evening and the session lasted between one-two hours. The sequence of events was: opening prayer; welcome speech by village head; formal introduction by team leader; edutainment drama on the consequences of polio rejection; Powerpoint presentation and computer simulation model on the polio virus, its structure, and types, as well as routes of transmission, early signs and symptoms and how complications occur after an initial infection; emotional film of victims of the disease, their experiences and frustrations; the different forms of disabilities and associated difficulties encountered by victims and their primary care givers; recorded video interviews of relatives of the victims, their experiences with the disease, cost of care, their frustrations; and advice to parents on the need to have their children vaccinated. At the end of each show, feedback was solicited from some participants, including community leaders, on the difference, if any, the show contributed to their understanding of the disease and their readiness to have their children vaccinated against polio.</p> <p>CONTROL: Baseline measures of polio vaccination uptake among children under the age of five from the four selected settlements (selected on basis of having the lowest uptake and highest number of reported cases of polio disease)</p>
Outcomes	<p><u>Outcome 1:</u> Average monthly increase in the number of vaccinated children six months post-intervention (n=1047; 95% CI 647-2045, p=0.001).</p>

Duration of intervention	2008
Notes	Follow-up: monthly supplementary vaccination activities were monitored for six successive months at the selected sites. Study also reports on numbers of zero doses detected pre- and post-intervention (125 and 88 respectively).

Oche 2011 (105)	
Methods	Controlled community trial
Participants	<p><i>Vaccine hesitancy:</i> Low immunisation uptake in the study area could be attributed to the low level of knowledge among mothers about immunisation, religious beliefs and poor attitude of health workers.</p> <p><i>Country:</i> Nigeria</p> <p><i>Intervention theme:</i> Dialogue-based (leaders and communities)</p> <p><i>Participants:</i> Mothers of children less than two years of age (0 to 23 months) were recruited from two communities (Kware and Bodinga towns), which are both headquarters of Local Government Areas (LGSs) with largely illiterate and farming populations. Islam is the main religion. Each site (intervention and control) had 179 mother-child pairs allocated. Only those in the intervention group were considered as these data were most relevant. Outcome was measured as the DTP1 and DTP3 status of each child comparing pre- and post-intervention rates (nine months post-intervention).</p>
Interventions	<p><i>Target vaccine:</i> DTP1 and DTP3</p> <p>INTERVENTION: Advocacy visits were paid to community and opinion leaders to explain the Community Level Nutrition Information System for Action (COLNISA) strategy – a participatory decision making process that addresses the problems of immunisation in the community, taking into cognisance its nature, misconceptions, drop outs, rejection of vaccines and availability of resources to tackle the problems. After this, the community then nominated ten literate persons from women associations, religious groups and traditional institutions to act as volunteers who were supported by the researchers and health workers from the study area.</p> <p>Volunteers were oriented for a total of four hours over two days on data</p>

	<p>collection, instruments, the benefits of immunisation and inter-personal communication skills to sensitise and mobilise mothers and caregivers for immunisation services.</p> <p>A pre-intervention questionnaire was administered to participants to provide information on socio-demographic characteristics of mother-child pairs, to assess maternal knowledge and utilisation of childhood immunisation services. The results were presented at a meeting with the community and other opinion leaders where problems hindering utilisation of immunisation services by mothers were identified. These included: not being aware of services (53%), cultural and religious beliefs (20%), the male factor (12%) (it is not clear from the paper what the 'male factor' is) and attitude of health workers (15%). Solutions were then put forward and an action plan drawn up to be implemented by the volunteers.</p> <p>The intervention included sensitisation and mobilisation of mothers and caregivers on the benefits and schedule of routine immunisation through compound meetings for females and community dialogue with leaders and heads of households of mother-child pairs. The volunteers also visited the houses of participants for interpersonal communication.</p> <p>CONTROL: Only pre- (one week after intervention group) and post-intervention questionnaire conducted.</p>
Outcomes	<p>At baseline, 59 and 53% of the mothers had adequate knowledge of childhood immunisation in the intervention and control communities, respectively. However, following intervention, 69 and 51% of the mothers in the intervention and control communities respectively had adequate knowledge. Similarly, at the post intervention phase of the study, DTP3 rose from 21 to 33% in the intervention community while a decrease in uptake from 26 to 20% was observed in the control community.</p>
Duration of intervention	Not specified.
Notes	<p><u>Outcome 1:</u> Follow-up: nine months post-intervention. Only data for intervention group (pre and post) included in forest plots and most relevant to this review. For the control group, pre-intervention DTP1 (29%) dropped to 25% post-intervention; the trend was similar for DTP3, from 26% to 20% pre-post intervention.</p> <p><u>Outcome 2:</u> At baseline, 106 (59%) and 94 (53%) of mothers had adequate knowledge in the intervention and control groups respectively. Post-intervention, 114 (69%) and 91 (51%) of mothers in the intervention and control groups respectively had adequate knowledge. This difference was</p>

	significant but comparison of changes in knowledge within the intervention group were not (increase of 10%).
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Pandey 2007 (81)	
Methods	Cluster randomised controlled trial (community based)
Participants	<p><i>Vaccine hesitancy:</i> Lack of awareness about entitled health services, including vaccination and especially among individuals of low socioeconomic status.</p> <p><i>Country:</i> India</p> <p><i>Intervention theme:</i> Dialogue-based</p> <p><i>Participants:</i> 105 randomly selected village clusters in Uttar Pradesh state in India. These encompassed 548 intervention and 497 control households, including both low-caste and mid- to high-caste households. The study sample were ethnically the same and similar in culture, and all spoke a single language (Hindi). For vaccination, outcome was measured by the number of infant vaccinations received per household (≥ 1 vaccination). 548 at pre-intervention and 536 at post-intervention.</p>
Interventions	<p><i>Target vaccine:</i> All routine childhood vaccines</p> <p>INTERVENTION: An information campaign was conducted twice in each selected village to disseminate information on entitled health services, education services and village governance requirements. Each round (two per village cluster) consisted of two to three meetings, as well as distribution of posters and leaflets. Residents were informed in advance about the dates and locations of meetings and separate meetings were held in low- and mid-to high-caste neighbourhoods. Each meeting lasted about an hour and consisted of a 15-minute audiotaped presentation that was played twice, opportunities to ask questions, and distribution of leaflets. It was indicated that the information was provided by the government - specifically, the Uttar Pradesh health, education, and village governance departments - and being distributed in the public interest by the research team and a local NGO.</p> <p>The introduction to the intervention was scripted to ensure uniform delivery and only questions for which the answers were already written on the leaflets</p>

	<p>were answered. The information in the presentation, leaflets and posters included:</p> <ul style="list-style-type: none"> -Health services information-specific days and hours a nurse midwife is available in the village; the obligation of the nurse midwife to provide free prenatal and postnatal care, including tetanus vaccines and prenatal supplements for mothers and health care and vaccinations for infants; health centres available for more specialized care; and where to complain about quality or quantity of health services. -Social services information - how much school fees are for low and mid-to high-caste children, sources and oversight of education funds, obligations of oversight committees, requirements for semi-annual village governance meetings, organisation and funding of village government and development work, right to obtain copies of village records, and where to complain about education or village governance problems. <p>CONTROL: No intervention took place in control village clusters.</p>
Outcomes	<p><u>Outcome 1:</u> Moderate increase in vaccination. Data not explicit regarding numbers and significance.</p> <p><u>Outcome 2:</u> Moderate levels of increased awareness and use of promotional materials. No further data available.</p>
Duration of intervention	May 2004 - May 2005
Notes	Follow-up after one year (baseline conducted in May 2004; follow-up May 2005).

Shukr 2010 (65)	
Methods	Cohort (one group pre + post)
Participants	<p><i>Vaccine hesitancy:</i> Reluctance and refusal of polio vaccination.</p> <p><i>Country:</i> Pakistan</p> <p><i>Intervention theme:</i> Dialogue-based</p> <p><i>Participants:</i> 404 parents who had already received the standard visit as part of the SIA campaign but remained reluctant about receiving polio drops. Outcome was measure by the rate of vaccination acceptance by reluctant parents.</p>

Interventions	<p><i>Intervention name:</i> N/A</p> <p><i>Target vaccine:</i> Polio</p> <p>INTERVENTION: Three SIA campaigns were conducted, each for four days (three day routine and one catch-up). Overall, there were 1,468,192 successful vaccinations and 404 reluctant parents. Reluctant parents received counselling from the WHO team.</p> <p>CONTROL: Standard SIA campaign for polio.</p>
Outcomes	<p><u>Outcome 1:</u> Of 404 reluctant parents 168 (42%) declined vaccination despite counselling. 132 (32.5%) declined for religious reasons.</p>
Duration of intervention	<p>Intensive polio days during three campaigns (22nd Jan, 19th March, and 13th April 2009).</p>
Notes	

Stockwell 2012 (101)	
Methods	Two-group cohort (Intervention study)
Participants	<p><i>Vaccine hesitancy:</i> Focus on low-income families who are identified as being at high risk for limited health literacy and may be at particular risk for not having needed immunisations. Eligible participants needed to have incomplete schedules for the target vaccines.</p> <p><i>Country:</i> USA</p> <p><i>Intervention theme:</i> Dialogue-based</p> <p><i>Participants:</i> Parents of children aged 11-18 years of age in need of either or both target vaccines identified across six sites (two intervention; n=195 participants; four control; n=166 participants) affiliated with the same ambulatory care network, serving primarily minority, publicly insured (low income) patients. Primary outcome (receipt of an additional adolescent vaccine – MCV4 or Tdap at four, 12, and 24 weeks after randomization) was measured in a total of n=344 individuals (n=178 for intervention – if using intention to treat analysis change this back to n=195; n=166 for control).</p>

Interventions	<p><i>Intervention name:</i> Text4Health - Adolescents</p> <p><i>Target vaccine:</i> Meningococcal (MCV4) and tetanus-diphtheria-acellular pertussis (Tdap)</p> <p>INTERVENTION: Parents received a series of automated text messages notifying them of their child’s need for vaccination. Each parent received text messages at weeks one, two, three, six, and seven. Messages were stopped if receipt of MCV4 or Tdap was documented in the registration system (EzVac).</p> <p>Text messages were developed with community input and were personalised to include the patient’s first name, clinic name, and a listing of times when immunisations could be administered at the clinic.</p> <p>Messages were sent in either English or Spanish. Families were also told how to decline further messages.</p> <p>CONTROL: Parents received the standard of care at the practice sites, which did not include immunisation reminders.</p>
Outcomes	<p><u>Outcome 1:</u> Adolescents in the text reminder group were more likely to receive MCV4 and DTaP at weeks 4 (15.4% v’s 4.2%, p<0.001; aOR=4.57 (95%CI: 1.83-11.42)), 12 (26.7% vs 13.9%, p<0.005; aOR=2.17 (95%CI: 1.23-3.82)) and 24 (36.4% vs 18.1%, p<0.001; aOR=2.48 (95%CI: 1.49-4.13)).</p> <p><u>Outcome 2:</u> Parents who received text & mailed reminders more likely to attend recall session than those who received mailed reminder only (21.8% v’s 9.2%, p<0.05).</p> <p>Attendance at recall at week 4 (aOR=3.77, 95%CI 1.74-8.16); week 12 (aOR=2.02; 95%CI: 1.21-3.36) and week 24 (aOR=1.77; 95%CI: 1.12-2.80).</p>
Duration of intervention	January 2009 – April 2009
Notes	<p><u>Follow-up:</u> Data on immunisation status was obtained using the hospital’s immunisation information system (EzVac) and the new York Citywide Immunisation Registry.</p>

Uskun 2008 (9)	
Methods	Cohort (one group pre + post intervention)

Participants	<p><i>Vaccine hesitancy:</i> Not clear - vaccination rates of region are higher than national average but below EPI targets-no information on particular issues of population.</p> <p><i>Country:</i> Turkey</p> <p><i>Intervention theme:</i> Dialogue-based</p> <p><i>Participants:</i> 229 healthcare workers (nurses, midwives and health officers responsible for vaccines and immunisation and GPs) from primary health centres. Outcome was measured in children aged <12 months.</p>
Interventions	<p><i>Target vaccine:</i> All scheduled vaccines</p> <p>INTERVENTION: 18 intensive immunisation workshops were conducted consecutively in the same location. Each workshop lasted for three days (eight hours/day) and had different participants. The workshops comprised instructive lectures interspersed with activities designed to elicit discussion of participants' knowledge about immunisation. The workshop content included vaccines, national vaccination schedule, cold chain and management, planning and regulation of immunisation, tracking the trends and increase in vaccination uptake and immunisation recording. Each of the groups received a standard education programme that was recommended by the MOH for EPI training. The course consisted of theoretical presentations between 08:00 and 12:00 hours, and the workshop programme between 13:00 and 17:00 hours. The trainees attended the program without missing a single class, partly because they were officially order to do so. Materials provided by the MOH for EPI training were given to the study participants. Interventions were enforced by three members of the research team who had been educated and certified in the modular training of EPI of the MOH of Turkey.</p> <p>CONTROL: Single group intervention. Rates three months prior to intervention used as control comparator.</p>
Outcomes	<p><u>Outcome 1:</u> Increased uptake rates for all vaccines on national schedule ($p < 0.001$) at intervention sites, particularly for Hepatitis B (all doses; 3rd dose increased from 14.5% in 2003 to 31.4% in 2004) and third dose (DTP/OPV) (increased from 22.2% in 2003 to 31.4% in 2004).</p>
Duration of intervention	<p>March to May 2004</p>
Notes	<p>Follow-up: three months after intervention. Note: Unclear whether this study represents vaccine hesitancy as rates of study area are higher than national average and only fall below EPI targets. There is no indication given as to what the reasons are for this other than perhaps a lack of knowledge on behalf of</p>

	the healthcare workers.
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Usman 2009 (145)	
Methods	Randomised controlled trial (Individual)
Participants	<p><i>Vaccine hesitancy:</i> Both parental (larger family size, lower parental education, mother's lack of knowledge and motivation) and provider factors (distance of EPI centre from home) reportedly affect immunisation schedule adherence.</p> <p><i>Country:</i> Pakistan</p> <p><i>Intervention theme:</i> Reminder/recall</p> <p><i>Participants:</i> 1500 mother-child units were enrolled at DTP1 visit from five EPI centres located in urban areas of Karachi city. Allocation: Each pair was randomized into one of four intervention arms: 375 in redesigned card (Group one), 375 in centre-based education (Group two), redesigned card and centre-based education (Group three) and a standard care only group (Group 4) (i.e., routine EPI centre visit). Only Group one and Group two vs. Group four were considered. Outcome was measured as the immunisation status of each child at the completion of 90-day follow-up after enrolment.</p>
Interventions	<p><i>Target vaccine:</i> DTP3 completion</p> <p>INTERVENTION: <u>Group one (Reminder /recall)</u> - To specifically address the needs of a low literacy population, a new and simpler immunisation card was designed – it's most important function was to act as a constant reminder to mothers for next immunisation visit. The card was larger (15.5 cm x 11.5cm when folded) and showed only the next immunisation date and day on both outer sides. Details of EPI centre, card number, card's date of issue, child's name and address, complete immunisation schedule dates, and instructions and information for the mother were written on the inner side. The card was placed in a plastic jacket and provided with a hanging string (cost about five cents/three Pakistani Rupees). At the time of enrolment, the data collector printed the upcoming DTP2 immunisation date and day on both outer sides of the card and showed it to the mother. The mother was asked to hand the card at a frequently visible place in her home and to bring it along on the next immunisation visit. The same process was repeated at DTP2 receipt and DPT2 date crossed out to avoid any confusion to the mothers.</p> <p>CONTROL: <u>Group four</u> – Received no intervention and underwent routine EPI centre visit for which there is no standard information sharing routine with</p>

	mothers about subsequent immunisation visits.
Outcomes	<u>Outcome 1:</u> Significant increase of 25% (adjusted RR=1.25, 95% CI=1.11-1.40) in DTP3 completion was estimated in the group that received the redesigned card compared with the standard care group.
Duration of intervention	6 September – 24 December 2003.
Notes	Follow-up: 90 days from the day of enrolment (completed on 23 March 2004).

Usman 2011 (78)	
Methods	Randomized controlled trial
Participants	<p><i>Vaccine hesitancy:</i> Substantial dropout from DTP1 to DTP3 immunisation - other socio-economically comparable countries in South-East Asia Region of the WHO have consistently achieved higher DTP3 levels than has Pakistan. Mother's lack of information might contribute to childhood immunisation dropouts.</p> <p><i>Country:</i> Pakistan</p> <p><i>Intervention theme:</i> Dialogue-based</p> <p><i>Participants:</i> Mother-child pairs were recruited across six EPI centres located in the rural peripheries of Karachi at the point of receiving DTP1; these sites were selected based on having the highest volume of children vaccinated for DTP1 immunisations the previous year. Allocation: 378 mother-child pairs (redesigned card group), 376 in centre-based education group, 374 in combined intervention group and 378 in standard care group (total n=1506). For the purposes of this review, only those in centre-based education group vs. standard care group were considered. Outcome was measured as the immunisation status of each child at the end of day 90 post-enrolment.</p>

Interventions	<p><i>Target vaccine:</i> DTP1-3</p> <p>INTERVENTION: Centre-based education was designed as a two-three minute conversation with the mother to convey the importance of the completion of immunisation schedule and to explain the potential adverse impact of incomplete immunisation on child's health. The session was in simple vocabulary in the local language (Urdu) and deliberately kept short in prevision of potential large-scale use by EPI staff in the future. Trained study interviews conducted the intervention.</p> <p>CONTROL: Routine EPI centre visit. There was no standardised procedure describing how the EPI staff should inform mothers about subsequent immunisation visits.</p>
Outcomes	<p><u>Outcome 1:</u> Increased vaccination for all three non-standard care interventions (39% completed DTP3). Immunisation card (66%; RR=1.7; 95% CI = 1.5, 2.0); centre-based education group (61%; RR=1.5; 95% CI = 1.3, 1.8); and combined intervention group (67%; RR = 1.7; 95% CI = 1.4, 2.0).</p>
Duration of intervention	November 2005 to May 2006.
Notes	<p>Follow-up: 90 days from the day of enrolment at DTP1 (Last follow-up August 2006). A significantly higher proportion of Mohajir children completed DTP3 in the centre-based education group compared with the standard care group (Adj. RR = 3.3; 95% CI = 1.9, 5.8) - among non-Mohajir children, the effect was weaker (Adj. RR = 1.3; 95% CI = 1.1, 1.6). These results were not included in forest plots for intervention as between two ethnic groups - note in text only.</p>

Characteristics of Included Studies (grey literature)

ECDC 2012 (176)	
Methods	<p>In Slovenia, the Institute of Public Health is responsible for monitoring the spread of disease and for the preparation of appropriate evidence-based recommendations to aid decision-making. During the A(H1N1) pandemic flu, other institutions were also involved, initially those in the health sector, such as the Ministry of Health, regional institutes of public health, hospitals and healthcare centres, and later other organisations (such as public institutions, schools and childcare facilities, businesses, religious organisations, etc.). The 'Plan of Pandemic Influenza Preparedness in the Health Field' is the basis for all operational documents of all organisations involved in the response to a pandemic. The plan also addresses communication issues.</p>

Participants	<p><i>Vaccine Hesitancy:</i> The guide covers the notions of trust and related issues such as reputation and adequate risk communication. In order to be successful in their communication activities, public health authorities need to build and foster their reputation as trustworthy sources of evidence-based information, as this will impact how the public perceives and acts upon their messages. Each action matters and can make a difference by either reinforcing a positive reputation or destroying it very quickly. Some vaccine-preventable diseases have become so rare that people can fail to realise the benefits of immunisation. There are also conflicting messages about benefits and safety of vaccines in the media (in particular in new and social media), which foster uninformed perceptions and have led certain population groups to question the benefits of vaccination, or to become more worried about alleged adverse effects of a vaccine than about the disease itself.</p> <p><i>Country:</i> Slovenia</p> <p>Intervention Theme: Dialogue: (6) Parents [community] in high income settings and social media (this theme was only a small part of the intervention); (7) Parents [community] and mass media interventions.</p> <p><i>Participants:</i> The Slovenian population (this included pregnant women, children, labour organisations, marginalised groups, the chronically ill); the professional (medical) audience.</p>
Interventions	<p><i>Intervention Name:</i> ‘Stop the flu! Knowledge/behaviour is your strongest defence’.</p> <p><i>Target Vaccine:</i> Influenza, A (H1N1).</p> <p>INTERVENTION: (All interventions and outcomes fall under the themes mentioned above)</p> <p>-In its Multiannual Strategic Programme 2007–2013, ECDC set out a specific target area concerning the communication of information on communicable disease prevention and control. Strategies to reach this target include the development of the means, procedures and necessary partnerships for the efficient and coordinated communication of key public health messages and information, as well as support to the EU Member States’ health communication capacities.</p> <p>- All materials had a uniform corporate identity and were used in a first phase to disseminate five key messages and advice regarding the pandemic flu.</p> <p>-The second phase focused on convincing people to get vaccinated. Key messages were designed to answer the main issues of public interest:</p> <ul style="list-style-type: none"> • Is the vaccine safe and effective? • Is the vaccine safe for pregnant women and nursing mothers? • What are the possible side effects of vaccination? • How long does the vaccine work?

	<ul style="list-style-type: none"> • Should I be vaccinated, even if I had recovered from pandemic influenza? • How am I vaccinated? • Who should not be vaccinated? • Who should be vaccinated? • Is this the same vaccine as for the seasonal flu? • Why is it good to be vaccinated? <p>-Tools for communicating with the general public included press conferences and press releases, leaflets, posters, a dedicated website (www.ustavimo-gripo.si), email, TV ad, three radio ads, and a free phone number. The professional (medical) audience was addressed via the tools mentioned above and in addition via e-mail messages, professional workshops and lectures, meetings, teleconferencing and telephone numbers for consultations (the regional health institutes).</p>
Outcomes	<p><u>Outcome 1:</u> The campaign did not succeed in the goal of convincing people to get vaccinated against the pandemic flu, which was also revealed in the above mentioned Eurobarometer survey. A factor that may influence this is that Slovenian citizens are considered to have a negative attitude towards vaccines in general –this also applies to vaccination against seasonal and pandemic flu. According to the Eurobarometer results, 35% of Slovenians considered that the vaccine against pandemic influenza would be safe and effective while 38% were convinced of the contrary. The survey showed that Slovenians were less confident about the vaccine than the average in Europe.</p> <p><u>Outcome 2:</u> The campaign was considered very successful in terms of information and knowledge-sharing. The population gained good knowledge about the disease, its consequences and the preventive measures. This was confirmed by a Eurobarometer survey conducted between 26 and 30 November 2009 in 27 EU countries and Norway, Switzerland and Iceland. It showed that Slovenians were satisfied with the information given by governmental and other professional bodies. When compared to the European average, Slovenians were the most likely to consider themselves well or very well informed.</p> <p>Strengths:</p> <ul style="list-style-type: none"> • Allowing the general public to communicate directly with relevant sources of information at national or regional level • Timely information to media about events related to the pandemic • Consistent messages among stakeholders • Spokespeople available at all times • The national campaign ‘Stop the flu’ considered comparable with the best and most effective campaigns in Europe, as well as among the first developed and most complex • The small size of the country and small number of stakeholders involved

	<p>allowed for rapid flow of information</p> <ul style="list-style-type: none"> • Communication characterised by transparency, clarity and good definition of key messages. <p>Weaknesses:</p> <ul style="list-style-type: none"> • Absence of a strategy for communication in social networks – consequently communication through this channel was considered unsuccessful • Responses and reactions to statements made by opponents of vaccination and to conspiracy theories were late and weak; this may be attributed to the lack of a communication strategy to address these issues • Some stakeholders that were poorly integrated into the communication activities occasionally opted for separate communications which were inconsistent with the unified and commonly agreed messages (e.g. a separate declaration of the end of the pandemic) • Insufficient number of communication experts • Insufficient number of spokespeople/experts so public can become quickly tired of the same speakers all the time; some speakers overloaded with communication responsibilities and could not devote sufficient time to their professional work • Absence of campaigns or communication activities addressing very specific audiences (e.g. young people, pregnant women) • Cooperation with associations of chronic patient's deficient (experience from other countries shows that this can be a very effective way for 'patient to patient' communication).
Duration of intervention	During the A(H1N1) pandemic (2009).
Notes	

Kershaw 2011 (178)	
Methods	<p>Uptake rates for MMR and DaPTP-Hib were examined pre- and post-intervention to determine whether the 'immunisation reminders project' has been effective at improving immunisation uptake rates among two-year-olds in SHR. Data for MMR was pulled from the Saskatchewan Immunisation Management System (SIMS) in May of 2010. Data for DaPTP-Hib was pulled from SIMS in August of 2010. To test for significance, rate ratios and confidence intervals were calculated. Compared rates for MMR and DaPTP-Hib for all of SHR, and also among four sub-groups: core neighbourhoods, non-core neighbourhoods, rural SHR, and foster children. Foster children are identified in SIMS as children who have Social Services listed as their address. Foster children cannot be included in the core or non-core sub-groups as their actual address is not listed in SIMS. Currently, information for foster children that are not up-to-date is sent to Social Services with the intention that the case</p>

	workers will inform the foster parents. However, at this time, we do not receive information as to whether they were or were not contacted.
Participants	<p><i>Vaccine Hesitancy:</i> In 2006, statistically significant differences (i.e., disparities) in immunisation uptake rates between two-year-old children in the city of Saskatoon based on where they lived. Incomplete immunisation in Saskatoon Health Region is primarily associated with low-income; however, single parenthood, cultural status and differences in beliefs also contributed to incomplete uptake rates.</p> <p><i>Country:</i> Canada</p> <p><i>Intervention theme:</i> Reminder/Recall: (2) Populations with low baseline uptake and reminder/recall based interventions</p> <p><i>Participants:</i> Parents</p>
Interventions	<p><i>Intervention Name:</i> Immunisation Reminders Project</p> <p><i>Target Vaccine:</i> Childhood</p> <p>INTERVENTION: Contacting the parents/guardians of 14-month-olds and 20-months olds in the Saskatoon Health Region (SHR) who are behind in their immunisations. Initially, these reminders were made via telephone. Up to five phone call attempts were made, and then a letter was mailed to the last known address. If there was still no response, a reminder home visit was attempted for children living in the six core neighbourhoods. Since January 2009, the intervention protocol changed and reminders for neighbourhoods outside of the core neighbourhoods were only sent through the mail.</p>
Outcomes	<p><u>-Outcome 1:</u> Immunisation uptake rates among two-year-olds for MMR increased 6.1% from 2007 to 2009 in SHR. Immunisation uptake rates among two-year olds for DaPTP-Hib (Diphtheria, Polio, Tetanus Toxoid, Pertussis, and Haemophilus Influenza type B) increased 3.4% from 2007 to 2009 in SHR.</p> <p>-Some of the sub-groups experienced a slight decrease for both MMR and DaPTP-Hib between 2008 and 2009. This was expected since slight fluctuations were anticipated after the implementation of the 'immunisation reminders project' and the initial increase in 2008 for both MMR and DaPTP-Hib uptake rates.</p> <p>-The lowest rates of all sub-groups analysed were for foster children whose 2009 MMR rates were 28.6% less than SHR as a whole, and whose 2009 DaPTP-Hib rates were 33.6% less than SHR as a whole.</p> <p>-Children from the core neighbourhoods (i.e., six low-income neighbourhoods) in Saskatoon were less likely to have up-to-date immunisations for both MMR and DaPTP-Hib than children from the non-core neighbourhoods. These differences were statistically significant for all seven years studied (2003-2009). Although not yet significant, the gap between the core and non-core neighbourhoods appeared to be decreasing.</p>

	-Children from Saskatoon were less likely to have up-to-date immunisations for both MMR and DaPTP-Hib than children in the rural region. However, this difference was only statistically significant for four of the seven years studied (2003, 2004, 2005 and 2008).
Duration of intervention	2007-2011
Notes	

Kondji 2006 (173)	
Methods	Nine west and central francophone African countries (Benin, Burkina Faso, Cameroon, Chad, Cote d'Ivoire, Guinea, Mali, Niger, and Central African Republic - RCA) participated in the Consultative Technical Committee Meeting on communication for poliomyelitis eradication that took place in Yaounde from June 22nd to 24th 2005. Since that time, The Communication Initiative has worked to support the collaboration of and exchange of information between the nine countries in support of implementation of the recommendations from that meeting. This collaborative work was technically conducted through new information and communication technologies and was supported by UNICEF West and Central Africa Regional Office (WCARO). Of the nine countries concerned, eight manifested both in the follow-up of the communication plans and the implementation of the recommendations.
Participants	<p><i>Vaccine Hesitancy:</i> Many cases of refusal are due to a lack of interpersonal communication with parents and misconduct of vaccination teams.</p> <p><i>Country:</i> Guinea, Chad</p> <p><i>Intervention theme:</i></p> <p>Guinea: Dialogue: (5) Parents in low income settings and social mobilisation.</p> <p>Chad: Dialogue: (1) Populations with low baseline uptake and involvement of religious leaders; (3) Populations with low baseline uptake and involvement of traditional leaders; (5) Parents in low income settings and social mobilisation.</p> <p><i>Participants:</i> Authorities and other local leaders as well as non-governmental organisations and associations, community local front line workers (social</p>

	mobilisers), community.
Interventions	<p><i>Intervention name:</i> EPI Communication for West and Central Francophone African Countries</p> <p><i>Target Vaccine:</i> Polio</p> <p>INTERVENTION: Guinea:</p> <ul style="list-style-type: none"> -Recruitment of a POLIO/EPI Communication Consultant and the designation of a communication focal point at the Vaccination Programme. -Undertaking a behavioural study on communication as regards to vaccination. -The organisation of a pre-campaign supervision week for the third round of the vaccination campaign against Maternal and Neo Natal Tetanus (MNT) in eight districts. <p>Following the analysis of the strengths and weaknesses of the previous vaccination campaigns, especially concerning communication, partners decided to organise a preparatory week for the third round of MNT in March 2006 in the eight high risk districts; during that week, the following interventions were implemented:</p> <ul style="list-style-type: none"> -reinforcement of the involvement of administrative and community leaders -reinforcement of the usage of rural community radios -reinforcement of the participative involvement of the civil society (NGOs and local associations) -reinforcement of interpersonal communication skills of vaccination teams on the management of post immunisation adverse effects -Improvement of vaccination visibility through a national generic mark (promotion/marketing) -Monthly contact bulletin for regular exchange of information <p>Chad:</p> <p>All interventions fall under themes: Dialogue: (1), (3) & (5)</p> <ul style="list-style-type: none"> -Increasing traditional leaders, local religious and women's groups' responsibility on the local management of known cases of refusals; the intervention of administrative authorities before and after the campaign was forbidden. -The identification and numbering of cases of refusal in households and compounds by local leaders. -The organisation of the campaigns with the full participation of local leaders, and the administrative authorities; the coordination of community based social mobilisation and the management of refusals cases were taken care of by the mayor of the rural council of Pala; the health authorities took care of technical support. -Meetings in communities by traditional chiefs on the campaign. -Door to door sensitisation before and during campaign by community

	<p>mobilisers appointed by traditional and religious leaders (people from the same community).</p> <p>-Carrying out of negotiation sessions before the campaign with families known to refuse vaccination by the local leaders.</p> <p>-Sensitisation through community radio with announcements from influential dignitaries in local languages and witnesses of parents whose children had been affected by polio.</p>
Outcomes	<p>Guinea: <u>Outcome 1</u>: at the end of December 2005, the cumulated vaccination uptake rate for DPT3 was 86% while in 2004 it was 69%. No prefectural division registered a DPT3 vaccination uptake rate of <50%, nine were between 50 and 70% and 29 had 80% and above.</p> <p>Chad: <u>Outcome 1</u>: 154 cases of refusals were censured in the Pala district and all were convinced and accepted to let their children be vaccinated after negotiations and sensitisation; the total number of children vaccinated after negotiation was 294 in Pala district.</p>
Duration of intervention	June 22nd to 24th 2005
Notes	

Rotary International 2007 (172)	
Methods	The 300 participants meeting in Muzaffarou, India, heard plenary addresses and then heard an interactive session of "new ideas ...past experiences, and the impact of certain misgivings". The paper reviews the immunisation and advocacy work of this programme.
Participants	<p>Vaccine Hesitancy: Moradabad is an area of particularly high resistance to immunising children.</p> <p><i>Country:</i> India</p> <p><i>Intervention Theme: Dialogue</i> (1): Populations with low baseline uptake and involvement of religious leaders; (5) Parents in low income settings and social mobilisation; (7) Parents and mass media interventions.</p> <p>Non-financial Incentives: (2) Parents/communities located in low-income setting and non-financial incentives: (3) Populations targeted by vaccine campaigns and non-financial incentives: (4) Populations with low baseline uptake and non-financial incentives.</p>

	<i>Participants:</i> Community
Interventions	<p>Intervention name: India PolioPlus Programme</p> <p><i>Target Vaccine:</i> Polio</p> <p>INTERVENTION:</p> <p>Non-financial Incentives (1), (3), (4);</p> <p>-In Moradabad, Rotarians used booths with a festive atmosphere to attract families. A team of a male and a female doctors worked on converting specific households resisting immunisation.</p> <p>-During the pilgrimage of Haj, the Saudi Arabian government issued a directive for Hajjis (pilgrims) to be vaccinated before arriving in Mecca. A polio immunisation camp for Haj pilgrims was organised in Moradabad.</p> <p>Dialogue (1), (5), (7)</p> <p>-Information, education, and communication (IEC) materials distributed include a Ramzam [holy month] calendar distributed to Haj pilgrim. The calendar included appeals by Ulemas (Islamic religious leaders) with pictures of adults and children taking the immunisation drops. Other IEC material, such as booklets, pamphlets (routine and appeal), and posters, were also distributed through the Haj stalls and booths. Routine immunisation pamphlets with "a complete info book on immunisation", detailing all the diseases and the time frame for each immunisation and their dosage - and including a Pulse Polio message" were prepared for distribution in Moradabad at immunisation booths and for house-to-house distribution. Local paediatricians participated in the publication of appeals pamphlets for the Moradabad area. A United Nations Children's Fund (UNICEF) Polio 'Kavariya rally' on August 19-20 2007 received Rotary support, including orange-coloured polio message t-shirts.</p>
Outcomes	<p>(All interventions contributed to the outcomes)</p> <p><u>Outcome 1:</u> 5% increase in immunisation uptake from booths. Doctors administered vaccines at 19 households, due to good will from the previously held medical check-up camps.</p>
Duration of intervention	Not known
Notes	

Gage 2003 (183)	
Methods	(1) Review of available literature, (2) Process evaluation to measure how well social mobilisation activities were conducted. This entailed the use of key informant interviews and non-routine methods to collect information on the strengths and weaknesses of social mobilisation for NIDS. (3) Caretaker survey (4) Vaccinator and mobiliser survey. (5) Qualitative methods: focus group discussions among male community members.
Participants	<p><i>Vaccine Hesitancy:</i> -Some people do not consider polio eradication a health priority and a section of the educated elite continues to oppose it. -There is insufficient knowledge about polio, the diseases against which children are immunised, and childhood vaccination in general and a lack of understanding (bordering on suspicion) as to the rationale behind the coexistence of routine EPI and NIDs. These are accentuated by the fact that vaccines given during NIDs were free and that health workers actually come to the door to vaccinate children. By comparison, participants interpreted fees paid at the health centre for sick and well-child consultations to be payment for vaccines even though EPI vaccines are actually free. The coexistence of free vaccines through NIDs and vaccines that were not perceived to be free of charge (at the health centre) fuelled suspicions and misinformation. -There is poor interpersonal communication between vaccinators and caretakers. Participants reported that vaccinators do not explain why children were immunised and against which disease children are protected. -Lack of respect is displayed by health workers towards clients had repercussions on the rate of acceptance of the door-to-door strategy. -Some religious leaders continue to hold misconceptions and spread false rumours about polio vaccine so full polio immunisation uptake is low at 42%.</p> <p><i>Country:</i> Republic of Niger</p> <p><i>Intervention theme:</i> Dialogue: (1) Populations with low baseline uptake and involvement of religious leaders; (3) Populations with low baseline uptake and involvement of traditional leaders, (5) Parents/ [community] in low income settings and social mobilisation</p> <p><i>Participants:</i> Strategies informed by and delivered by:</p> <ul style="list-style-type: none"> - Local opinion leaders (political, religious, and traditional authorities) - Local animators among the nomadic populations - Traditional communication networks such as public criers - Associations and NGOs such as the national Red Cross and Niger Scouts - Populations living in hamlets, camps, and tribes never touched by the NIDs, especially hard-to-reach populations such as nomadic groups

Interventions	<p><i>Intervention name:</i> National Immunisation Days (NIDS)</p> <p><i>Target vaccine:</i> Polio</p> <p>INTERVENTION: All participants were involved in the following strategies:</p> <ul style="list-style-type: none"> -Investigating each sub-strategy used in social mobilisation since the onset of the 2000 NIDs and assess its impact on behaviour change among the Nigerien population; -Undertake a rapid assessment of sources of information on polio eradication according to sex, age, and area of residence; -Examine educational material used by health workers for each social mobilisation strategy used during NIDs; -Formulate innovative, replicable, sustainable strategies that could be used to improve social mobilisation activities for upcoming NIDs and the national EPI Programme. - Print media, radio and television, and public and private theatre. -Radio, television, traditional leaders and town criers were the primary communication channels.
Outcomes	<p>The focus group discussions revealed generally positive attitudes towards polio eradication and NIDs, although participants did acknowledge that in the past, there was greater opposition to these efforts.</p> <p><u>Outcome 1:</u> Perceived reduction in the number of new cases of AFP in the communities examined.</p> <p><u>Outcome 2:</u> Changing attitudes were attributed to the intensive social mobilisation and sensitisation efforts, a recognition that polio immunisation promoted children's health.</p>
Duration of intervention	Commenced in 2003.
Notes	<p><i>Suggestions:</i> -Participants in the focus group discussions were also asked what more could be done to foster favourable attitudes among people who were opposed to immunisation. The responses reflect the importance of improving the quality of interpersonal communication by health workers at fixed facilities and of continued sensitisation by traditional leaders.</p> <p>-Young men in Maradi Town noted that if the Government continued to use force to resolve refusal cases during NIDs (for example, during the October/November 2002 NIDs, the military was sent to Soumarana and surrounded the village while the vaccinators were there), this would lead even current supporters of polio eradication to refuse to have their children vaccinated. These young men also emphasised the importance of strengthening routine immunisation and community outreach, which they</p>

	preferred over the door-to-door immunisation strategy.
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UNICEF 2011 (184)	
Methods	<p>The review team comprised six international communication professionals representing diverse institutions and backgrounds in public health, communication, and immunisation. The review methodology consisted of appraisal of various programme documents and reported and evaluation data, meetings with stakeholders at national and provincial levels, discussions with field staff, and meetings and focus group discussions with a multitude of players in polio partners' PEI efforts.</p> <p>Team A visited the Southern region (Kandahar) to conduct an overall assessment of the efficacy of the Polio Communication Network and linkages with communication and capacity-building; team B visited the Western region (Herat) to review how partnerships, including cross-sectoral ones, and the media can be better used for polio communication; and team C visited the Northern region (Mazar-e-Sharif) in an attempt to understand better how polio and EPI communication can be strengthened and integrated into existing communication approaches. The selection of themes and geographic areas of focus were based on a combination of epidemiological, operational and communication challenges.</p> <p>The review was conducted using a combination of information gathering techniques including discussions and briefings with key programme staff, review of relevant materials, reports and data, undertaking field visits to the MoPH and clinics to meet with health service providers, individual and group interviews with UNICEF staff from the polio programme (at both national and provincial levels) and those working in other programme sections, and through discussions and interviews with other programme partners (including implementing NGOs, religious leaders, media representatives and the Education Directorate).</p> <p>The Polio Communication Officer for Herat was also present at meetings and available to provide context and additional perspective. A doctor from a local hospital acted as an independent translator.</p>
Participants	<p><i>Vaccine Hesitancy:</i> -Geographically isolated populations -Limited capable human resources . -Difficult to reach women and actively engage them in the programme. -Limited commitment at some levels, and the monetisation of communication - activities amongst partners.</p>

	<p><i>Country:</i> Afghanistan</p> <p><i>Intervention Theme:</i> Dialogue: (1) Populations with low baseline uptake and involvement of religious leaders; (5) Parents in low income settings and social mobilisation; (7) Parents and mass media interventions.</p> <p><i>Participants:</i> Community and community mobilisers who were involved in all interventions mentioned below: Mullahs, Teachers, Community Health Workers, and Community Elders.</p>
Interventions	<p><i>Name of intervention:</i> Global Polio Eradication Initiative (GPEI).</p> <p><i>Target Vaccine:</i> Polio</p> <p>INTERVENTION: Independent polio communication review conducted in Afghanistan, as part of the Global Polio Eradication Initiative (GPEI).</p> <p><i>Southern Region</i></p> <p>Theme: Dialogue (1) & (5)</p> <ul style="list-style-type: none"> -Courtyard mobilisers engage women on polio facts, and the need to bring children to the doorstep for vaccination when the teams visit -Community Mobilisers (CMs): Mullahs, Teachers, Community Health Workers, and Community Elders have the task of orienting children on polio messages and equipping them with relevant information that they can take home with them. -Cross-border communication and related IEC. <p>Theme: Dialogue (5) & (7)</p> <ul style="list-style-type: none"> - Three vaccination teams active in the border area. The DCFP along with CCFPs visit the border area during the polio campaign and undertake campaign awareness by putting up banners, posters and distributing leaflets. Loudspeaker announcements are also made during the round. In order to ensure that the children coming in from Pakistan are not missed a shed was put up at the Afghan border entry point. <p>Theme: Dialogue (7):</p> <p>Key messages development and use of media channels.</p> <p><i>Western Region</i></p> <p>Theme: Dialogue (5)</p> <p>Strategic partnerships to strengthen community level interventions – current partnerships with education: WASH and Child Protection sections and opportunities for integration / convergence;</p> <p>Theme: Dialogue (7):</p> <p>Mass media and outdoor display materials (billboards, banners and posters).</p>

Outcomes	<p><i>Southern Region</i></p> <p>Theme: Dialogue (1) & (5) <u>Outcome 1:</u> -Community mobilisers were well accepted by the community and many of them played critical roles in converting refusals. -Turnover of staff in the PCN is frequent and erratic. Whenever a high level of uptake is attained in a particular cluster that cluster is not considered by the Partners to be high risk anymore and the PCN is disbanded. Once staff have been suddenly let go, they contribute to a rising resistance for the programme, which explains the sporadic spikes in refusal from one round to the next. Uptake from one month to another may also spike up or down due to staff taking higher paying jobs.</p> <p><u>Outcome 2:</u> - The IEC tools are text heavy and are not understood by many community members, including influencers and women. - Spin Boldak: campaign awareness and vaccination- both seemed to be progressing well.</p> <p><i>Western Region</i></p> <p>Theme: Dialogue: (1), (5) & (7) <u>Outcome 2:</u> -Mass media products were used in NIDs. Previous communication activity plans the team reviewed showed that these were being utilised in Herat but not at a high enough insertion rate to be fully effective.</p>
Duration of intervention	2007-2008
Notes	Changes in uptake rates not quantified

Characteristics of excluded studies [peer reviewed; ordered alphabetically]

Author/Pub Year	Reason for exclusion
Abbott 2013	Relevant to Theme 3 - PICO 1 & PICO 2 - Data issues
Abramson 2010	Not relevant PICO (Multi-component)
Ajenjo 2010	Not relevant PICO (Multi-component)
Al-Tawil 2013	Not relevant PICO (Multi-component)
Atchison 2013	Not relevant to PICO (Reminder/recall)
Babcock 2010	Not relevant to PICO (Mandates)
Ballestas 2009	Not relevant PICO (Multi-component)
Bandaly 2009	Not relevant to PICO (Education)

Barham 2009	Not relevant to PICO (Incentive)
Baudier 2007	Not relevant to PICO (Educational materials)
Beggs 2013	Not relevant PICO (Multi-component)
Bertin 2007	Not relevant PICO (Multi-component)
Boivin 2008	Outcome 2
Bonilla 2011	Full text not available
Boom 2007	Outcome 2
Brigham 2012	Not relevant to PICO (Dialogue - all other)
Buttenheim 2013	Full text not available
Butteri 2010	Outcome 2
Cadena 2011	Not relevant PICO (Multi-component)
Campbell 2007	Not relevant PICO (Multi-component)
Camurdan 2012	Not relevant PICO (Multi-component)
Cates 2011	Not relevant PICO (Multi-component)
Chan 2013	Not relevant to PICO (Educational materials)
Cheema 2013	Outcome 2
Coady 2008	Outcome 2
Cox 2010	Outcome 2
Cox 2012	Not relevant to PICO (Personal involvement)
Crosby 2008	Outcome 2
de Juanes 2007	Not relevant PICO (Multi-component)
Djibuti 2009	Not relevant PICO (Multi-component)
Doherty 2008	Outcome 2
Doratotaj 2008	Not relevant PICO (Multi-component)
Duval 2011	Not relevant PICO (Multi-component)

Eckert 2011	Not relevant PICO (Multi-component)
Eckrode 2007	Not relevant to PICO (Vaccination programme)
Ernsting 2013	Not relevant to PICO (Educational materials)
Ferguson 2010	Relevant to Theme 1 - PICO 9 - Data issues
Fiks 2007	Not relevant to PICO (Reminder/recall)
Fiks 2009	Not relevant to PICO (Reminder/recall)
Fiks 2013	Not relevant PICO (Multi-component)
Friedl 2012	Not relevant PICO (Multi-component)
Fu 2012	Not relevant PICO (Multi-component)
Gainforth 2012	Outcome 2
Galagan 2013	Not relevant PICO (Multi-component)
Gargano 2011	Not relevant PICO (Multi-component)
Gerend 2007	Outcome 2
Gerend 2012	Not relevant to PICO (Educational materials)
Girard 2012	Not relevant to PICO (Mandates)
Goel 2012	Not relevant PICO (Multi-component)
Gottvall 2010	Outcome 2
Gowda 2013	Outcome 2
Gunn 2007	Not relevant PICO (Multi-component)
Gust 2009	Outcome 2
Harari 2008	Not relevant PICO (Multi-component)
Harris 2011	Not relevant PICO (Multi-component)
Helms 2011	Not relevant to PICO (Mandates)
Hicks 2007	Relevant to Theme 1 - PICO 9 - Data issues
Honda 2013	Not relevant PICO (Multi-component)

Hopfer 2012	Not relevant to PICO (Dialogue - HCW)
Hsu 2010	Outcome 2
Hu 2011	Outcome 2
Humiston 2011	Not relevant PICO (Multi-component)
Igarashi 2010	Not relevant PICO (Multi-component)
Jackson 2010	Outcome 2
Jackson 2011	Relevant to Theme 1 - PICO 8 - Data issues
Jimenez-Garcia 2012	Not relevant to PICO (Vaccination programme)
Jung 2013	Not relevant PICO (Multi-component)
Juraskova 2011	Not relevant to PICO (Educational materials)
Karanfil 2011	Not relevant to PICO (Mandates)
Kennedy 2008	Outcome 2
Kennedy 2011	Outcome 2
Kepka 2011	Outcome 2
Kharbanda 2011	Relevant to Theme 1 - PICO 6 - Data issues
Kimura 2007	Not relevant PICO (Multi-component)
Klein 2009	Outcome 2
Krawczyk 2012	Outcome 2
Lahariya 2007	Relevant to Theme 1 - PICO 5 - Data issues
LaMontagne 2011	Not relevant PICO (Multi-component)
LaVela 2008	Outcome 2
Lechuga 2011	Outcome 2
Lee 2008	Not relevant to PICO (Incentive)
Lemstra 2011	Not relevant to PICO (Reminder/recall)
Levi 2007	Outcome 2

Link 2010	Outcome 2
Llupia 2010	Not relevant PICO (Multi-component)
Llupia 2013	Not relevant PICO (Multi-component)
Looijmans-van den 2010	Not relevant PICO (Multi-component)
Luthy 2013	Outcome 2
Malmvall 2007	Not relevant PICO (Multi-component)
Maltezou 2008	Not relevant PICO (Multi-component)
Maltezou 2012	Not relevant to PICO (Vaccination programme)
Marek 2012	Outcome 2
Marshall 2007	Not relevant to PICO (technology/combination vaccines)
Mayne 2012	Outcome 2
McCarthy 2012	Not relevant to PICO (Educational materials)
McElligott 2010	Not relevant to PICO (Reminder/recall)
Melinkovich 2007	Not relevant PICO (Multi-component)
Milkman 2011	Not relevant to PICO (Reminder/recall)
Miller 2011	Not relevant to PICO (Mandates)
Moniz 2013	Not relevant to PICO (Reminder/recall)
Moss 2012	Not relevant PICO (Multi-component)
Mouzoon 2010	Not relevant PICO (Multi-component)
Nace 2007	Not relevant PICO (Multi-component)
Nan 2012	Outcome 2
Nicholson 2009	Not relevant PICO (Multi-component)
Nyamathi 2009	Not relevant PICO (Multi-component)
Ofstead 2013	Not relevant to PICO (Incentive)
Palmore 2009	Not relevant to PICO (Mandates)

Panda 2011	Not relevant PICO (Multi-component)
Payaprom 2011	Not relevant PICO (Multi-component)
Phommathansy 2010	Not relevant PICO (Multi-component)
Pinquier 2013	Full text not available
Polgreen 2008	Not relevant to PICO (Mandates)
Pollack 2011	Not relevant PICO (Multi-component)
Porter-Jones 2009	Not relevant to PICO (Dialogue - all other)
Prinja 2010	Not relevant PICO (Multi-component)
Quan 2012	Not relevant PICO (Multi-component)
Rahman 2013	Not relevant PICO (Multi-component)
Rakita 2010	Not relevant to PICO (Mandates)
Reiter 2011	Outcome 2
Riphagen-Dalhuisen 2013	Not relevant PICO (Multi-component)
Robertson 2013	Not relevant to PICO (Financial incentive)
Robner 2008	Not relevant to PICO (Mandates)
Rothan-Tondeur 2010	Full text not available
Saitoh 2013	Not relevant to PICO (Dialogue - HCW)
Sales 2011	Not relevant to PICO (Educational materials)
Samuels 2008	Not relevant PICO (Multi-component)
Sasaki 2011	Not relevant to PICO (Vaccination programme)
Schechter 2010	Outcome 2
Schensul 2009	Not relevant PICO (Multi-component)
Schwarz 2008	Not relevant PICO (Multi-component)
Sheikh 2009	Outcome 2
Slaunwhite 2009	Not relevant to PICO (Educational materials)

Slavin 2008	Not relevant to PICO (Educational materials)
Smith 2011	Not relevant PICO (Multi-component)
Spleen 2012	Outcome 2
Stitzer 2010	Not relevant to PICO (Incentive)
Swenson 2012	Not relevant PICO (Multi-component)
Szilagyi 2011	Not relevant PICO (Multi-component)
Taddio 2013	Outcome 2
Talbot 2010	Not relevant PICO (Multi-component)
Tam 2009	Not relevant to PICO (Dialogue - HCW)
Taylor 2008	Relevant to Theme 1 - PICO 9 - Data issues
Thomas 2008	Not relevant PICO (Multi-component)
Uddin 2010	Not relevant PICO (Multi-component)
Van Buynder 2011	Relevant to Theme 1 - PICO 7 - Data issues
Vanderpool 2013	Not relevant to PICO (Educational materials)
Vora 2009	Relevant to Theme 3 - PICO 1 & PICO 2 - Data issues
Waisbord 2010	Not relevant PICO (Multi-component)
Wallace 2008	Outcome 2
Walter 2008	Not relevant PICO (Multi-component)
Wang 2007	Not relevant PICO (Multi-component)
Watson-Jones 2012	Not relevant to PICO (Vaccination programme)
Weaver 2007	Not relevant PICO (Multi-component)
Williams 2013	Not relevant PICO (Multi-component)
Wright 2012	Not relevant to PICO (Vaccination programme)
Zimmerman 2009	Not relevant PICO (Multi-component)

Section 3 – Synthesis of findings, conclusions and implications for research & practice

(Addresses objective 4)

3.1 Synthesis of findings

Overall this review has found that there are 1) few existing strategies that have been explicitly designed to address vaccine hesitancy; and 2) even fewer strategies that have been evaluated for impact. The first of these issues is most likely because ‘vaccine hesitancy’ is an emerging issue, which to date, has not had a clear definition from which to explore and interrelate identified concerns. As such, interventions are often only half-conceived; target audiences are not always appropriately identified, and there is a lack of rigorous understanding of the actual problem. Interventions around polio vaccination are the exception to this – and the findings of this review indicate their greater success as a result.

At present, the efforts that have been made to address issues of hesitancy are disparate. This is not surprising given the complexity of the problem but it does make interpretation of the evidence more difficult. Specifically, while a number of interventions did have a positive impact, it was variable. Wide variation was observed in the effect size between studies, settings and target populations. Even within studies there was wide variation on the impact on uptake of specific vaccines. In addition, the high level of heterogeneity across study design and outcomes coupled with few available studies further limited our ability to draw many general conclusions about the effectiveness of different strategies.

Nonetheless, across the literature, interventions that are multicomponent and/or have a focus on dialogue-based approaches tend to perform better. This message is corroborated by the more formal GRADE assessment of the evidence which indicated greater quality of evidence for social mobilisation, mass media and communication tool-based training for HCW. Together, these interventions suggest that taking a comprehensive approach that targets multiple audiences and layers of social interaction are more likely to bring positive results. The evidence for the other interventions, non-financial incentives and reminder-recall activities, was also of good quality, and carries the potential to bring positive change by addressing the more practical aspects of vaccination. It is important to reiterate however, that the key to success seems to lie in designing more complex, but integrated, multi-component interventions.

This review shows that vaccine hesitancy is a complex issue and no single strategy will be able to address it single-handedly. There are some promising examples, but many are incomplete and most are not directly comparable. Perhaps one of the greatest drawbacks of the interventions identified is that so many operate from an assumption-based rather than an evidence-based approach; appropriate evaluation is also lacking. On a more positive note, there is a growing body of research on the determinants of vaccine hesitancy which can help inform and refine currently used approaches that look promising but have not yet been fully implemented nor evaluated, as well as supporting the formative research, design and evaluation of new interventions. This is an opportunity to develop early learnings and set the precedent to advance the understanding and management of issues of vaccine hesitancy.

3.2 Conclusions and implications

Vaccine Hesitancy (peer reviewed and grey literature)

This review of the peer reviewed and grey literature indicates that relatively little research has been conducted on strategies to explicitly address vaccine hesitancy. What research has been done has largely been conducted in the American region and mostly targets health care workers and parents of children eligible for vaccination. Strategies to address resistance to polio, occupational flu and HPV vaccination have been most frequently researched. The majority of interventions have not been evaluated and few of those that have been evaluated (only 14%) provide strategies that could be deployed in other settings.

The lack of evaluated strategies to address vaccine hesitancy meant that five out of the fifteen PICO questions defined by the SAGE working group for inclusion in this review could not be addressed. Of the ten that were addressed in the review, the evidence to answer these questions came from only one or two studies each. Despite the low number of studies, there is some opportunity to be moderately confident in several of the interventions including: social mobilisation (77), mass media (81), communication tool-based training for HCW (91), non-financial incentives (91) (Banerjee), and reminder-recall activities (Usman 2009). However, none of these interventions were without shortcomings, and given the additional caveats around indirectness and the variability in content, setting, delivery method, target population composition and effect estimates across outcomes, the success, and potential application, of these interventions must be cautiously considered when looking to deliver them in different circumstances.

In light of these restrictions, it is worthwhile acknowledging that vaccine hesitancy is an emerging issue and area of research, so new approaches will be needed which have no precedent and are yet to be evaluated. What we do have considerably more of is the evidence of the determinants of vaccine hesitancy, which need to be the basis of strategies in development and to be evaluated. One of the biggest failings has been the amount of assumption-based rather than evidence-based strategies to support the delivery and uptake of vaccinations.

The interventions that were evaluated using GRADE included: 1) dialogue based interventions, including community-level engagement strategies; the involvement of local political, religious and traditional leaders; use of social media and interactive modes of healthcare worker training; 2) the use of non-financial incentives; and 3) the use of reminder-recall interventions to prompt parents to take their children for vaccination. The impact of these strategies was assessed across different target populations. The effect of these strategies was generally positive but level of impact varied. The high level of heterogeneity across study design and outcomes coupled with few available studies limits our ability to draw any general conclusions about the effectiveness of different strategies. Without further evaluation of similar strategies across different settings, populations and vaccines, current strategies are indicative examples, and cannot be considered as best practice.

No evaluated strategies were identified to answer PICO questions on the impact of religious or traditional leaders in populations with high baseline uptake ($\geq 80\%$) or the effect of non-financial incentives on parents; on populations targeted by vaccination campaigns; nor on populations with low-baseline vaccine uptake. One reason for the paucity of relevant strategies available to answer key questions is that much emphasis was put on trying to assess the impact of specific, single component strategies, although many evaluated strategies are multicomponent. Evaluated, multicomponent interventions were identified but the majority only offered data on the impact of

the overall intervention, not the independent impact of the individual component parts. Another contributing factor is that ‘vaccine hesitancy’ as a concept and term has only recently been coined and has not yet found general currency among researchers or immunisation professionals. The terms ‘vaccine hesitant/hesitancy’ were only identified in five peer reviewed studies (all published in 2013). As such, every effort was made to identify studies that addressed one or more of the determinants of vaccine hesitancy as set out by the SAGE working group, as opposed to selecting any study that reported on strategies that impacted on vaccination uptake in general. Given the newness of the “vaccine hesitancy” concept, all strategies included in this review are accompanied by explanatory notes on how the issue being addressed reflects the current definition of vaccine hesitancy.

Reproductive health technologies (grey literature only)

Reproductive health strategies were analysed to obtain insights surrounding low uptake of other available health technologies and to ascertain whether strategies aimed at addressing hesitancy surrounding reproductive health technologies could be useful for addressing vaccine hesitancy.

Unlike the vaccine hesitancy search, the majority of interventions aimed to address hesitancy surrounding uptake of reproductive health technologies were primarily focused in WHO AFR and SEAR regions. Many interventions did not focus on a specific reproductive health technology, although male and female condoms featured prominently. Similar to the vaccine hesitancy search, most targeted healthcare workers but also aimed to engage religious and other influential leaders in family planning. The engagement of religious and community leaders as a strategy was common in low income regions.

Many interventions aimed to address contextual issues such as gender norms (often aimed at men) and a high proportion also aimed to address individual/social group influences on reproductive health choices, such as beliefs and attitudes about reproductive health. The majority of interventions were not evaluated but interventions that were evaluated were mostly dialogue-based or multi-component interventions.

3.3 Opportunities

Despite the large body of literature on the many determinants of vaccine hesitancy, most interventions have focused on individual level issues (e.g., knowledge, awareness) and vaccine/vaccination specific concerns (e.g., mode of delivery, role of healthcare professionals). There needs to be more attention given to understanding and addressing hesitancy at the community level (e.g. social norms).

There is an opportunity to broaden the outcomes of interest when assessing the effects of interventions, in particular, more intermediary outcomes such as changes in knowledge, norms, attitude and awareness. These outcomes might indicate important shifts along the vaccine continuum, either away from or towards acceptance, even if they do not necessarily lead to a change in vaccination uptake. Appreciating where individuals and communities lie on the continuum and what defines this offers another insight to inform intervention design.

3.4 Limitations

As discussed earlier, the newness of the concept of ‘vaccine hesitancy’ presented challenges in terms of identifying literature that specifically addresses vaccine hesitancy. Because the term is not yet frequently used, the search terms applied were more conceptually driven, and therefore much of the literature was also about issues of under-immunisation. However, in order to focus this review,

studies were only included where the determinants of vaccination issues matched one or more of the determinants set out in the SAGE WG Model of determinants of Vaccine Hesitancy. There was also the issue that even when a study explicitly mentioned the terms 'hesitant/hesitancy', the authors working definition may not completely reflect that set out by the SAGE WG. Although regional databases were included in the peer-reviewed literature searches and extended across all UN languages, there was an overrepresentation of literature on this topic in higher income regions (AMR, EUR). Grey literature was searched to improve representation from other regions.

This review may also be subject to publication bias, in that unsuccessful interventions may be less likely to be documented in either the peer-reviewed or grey literature. Consequently, although the review gives some indication of interventions that successfully reduced vaccine hesitancy in specific populations and settings, interventions that were found to have no effect or a negative effect may be under-represented.

Another reason for the paucity of relevant studies is that the questions emphasise specific, single component strategies, but many evaluated strategies are neither designed nor presented in this way. Evaluated, multi-component interventions were identified but only overall impact data were presented and VH data was not separately available.

3.5 Implications for research & practice

Vaccine hesitancy is complex and dynamic; future strategies need to reflect and address these complexities in both design and evaluation. In the first instance, implementers must adequately identify the target population and understand the true nature of their particular vaccine and/or vaccination concerns; this will help ensure a well-informed intervention. Recognising that vaccine hesitancy is influenced by very local but also global influences, researchers and implementers should seek a thorough understanding of the dynamic context outside of immunisation programmes.

The vaccine hesitancy framework developed by the SAGE working group should prove valuable in future efforts to identify, investigate and address issues that arise and help discern issues of vaccine hesitancy from the more well-known and studied factors influencing vaccination uptake such as access or vaccine supply issues. There is no single strategy that can address vaccine hesitancy; well integrated, multi-component strategies should be promoted and must be accompanied by an appropriate evaluation process. Specifically, implementers must be able to appreciate the influence of individual components which will benefit the immediate operations and the design of future interventions.

Overall, the design and delivery of interventions should try to reflect the following points: 1) Target audiences should be clearly identified and specific issues well researched and understood; 2) Interventions should focus on meaningful engagement (i.e., dialogue-based, social mobilisation) that supports realistic action; 3) Contextual influences, from the individual through to the health system, should be acknowledged and accounted for when choosing strategies; 4) Interventions should be multi-component and seek to address primary determinants of uptake across the different domains of interest; 5) Interventions must be evaluated.

Vaccine hesitancy is an emerging, and evolving area, which is new and needing new, and sometimes yet untried, approaches to effectively address it. Adapting old ways in small ways, will not change the tide.

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5.1 APPENDICES

Appendix 1: SAGE Working Group (WG) “Model of determinants of Vaccine Hesitancy”



Appendix 2: Peer reviewed literature search strategy (Medline)

Ovid MEDLINE(R) 1948 to October 2013

1. ((vaccin\$ or immunis\$ or immuniz\$) adj5 (anxiety or attitude\$ or awareness or behavior?r or belief\$ or criticis\$ or doubt\$ or distrust or dropout\$ or exemption\$ or fear\$ or hesitanc\$ or trust or mistrust or perception\$ or refus\$5 or rejection or rumo?r\$ or intent\$5 or controvers\$ or misconception\$ or misinformation or opposition or delay or dilemma\$ or objecto\$)).ti,ab.
2. ((vaccin\$ or immunis\$ or immuniz\$) adj3 (uptake or barrier\$ or choice\$ or mandatory or compulsory or concern\$ or accepta\$ or knowledge or parent\$ con\$)).ti,ab.
3. (((vaccin\$ or immunis\$ or immuniz\$) adj5 confidence) not confidence interval).ti,ab.
4. ((vaccin\$ or immunis\$ or immuniz\$) adj5 decision making).ti,ab.
5. ((vaccin\$ or immunis\$ or immuniz\$) and (anti-vaccin\$ or antivaccin\$)).ti,ab.
6. 1 or 2 or 3 or 4 or 5
7. exp vaccination/
8. Vaccines/
9. Mass Vaccination/
10. Immunisation/
11. exp Immunisation Programs/
12. 7 or 8 or 9 or 10 or 11
13. Public Opinion/
14. Attitude to Health/
15. Attitude/
16. Health Knowledge, Attitudes, Practice/
17. "Patient acceptance of health care"/
18. Treatment Refusal/
19. Parental Consent/
20. Decision Making/
21. Prejudice/
22. Internet/
23. 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22
24. 12 and 23
25. 6 or 24
26. limit 25 to humans
27. ((vaccin\$ or immunis\$ or immuniz\$) adj5 (anxiety or attitude\$ or awareness or behavior?r or belief\$ or criticis\$ or doubt\$ or distrust or dropout\$ or exemption\$ or fear\$ or hesitanc\$ or trust or mistrust or perception\$ or refus\$5 or rejection or rumo?r\$ or intent\$5 or controvers\$ or misconception\$ or misinformation or opposition or delay or dilemma\$ or objecto\$)).ti,ab.

28. ((vaccin\$ or immunis\$ or immuniz\$) adj3 (uptake or barrier\$ or choice\$ or mandatory or compulsory or concern\$ or accepta\$ or knowledge or parent\$ con\$)).ti,ab.
29. (((vaccin\$ or immunis\$ or immuniz\$) adj5 confidence) not confidence interval).ti,ab.
30. ((vaccin\$ or immunis\$ or immuniz\$) adj5 decision making).ti,ab.
31. ((vaccin\$ or immunis\$ or immuniz\$) and (anti-vaccin\$ or antivaccin\$)).ti,ab.
32. 27 or 28 or 29 or 30 or 31
33. exp vaccination/
34. Vaccines/
35. Mass Vaccination/
36. Immunisation/
37. exp Immunisation Programs/
38. 33 or 34 or 35 or 36 or 37
39. Public Opinion/
40. Attitude to Health/
41. Attitude/
42. Health Knowledge, Attitudes, Practice/
43. "Patient acceptance of health care"/
44. Treatment Refusal/
45. Parental Consent/
46. Decision Making/
47. Prejudice/
48. Internet/
49. 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48
50. 38 and 49
51. 32 or 50
52. Limit 51 to humans.

Appendix 3: Search Strategy – Grey Literature

OpenGrey

Keywords: Immunisation, vaccination, vaccine, intervention, strategy. Results for each keyword were filtered by discipline – once under ‘Health services, health administration, community care services’ and once under ‘Medicine’. Other disciplines were not considered relevant eg. Veterinary science, bioengineering.

New York Academy of Medicine

Keywords linked by Boolean operators: Immunisation, vaccination, strategy, intervention, evaluation. *NB: Searches also checked for ‘vaccine’, but same results as for ‘vaccination’.* Specific concept keywords including hesitancy, acceptance, refusal, coverage and uptake searched but either no/irrelevant results.

Global Health

Basic search strategy built to investigate results.

1. Immunisation/
2. vaccination/
3. (vaccinat* or revaccinate* or immuniz* or immunis* or immunother* or inoculat* or prophyla*).ti,ab.
4. 1 or 2 or 3 or 4 or 5
5. (rate* or uptake or uptake or compliance or refusal or accept* or hesitan*).ti,ab.
6. Intervention*.ti,ab.
7. Strategy*.ti,ab.
8. Evaluat*.ti,ab.

NICE-UK

Keywords (mixed pairs): Immunisation, vaccination, strategy, intervention
Broad terms were run but results were very high so the decision was made to use more targeted search terms which included hesitancy, refusal, trust, confidence, acceptance, engagement, anxiety, concern, distrust, barrier, rejection, fear.

DFID (R4D)

Keyword searches using above broad terms were run but results were very high.
Searches run using focused concepts (eg. hesitancy, acceptance) retrieved more targeted results which have been put forward for screening.

The Communication Initiative Network

Searched term ‘Vaccine Hesitancy’.

Polio Communication Initiative Network

Used the search term ‘Communication Review’ which showed reports that refer to refusals or approaches to stimulate demand for polio vaccine.

Appendix 4: Search methods - Reproductive health technologies

A database search of OpenGrey, New York Academy of Medicine and Global Health was conducted. Organisational websites searched included NICE, DFID and UNFPA.

NY Academy Grey Literature Report

Keywords linked by Boolean operators: Reproductive health technologies, reproductive health interventions. Specific concept keywords including hesitancy, acceptance, refusal, uptake and uptake searched but no results.

OpenGrey

Keywords linked by Boolean operators: Reproductive health technologies, reproductive health interventions. Specific concept keywords including hesitancy, acceptance, refusal, uptake and uptake searched. Results for each keyword were filtered by discipline – once under ‘Health services, health administration, community care services’ and once under ‘Medicine’. Other disciplines were not considered relevant eg. vet science, bioengineering.

Global Health

(No results found when searching for ‘reproductive health’ and ‘hesitancy’).

NICE-UK

Keywords (mixed pairs): Technologies, intervention. Decision made to use more targeted search terms which included hesitancy, refusal, trust, distrust, barrier, after filtering by ‘Grey Lit’ totalled 55 results.

DFID (R4D)

Keyword searches using above broad terms were run but results were very high. Searches run using more focused concepts (eg. hesitancy, acceptance etc) retrieved more targeted results.



UNFPA

Used search term ‘reproductive health’.



Appendix 5: Characteristics of evaluated interventions by theme – Vaccine hesitancy (Peer reviewed and grey literature listed by theme and impact)

NB: Yellow highlighted strategies are those that have been included for PICO





Peer Reviewed




Ref	Region	Country	Vaccine	Target popln	Issue	Strategies	Primary outcome	Details	Significant	Secondary outcome	Details	Significant
Multi-component												
Williams et al., 2013 (93) Study mentions term 'vaccine hesitancy'	AMR	USA	Childhood	Parent	Limited data on strategies to improve parental attitudes about childhood vaccines (PACV) or vaccine uptake among vaccine hesitant parents.	See Characteristics of Studies p.94		Parents in the intervention group had a significant decrease in PACV score at two months compared to control (median difference 6.7, P = .049); this remained significant after adjustment for baseline PACV score, race/ethnicity, and income (P = .044). There was no difference in the on-time receipt of vaccines between groups at 12 weeks.	Yes	n/a		
Reiter et al., 2011	AMR	USA	HPV	Parents, HCW and School Staff	Low HPV awareness.	One-time education sessions and completed self-administered surveys	n/a	n/a	n/a		HCW indicated much higher levels of self-rated HPV knowledge on their post-intervention surveys (mean=8.12, SD=1.09) compared to their pre-	Yes




										<p>intervention surveys (mean=5.69, SD=2.01, p<0.001). The intervention also substantially increased HCW's objectively assessed knowledge about HPV and HPV vaccine. School staff members rated their HPV knowledge higher following the intervention (mean=7.36, SD=1.79) than before (mean=4.75, SD=2.36, p<0.001). The education intervention also increased the proportion of staff members who answered HPV knowledge items correctly. Post intervention: parents recalled having moderate self-rated knowledge about HPV</p>	
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											prior to the intervention (mean=5.69, SD=2.76); they offered higher self-ratings of their HPV knowledge following the intervention (mean=8.76, SD=1.32, p<0.001).	
Jackson et al., 2011	EUR	UK	MMR	Parent	Concern about the safety of the combined MMR vaccine continues to impact on MMR coverage. 1st and 2 nd dose uptake rates remain short of that required for population immunity. Some parents lack	Balanced information, group discussion, leaflet, coaching exercise.		93% parents in the intervention arm reported taking their child for the vaccination compared to 73% in the control arm.	Yes		Small changes in the predicted direction were evident for the intervention arm for knowledge, intended choice, attitudes, and beliefs. However repeated measures ANOVAs revealed no significant time by arm effects.	No

					confidence in making a decision about vaccination.							
Swenson et al., 2012 (98)	AMR	USA	Pneumococcal, Influenza and Tetanus	Adult	Low immunisation rates missed opportunities.	Clinical decision support system (CDSS) (i.e., automatic identification of those patients eligible for vaccines).	↑	10% improvement in immunisation rates in adults 65 years and younger adults with chronic health issues. Improvements sustained beyond the project.	Not provided	n/a		
Moss et al., (10)	AMR	USA	Adolescent	HCW	Low immunisation rates.	One hour, one-to-one webinar between clinical coordinators and State Immunisation Branch followed by weekly emails. Content covered: adolescent vaccines, clinic vaccination rates, examples of strategies the clinics could implement to improve immunisation rates such as reviewing and flagging charts, decreasing missed opportunities to vaccinate, establish centre guidelines for immunisations, standing orders, reminder letters, and automated reminder phone calls.	↑	Uptake of targeted adolescent vaccinations increased during the one-month intervention period by about 1-2% (all p<.05). Uptake for all vaccines increased from 31.1% to 32.2%, from 64.2% to 64.9% for Tdap, from 46.4% to 47.4% for Meningococcal conjugate, from 52.4% to 54.0% for HPV1, 35% to 36.1% for HPV2, from 21% to 22% for HPV3, 71.2 to 71.6% for MMR (completed 2 dose), 78.3 to 78.6% for Hep B (completed 3 dose), 63.9 to 64.2 for varicella 1 and from 38.8 to 39.4 for varicella 2.	Yes	n/a		
Quan et al., 2012 (32)	AMR	USA	Influenza	Parent	Vaccination not a priority for HCW.	Serial vaccination campaigns including mobile carts, mandatory declination, and peer-to-peer vaccination efforts.	↑	Increased rates from 44% to 62.9%.	Not provided	n/a		
Quan et al., 2012 (24)	AMR	USA	Influenza	HCW	Vaccination not a priority for HCW.	Mandatory vaccination campaign.	↑	Increased rates of compliance to over 90%.	Not provided	n/a		

Cadena et al., 2011 (52)	AMR	USA	Influenza	HCW	Low immunisation rates.	Quality improvement tools - support of leadership, distribution of vaccine kits, grand rounds, vaccine-specific website, screensaver, emails, phone messages, and audit feedback.		Increased vaccination rates (58.8% to 76.6%) ($p < .01$).	Yes	n/a		
Cates et al., 2011 (23)	AMR	USA	HPV	AMR	Low immunisation rates.	Social marketing: bi-lingual materials including posters and brochures through healthcare providers and community locations, access map of providers, materials to support communication between provider and patient. Project website, toll-free hotline, media releases, radio public service announcement.		Vaccination rates within six months of campaign launch were 2% higher in two of the four intervention counties compared with 96 non-intervention counties.	Not provided	n/a		
Duval et al., 2011 (7)	AMR	USA	Influenza & Pneumococcal & Hepatitis B	Adult	Low acceptance of vaccine.	Quality improvement activities - educational interventions to improve patient acceptance of vaccinations, educational interventions to improve staff participation in QI activities, improved techniques of quality improvement data collection and analysis by participants.		Baseline vaccination rates of 77.1% for influenza, 84.6% for hepatitis B, and 54% for pneumococcal pneumonia. After the educational intervention, immunisation rates for influenza, hepatitis B, and pneumococcal were 82.1%, 86.4%, and 65.5% respectively. The improved rate for pneumococcal pneumonia exceeded the CDC's recommended rate of 60%. However, the 90% immunisation rate goals for influenza and hepatitis B were not met after this initial QI project.	Yes for influenza and pneumococcal polysaccharide (both $p < 0.001$)	n/a		
Eckert et al., 2011 (150)	AMR	USA	Influenza	Adult	Low immunisation rates.	Educational sessions (in-clinic with peers); influenza prevention video in waiting room that played continuously in nine languages; dated stickers noting acceptance or refusal on front of obstetrics		High uptake rate (76%) which compares well with nationwide 38% (CDC) and 46.6% from ten states using the Pregnancy Risk Assessment Monitoring	Not provided	n/a		





						patient charts to prompt provider; standing orders; real-time electronic vaccine registry (updated daily) to identify patients who had not been vaccinated; patients contacted personally in their own language to encourage attendance for immunisation; transportation assistance.		System (PRAMS).				
Gargano et al., 2011 (207)	AMR	USA	Influenza	Adolescent	Low immunisation rates.	Arm one: a middle- and high school-based influenza vaccination intervention (educational material and free vaccination at school clinic); Arm two: a provider-based influenza intervention (educational material & free vaccination at HCP) and Arm three: A standard-of-care condition. Additional interventions: educational brochure, school presentations, community-based outreach.		School-based (72% increase in vaccination from baseline (p<.001)); Provider-based (33% increase from baseline (p=.006)) [County 1]. In phase one, school based approach (RR=2.4; 95%CI: 1.7-3.2) and provider based approach (RR=1.9; 95%CI: 1.4-2.5) improved uptake compared to standard of care approach. Both continued to increase in the second phase but only school-based continued to be significantly higher than the standard-of-care county (twice as likely to be vaccinated). School based approach (RR=2.3; 95%CI: 1.9-2.9) and provider based approach (RR=1.2; 95%CI: 0.97-1.5).	Not provided	n/a		
Harris et al., 2011 (45)	AMR	USA	Influenza	HCW	Low immunisation rates.	Survey to establish association between workplace exposure to vaccination reminders and rewards and being vaccinated for seasonal or H1N1 influenza.		No effect of reminders or rewards on either seasonal flu or H1N1 vaccination.	n/a	n/a		
Humiston et al., 2011 (43)	AMR	USA	Influenza	Elderly	Low immunisation rates.	Intervention (patient tracking, provider reminders, patient recall, outreach to patients i.e., telephone call) vs standard-of-care.		Higher vaccination rates in intervention group (64% vs 22%, p<0.0001); controlling for all other factors -	Yes	n/a		

								intervention group six times more likely to receive vaccine (aOR=6.27; 95%CI: 5.42-7.26).				
LaMontagne et al., 2011 (20)	SEA R, AM R, AFR, WP R	India, Peru, Uganda, Viet Nam	HPV	Community	Vaccine acceptance.	School-based vs health-centre based vs combined with other health interventions		Uptake achieved through school-based programmes was 82.6% (95% CI: 79.3–85.6) in Peru and 88.9% (95% CI: 84.7–92.4) in Uganda, and it increased between the first and second years in Vietnam, from 83.0% (95% CI: 77.6–87.3) to 96.1% (95% CI: 93.0–97.8). In India, where a combination of school- and health-centre-based delivery was used, the uptake achieved by the campaign approach ranged from 77.2% (95% CI: 72.4–81.6) to 87.8% (95% CI: 84.3–91.3) depending on the type of geographical area (i.e. urban, rural or tribal); similar findings were observed with the routine delivery approach. The highest uptake was achieved with the health-centre-based programme in Vietnam: 98.6% (95% CI: 95.7–99.6); the lowest uptake was found with the Child Days Plus programme in Uganda: uptake was 52.6% (95% CI: 47.3–57.9).	Yes	n/a		
Panda et al., 2011 (34)	AM R	USA	Influenza	HCW	Low immunisation rates.	Physician education programme and posters to offices offering prenatal care		Influenza vaccination rates increased (19% vs. 31% - pre-post intervention).	No		More patients remembered that the vaccine was offered to them during	

											pregnancy (28% vs. 51% - pre-post intervention)	
Payprom et al., 2011 (33)	SEAR	Thailand	Influenza	Adult	Low immunisation rates.	Educational leaflet based on the Health Action Process Approach (HAPA) and formulation of an action plan identifying where, when, and how they would seek vaccination vs standard government information leaflet.		No significant difference in vaccination rates.	n/a		Greater changes on measures of risk perception, outcome expectancies, self-efficacy and intention for intervention arm. Vaccination directly predicted by self-efficacy and intention.	
Smith et al., 2011 (68)	AMR	USA	Pneumococcal	Adult	Low immunisation rates.	Use of electronic technologies including: a revised nursing screening tool, a scheduled vaccine order, storage of vaccine in automated dispensing cabinets on the nursing unit, creation of a vaccine tracking system.		Increased vaccination rates (19.1% vs. 74.2%, p<0.001).	Yes	n/a		
Usman et al., 2011 (78)	EMR	Pakistan	DTP	Parent	Low socio-economic status causes dropout.	See Characteristics of Studies p.94.		Increased vaccination for all three non-standard care interventions (39% completed DTP3). Immunisation card (66%; RR=1.7; 95% CI = 1.5, 2.0); centre-based education group (61%; RR=1.5; 95% CI = 1.3, 1.8); and combined intervention group (67%; RR = 1.7; 95% CI = 1.4, 2.0).	Yes	n/a		
Abramson et al., 2010 (55)	EMR	Israel	Influenza	HCW	Low immunisation rates.	Lecture session given by a family physician, email distributed literature and reminders, key figure from the local staff who personally approached each staff member.		Increased vaccination with intervention (52.8% vs. 26.5% control; p<.001).	Yes	n/a		
Ajenjo et al., 2010 (54)	AMR	USA	Influenza	HCW	Low immunisation rates.	Multiple strategies used over the time period. Most successful were: Incentive program, use of declination statements.		Increased vaccination rates (45% in 1997 to 72% in 2007, p<.001) (across all interventions).	Yes	n/a		

Banerjee et al., 2010 (91)	SEA R	India	Childhood	Parent	Low immunisation rates.	See Characteristics of Studies p. 94.	↑	Addressing supply (A - 18%) and incentives (B - 39%) both increased full vaccination rates vs control (C - 6%). Incentives had highest impact. [RR B vs C was 6.7 (4.5-8.8) and RR B vs. A was 2.2 (1.5 to 2.8)]. Neighbouring villages of B were more likely to be fully immunised than those of A (1.9, 1.1 to 2.8).	Yes	n/a		
Akker et al., 2010 (116)	EUR	Netherlands	Influenza	HCW	Low immunisation rates.	Multi-component intervention. (A) Outreach visit with promotional materials - announcements for program, meetings and vaccination; personal invitation letter for the meetings; information leaflets; posters; reference to website; (B) Information meeting with plenary presentation on disease and vaccination; discussion in small groups; video with role models; held by specialised nurse; guided by protocol; (c) Appointment of physician as a local program coordinator to organise and promote vaccination.	↑	9% increase in vaccination uptake vs control (RR 1.59, 95% CI: 1.08-2.34, p = 0.02).	Yes	n/a		
Mouzoon et al., 2010 (37)	AM R	USA	Influenza	HCW	Low immunisation rates.	Employee survey about knowledge, education, making vaccines readily available and free-of-charge, immunisation nurses as clinical champions, monitoring and reporting vaccination rate, recognising clinic with highest rate.	↑	Rates increased from 36% to 64% over three year period of interventions being run.	Not provided	n/a		
Mouzoon et al., 2010 (40)	AM R	USA	Influenza	Maternal	Low immunisation rates.	Direct encouragement and behaviour modelling, implementing standing orders, offering vaccination training to obstetricians and nurses.	↑	Rates increased from 2.5% to 37.4% over three year period.	Not provided	n/a		


Prinja et al., 2010 (80)	SEAR	India	DPT	Parent	Cultural reasons for the delay in the first dose. HCW usually administer vaccine only to the resident population.	Community volunteers acting as community mobilisers; female multi-purpose health workers and part-time vaccinators to fill vacant positions/absenteeism at sub centres; micro-planning; continuing education sessions for doctors and health workers; intensive monitoring and monthly feedback.	↑	70% received a third DPT dose before the age of 6 months (vs pre-intervention 62%; p = 0.002). Mean age for first, second and third DPT dose administered decreased by 17, 21 and 34 days respectively (p for trend <0.0001). Village based volunteers seen as key elements of improvement.	Yes	n/a		
Uddin et al., 2010 (89)	SEAR	Bangladesh	EPI (BCG, DPT-1,2,3, Measles)	HCW, parents	Low immunisation rates.	Intervention package included: Extended EPI schedule (i.e. clinical hours); training for service providers on valid doses and management of side effects; a screening tool to identify immunisation needs among clinical attendees; EPI support group for social mobilisation (members included mothers of children who have completed all doses, school/college students, school teachers, Imams, local elites, and health service providers)	↑	99% fully immunized post-intervention vs 43% pre-intervention. 1% dropout post-intervention vs 33% pre-intervention.	Not provided	n/a		
Nicholson et al., 2009 (35)	AMR	USA	Influenza	HCW	Low immunisation rates.	Nursing department used to recruit flu coordinators from other hospital departments to coordinate administration of vaccinations. Education provided to coordinators along with list of employees, vaccination supplies and consent/declination forms.	↑	20% increase in vaccination since previous influenza season.	Not provided	n/a		
Nyamathi et al., 2009 (15)	AMR	USA	Hepatitis A & B	Adult	Low immunisation rates/complex environment	(A) Nurse case-managed sessions plus targeted hepatitis education, incentives and tracking vs (B) standard targeted hepatitis education plus incentives and tracking vs (C) standard targeted hepatitis education and incentives	↑	(A) 68% uptake vs (B) 61% vs (C) 54% completed three-series vaccine at six months.	Not provided	n/a		



						only.						
Uskun et al., 2008 (9)	EUR	Turkey	Childhood	HCW	There is a gap between the EPI targets and the vaccination uptake rates in certain provinces.	See Characteristics of Studies p.94.		Increased uptake rates for all vaccines on national schedule ($p < 0.001$) at intervention sites, particularly for Hepatitis B (all doses; 3 rd dose increased from 14.5% in 2003 to 31.4% in 2004) and third dose (DTP/OPV) (increased from 22.2% in 2003 to 31.4% in 2004).	Yes	n/a		
Walter et al., 2008 (28)	AMR	USA	Influenza	Adult	Low immunisation rates.	Postcard reminders with extra educational message (control was standard postcard reminder) and practice improvement interventions (implementation of at least one office-based intervention to improve rates based on practice feedback of barriers).		No effect.	n/a	n/a		
Campbell et al., 2007 (13)	AMR	USA	Hep. A & B	Adult	Low immunisation rates.	Convenience (available onsite immediately vs available after serologic results), monetary incentives (\$5 per dose).		Vaccination significantly higher when available immediately on site [AOR = 48.6, 95% CI = 35.7-66.0] or off-site with incentive [AOR = 11.2, 95% CI=8.1-15.6]; lowest when offered only after receiving results (6-8 weeks later). NB - of 83% willing to be vaccinated - only 36% received one or more doses.	Yes	n/a		
Kimura et al., 2007 (42)	AMR	USA	Influenza	HCW	Low immunisation rates.	Education campaign (in-service training with education video and Q&A brochure, flyer with pay checks, posters in common areas) plus Vaccine Day (well publicised day with free vaccinations offered onsite) vs. Vaccine Day only vs		Increased vaccination rates. Highest for Education plus VD (53%; PR=1.45; 95% CI = 1.24, 1.71); then VD only (46%; PR=1.41; 95% CI = 1.17, 1.71. Education only NOT effective (34%; PR=1.18; 95% CI = 0.93,	Yes	n/a		






						Education only vs. control.		1.50). Control was 27%.				
Weaver et al., 2007 (27)	AMR	USA	Influenza	Adult	Low immunisation rates.	Patient reminder letters and education; provider reminders and posters; computerized clinical reminders for vaccination targeted to spinal cord injuries & disorders (SCI & D); standing orders.	↑	Moderate increase in vaccination rates (33% baseline to between 62.5% - 67.4% post-intervention; p = 0.004).	Yes	n/a		
Harari et al., 2008 (143)	EUR	UK	Pneumococcal	Elderly	Low immunisation rates.	Completion of self-administered Health Risk Appraisal for older persons with individualised written feedback to patient and their GP.	↑	Slightly higher vaccination uptake (no figures available); No effect on other categories of health behaviour or preventative care.	Not provided	n/a		
Samuels et al., 2008 (94)	AMR	USA	Childhood	Parent	Late onset special health care needs/high family incomes	Additional nurse practitioner time at medical home.	▬	No effect.	n/a	n/a		
Jung et al., 2013 (148)	AMR	USA	Herpes zoster	Adult	Cost and access barriers.	Free vaccination.	↑	Those who received the shingles vaccine, 98.0% (95%CI: 95%-100%), was significantly greater than the proportion in the group that declined, 74.2% (95% CI; 64%-85%) (P<.0001).	Yes	n/a		
Galagan et al., 2013 (21)	AFR, WP R	Uganda, Vietnam	HPV	Parent	Influences of parental acceptance of HPV.	Exposure to community influencer(s) with whom parents spoke prior to vaccination (e.g., trained health personnel or family/community members) vs IEC materials and activities received by parents (e.g., leaflet, radio program, attending group meeting).	↑	Exposure to community influencers associated with uptake (all <0.001) (Uganda); Trained personnel < (0.002) and parent/in-law/spouse/other relative (0.003) (Vietnam).	Yes			
Fiks et al., 2013 (22)	AMR	USA	HPV	HCW, parent	Low immunisation rates	Automated decision-support for Families (e.g., reminder calls) vs clinicians (e.g., auto-alerts & education) vs. both vs no intervention.	↑	Clinician-focused intervention most effective for initiating vaccination series (p=.003 against control); family-focused better for promoting	Yes			

								completion (p=<.001 against control; p=.02 against clinician for dose 1 and p=.30 against clinician for dose 2).				
Honda et al., 2013 (44)	WP R	Japan	Influenza	HCW	Implementing mandatory vaccination programmes challenging due to religious, philosophical and medical reasons.	Multifaceted intervention including (1) use of a declination form, (2) free vaccination, (3) hospital-wide announcements during the vaccination period, (4) prospective audit and real-time telephone interview for healthcare workers who did not receive the vaccine, (5) medical interview with the hospital executive for noncompliant (no vaccine, no declination form) healthcare workers during the vaccination period, and (6) mandatory submission of a vaccination document if vaccinated outside of the study institution.	↑	With the new multifaceted intervention, the vaccination rate in the 2012-2013 season increased up to 97% (p<.001) vs previous season 2011-2012. This rate is similar to that reported in studies with a mandatory vaccination program. Improved vaccination acceptance, particularly among physicians, likely contributed to the overall increase in the vaccination rate.	Yes	n/a		
Al-Tawil et al, 2013 (8)	EM R	Egypt	Hep. B	HCW, adult	HCW and haematological patients needing blood/ blood product transfusion are particularly vulnerable to blood born infections (BBI) including viral hepatitis.	Infection control as a part of hospital procedures: included educational sessions about mode of transmission, sequelae, HBV vaccine, blood testing for Hepatitis, post-exposure management following sharps injury. In-situ tutorials in respective work places focused on enhancing infection control practice including proper hand-washing techniques, gloves, dealing with sharps and blood, sterilisation, brochures and posters including demonstrations and contact numbers of infection control unit. Parallel education for patients through focused sessions, interactions, hand-outs, brochures and posters.	↑	Baseline knowledge regarding HBV transmission, sequelae and preventive measures, was poor in both groups. Only 38% of patients and 40% of nurses received HBV vaccination. Targeted infection control policy and procedures significantly improved knowledge and awareness regarding HBV in both groups. Vaccination uptake significantly increased and reached 88.7% for nurses and 72% for patients.	Yes	↑	Positive attitude towards HBV vaccination improved for nurses (94.6%) and patients (97.3%), became aware of vaccine availability. All nurses and patients believed in effectiveness of the vaccine to prevent HBV infection and will take the vaccine if recommended by their physicians.	Yes
Rahman	EM	Iraq	DTP &	Religious	Low	A visit was carried out to the family	↑	The vaccination uptake rates	Yes	n/a		

et al., 2013 (76)	R		measles	leaders, communit y	immunisatio n rates.	<p>of the local sheikh who was the most influential spiritual leader for the Sorchi population, to request their help in improving vaccination uptake among their tribe. The sheikh's family sent a verbal message to their recognized representatives in all tribal villages that the vaccination programme is of great benefit for people in preventing many diseases and that they were requesting all families of the tribe to vaccinate their male and female children, as they did with their family and relative's children. For the health education stage each of the 30 selected villages was offered a visit. During each visit the planned health education programme was applied by one of the researchers with two paramedics from the vaccination unit. Invitation for attendance was done using loudspeakers, sending children to nearby houses and interpersonal communication. The activities included lectures, posters and a video film with the participation of local peer leaders. The sessions were held at places known to the villagers as collection sites during special occasions. Recognised representatives of the local sheikh's family were involved with the team in all 15 Sorchi villages.</p> <p>The post-intervention stage lasted six months. All the procedures conducted, other than health education, were exactly the same</p>		<p>of DPT1, DPT2, DPT3 and measles vaccines during the post-intervention period (January to June 2007) were significantly improved (95.5%, 90.0%, 84.4% and 80.3% respectively) compared with the pre-intervention period (January to June 2006) (55.9%, 42.7%, 21.5% and 27.6% respectively). The dropout rates of those vaccines were also significantly decreased. Vaccination in villages where spiritual leaders were involved improved significantly more than other villages.</p>			
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						as in 2006, i.e. the routine vaccination programme usually conducted by the local Department of Health. The researchers kept a neutral attitude during the post-intervention.						
Beggs et al., 2012 (99)	AMR	USA	Pneumococcal, Herpes Zoster, Tetanus (Adult)	HCW.	Vaccine use in adults is suboptimal due to vaccines being overlooked or designated as less important given the possibility of more acute health issues identified at physician visits. Adult patients are often unaware of routine vaccination recommendations.	A chart review focusing on vaccination rates of herpes zoster, tetanus and pneumococcal vaccinations was conducted at baseline and included an educational intervention which included presenting baseline vaccination rates to the medical residents at a primary care centre and posting weekly educational flyers focusing on the targeted vaccines. A multiple choice survey was administered baseline and after the intervention to evaluate a change in resident knowledge of vaccine recommendations.	n/a				Only one of the nine vaccine-related questions demonstrated statistical knowledge improvement from before to after intervention (question 9 focusing on herpes zoster). Results comparing number of indications, specific indications, revaccination, and previous vaccination status were similar before and after the intervention. Three survey questions demonstrated statistically significant differences in regards to resident characteristics after the intervention.	One question


Camurdan et al., 2012 (51)	EUR	Turkey	Influenza	Parent	The vaccination rates of children with chronic illnesses against vaccine-preventable diseases are low especially for influenza.	Diabetic children and their families were invited to participate in a meeting held to give them information about the influenza vaccine and filled in a questionnaire covering their demographic data, the previous vaccination recommendations of the clinicians that were in charge of their follow-up, previous vaccinations of seasonal influenza and/or 2009 pandemic H1N1, and any self-afforded vaccines. During the meeting, the necessity, benefits, adverse-effects and other information about the influenza vaccine were given by a social paediatrician and they were recommended by their paediatric endocrinologist to receive the vaccine every year. A vaccine-card was given to every patient having the warning "Influenza vaccine should be performed in September 2011" on it. All the families were called by phone and asked whether they were reminded about the vaccination at the follow-up visits after the meeting and whether they had received the vaccination and the reasons if they had not.		The 2010 influenza vaccination rate of 28.5% increased to 50.0% ($p=0.0001$). The only independent contributing factor to the influenza vaccination rate in 2011 was "receiving the influenza vaccine in the previous (2010) season" and it had a coefficient of 2.4 affecting the intervention success ($\beta=2.4$, CI 95%=1.2-5.3, $p=0.03$). The most important factor in increasing the rate of influenza vaccination among diabetic children is "recommendation by the physician" who is in charge of taking care of them and the recommendation should be reinforced by consecutive reminders.	Yes	n/a		
Zimmerman et al., 2009 (26)	AMR	USA	Influenza	HCW	Low immunisation rates.	Education, publicity and free and easily accessible influenza vaccines, mobile vaccination carts and incentives. Interventions offered as (1) Publicity and education only, (2) 1 and carts, (3) 1 and incentives, (4) 1 and carts and incentives. Intervention groups divided by:		Vaccination rates across healthcare personnel increased from 32.4% to 39.6% ($p<.001$). Data given on differential effectiveness of different groups of interventions - for example, Incentives + carts + publicity and education had	Yes	n/a		

						business and/or admin roles / indirect patient contact / direct patient contact.		the largest effect on direct patient contact rates (10.3% increase, $p < .001$) but for indirect patient contact, incentives plus publicity and education had a greater effect (10.5% increase; $p < .001$) than using all interventions (5.9%, $< .001$).				
Dorototaj et al., 2008 (49)	AMR	USA	Influenza	HCW	Low immunisation rates.	(1) Multi-component approach - educational posters, newsletters, t-shirts, buttons, department meetings, extended opening hours for vaccination) vs (2) Educational letter from head of infectious diseases vs (3) Incentive - raffle ticket with \$3000 holiday vs (4).		No significant difference across intervention groups. Control (38%) vs letter (39%) vs raffle (42%) vs letter and raffle (44.5%) ($p = .66$). Also no difference across occupation: registered nurses (42.5%) vs licensed practical nurses (38.5%) vs resident (41%) vs professional staff (42.5%) ($p = .87$).	No	n/a		
Pandey et al., 2007 (81)	WPR	Australia	Pneumococcal	HCW, parent	Lack of awareness about entitled health and social services contribute to poor delivery of such services especially among those of low socioeconomic status.	See Characteristics of Studies p.94.		Moderate increase in vaccination. Data not explicit regarding numbers and significance.	Not provided		Moderate levels of increased awareness and use of promotional materials. No further data available.	Not provided
Djibuti et al., 2009	EUR	Georgia	DTP-3, Polio, Hep. B	HCW	Issues of human resources	'Supportive supervision' - Package of activities including: supportive supervision guidelines for district		Increased district -level DTP-3 immunisation uptake rate (Pre-post: Intervention:	Yes (for DTP3).		Intervention districts significantly increased uptake rates for DTP-	Yes


(208)					and its management (health system).	immunisation managers, district-level training in continuous supportive supervision, monitoring and evaluation of performance, funding to carry out intervention. Introducing updated job descriptions with documented lines of supervision; b) improving communication lines and skills, and c) introducing guidelines and tolls for supervision, performance review and monitoring, and evidence-based action planning.		77.4% to 89.1%) (p=0.000) vs (control: 81.3% to 84.8%) (p=0.371. Polio-3 uptake: Intervention (64.1% to 90.6%)(p=0.000) Control (65.2% to 82.2%)(p=0.013) Hep-B-3 uptake intervention (62.9% to 81.5%)(p=0.002) control (58.8% to 68.1%)(p=0.001).			3 by 11.7% (P = 0.000), decreased contraindication rates by 1.93% (p = 0.057), decreased refusal rates by 1.47% (p = 0.044), and increased number of vaccinated children per 100 dose by five for DPT (p = 0.016), by six for OPV (p = 0.029), and by seven for HEP B vaccines (p = 0.022).	
Igarashi et al., 2010 (92)	AFR	Zambia	Childhood	Community	Low immunisation rates.	Growth Monitoring Programme Plus (GMP+) - sessions conducted monthly and provided essential child health services including - growth monitoring, immunisation, vitamin A supplementation, deworming, nutrition counselling, family planning, community referral, oral rehydration salts distribution, and the promotion of key child health behaviours. Community volunteers received training to equip them with competent operational and managerial skills in organising the implementation of the GMP+.	↑	Full immunisation uptake increased significantly in the intervention arms (both primary and lagged) (p<0.001).	Yes	n/a		
Goel et al., 2012 (67)	India	SEAR	Childhood	HCW / Women's groups / Government	Very low immunisation rates.	<i>Muskaan Ek Abhiyan - The Smile Campaign</i> . Strengthening micro-plans, enhanced inter-sectoral coordination (policy), increased involvement of women groups in awareness generation, enhanced political and budgetary support, strengthening of monitoring and supervision, performance-based incentives to service providers.	↑	Proportion of fully immunised 12-23 month old children in Bihar increased significantly from 19% (2005) to 49% (2009) (p<0.001) BCG (52.8% to 82.3%) (p<0.001) DPT-3 (36.5% to 59.3%) (p<0.001) OPV-3 (27.1% to 61.6%)	Yes	n/a		


								(p<0.001) Measles (28.4% to 58.2%) (p<0.001) Also, improvement compared with other Empowered Action Group States (Bihar 16% to 26%).				
Wang et al., 2007(209)	WP R	China	Hep. B	Community	Low immunisation rates.	Cold-chain interventions. (1) Vaccine inside the cold chain and administered in township hospitals vs (2) Vaccine stored outside the cold chain in villages and administered by village-based health workers to infants at home vs (3) Same as (2) but with HB-Uniject outside the cold chain. Training of immunisation providers and public communication conveying importance of birth dose performed across all groups.	↑	Among children born at home, timely administration (within 24 hours after birth) increased in all groups. (1) from 2.4% to 25.2%, (2) from 2.6% to 51.8%, (3) 0.6% to 66.7% (for all p<0.001).	Yes	n/a		
Melinkovich et al., 2007 (90)	AM R	USA	Childhood	Community	Low immunisation rates.	Quality improvement measures - immunisation registry (e.g., standing orders, reminder/recall for parents), clinic-specific feedback on immunisation levels, team-based meetings, staff education, Immunisation Protocol development, sharing immunisation "best practices", celebrating successes.	↑	21-23 month old cohort - immunisation rates increased 26% (from 66% in 1996 to 92% in 2006). 24-35 month old cohort - Increased 47% (from 38% in 1995 to 85% in 2006). Overall trend is that as increasing number of quality improvement measures are implemented, the rates increase (registry implementation looks like it had the largest effect).	Not provided	n/a		
Nace et al., 2007 (36)	AM R	USA	Influenza	HCW	Few studies address improvement efforts aimed at long term	A needs analysis was conducted to determine the organisational and individual level barriers to influenza vaccination of staff. Systems changes, educational interventions and reminders were implemented	↑	Immunisation rates improved from 54% to 55% to between 74% and 95% over the past 4 years.	Yes	n/a		




					care staff influenza immunisation.	based on the barriers assessment.						
Ferguson et al., 2010 (48)	WPR	Australia	Influenza	Community	Low awareness of RV infection and preventive measures.	Patient and family education in Hematopoietic stem cell transplantation (HSCT): improving awareness of respiratory virus infection and influenza vaccination. A descriptive study and brief intervention.	↑	Household vaccination at HSCT admission was 71% for attenders and 30% for non-participants (RR 2.38, 95% confidence interval (CI) 1.49-3.80, P<0.0001).	Yes	↑	Increased awareness that influenza post-HSCT could be fatal or require intensive care (68-87%, P=0.003), knowledge of effective prevention strategies (41-78%, P<0.0001) including vaccination (11-58%, P<0.0001) and belief among family/friends (but not patients) that household vaccination reduces influenza risk post-HSCT (57-97%, P<0.0001 and 76-81%, P=0.2, respectively).	Yes
Gottvall et al., 2010 (104)	EUR	Sweden	HPV	Adolescent	Low knowledge and awareness of HPV infection and vaccination.	Educational intervention: classroom lesson, website and a folder.	n/a			↑	At baseline, the median score for HPV knowledge was one out of ten in both groups. At follow-up, the median knowledge score had increased to six in the intervention group but was still one in the comparison group (P < 0.001). Attitudes to HPV vaccination, condom use and pap smear testing remained the same (P	HPV knowledge: yes. Pap smear


											> 0.05).	te sti ng an d co nd o m us e: no .
Hsu et al., 2010 (110)	AMR	USA	Hep. B	Adult	Asian Americans are disproportionately affected by Hepatitis B. Knowledge and awareness of prevention strategies such as receiving hepatitis B vaccination.	Examination of baseline characteristics and educational intervention, infection status, and missing responses of at-risk Asian Americans.	n/a				The mean pre- and post-test scores were different by group (P < 0.01). All groups had significantly improved knowledge of prevention (F = 7.65, P < 0.01). Age and race were positively related to immunisation status, with older participants more likely to get vaccinated (OR = 1.02, CI = 1.00-1.03). Chinese, Korean and Vietnamese were more likely to receive vaccination. For infection, only gender was correlated with infection status, with odds of being HBV carriers for females being 74% less than	Yes




												that for males (OR = 0.26, CI = 0.07-0.90).
Akker et al., 2010 (116)	EUR	Netherlands	Influenza	HCW	Low immunisation rates.	Cluster RCT among 33 Dutch nursing homes to assess the effects of a systematically developed multi-faceted intervention programme on influenza vaccine uptake among HCW.	↑	Significantly higher though moderate influenza vaccine uptake among HCW in nursing homes.	Yes	n/a		
Swenson et al., 2012 (98)	AMR	USA	Pneumococcal, Influenza and Tetanus	Adult	Low immunisation rates.	An adult immunisation improvement project was undertaken in a large integrated, safety-net health care system. A Clinical Decision Support System (CDSS) was developed to query patient records and identify patients eligible for vaccination and then generate a statement that recommends immunisation or indicates a previous refusal. A new agency policy authorised medical assistants and nurses in clinics and nurses in the hospital, to use the CDSS as a standing order. Immunisation delivery work flow was standardised and staff received feedback on immunisation rates.	↑	10% improvement in immunisation rates in adults 65 years of age or older and in younger adults with diabetes or chronic obstructive pulmonary disease. Overall, the improvements were sustained beyond the project period. The CDSS was expanded to encompass additional vaccines.	Yes	n/a		
Maltezu et al., 2008 (38)	EUR	Greece	Influenza	HCW	Low immunisation rates.	Mobile vaccination team, informative leaflets, informing the manager of the hospital and the directors of the departments about the significance of increasing HCW influenza vaccination and organising a vaccine programme, training the infection control nurse about the programme, appointing a specific person for organising the programme use of informative	↑	The mean HCW vaccination rate against influenza during 2005-2006 was 16.36% compared with 1.72% during the previous season. Logistic regression analysis showed that the implementation of the following strategies was significantly associated with influenza vaccination rates above the mean vaccination	Yes	n/a		

						posters, leaflets and videotapes, organising lectures on nosocomial influenza, scheduling frequent informative meetings with personnel, vaccination of personnel in a specifically designed area, organising massive vaccination prescription in a designated area and lectures on influenza and influenza vaccine.		rate: a mobile vaccination team (OR 2.942, 95% CI 1.154-5.382, p-value 0.016) and lectures on influenza and influenza vaccine (OR 2.386, 95% CI 0.999-5.704, p-value 0.036).				
Boom et al., 2007 (106)	AMR	USA	Childhood	HCW	Children continue to fall behind the recommended vaccination schedule at an early age.	Provider education programmes that use academic detailing to improve immunisation-related behaviours in private provider offices. The intervention included peer-based academic detailing in which teams of one physician, one nurse and one office manager visited paediatric and family practices to deliver an educational presentation and develop practice-specific action plans.	n/a				Comparison of pre-post intervention surveys showed that providers' willingness to give the maximum number of immunisations due at one visit ($P < .001$) increased. More providers reported routinely screening immunisation records at sickness or injury visits ($P < .05$) and using minimum intervals ($P < .001$) post intervention. Mean change in baseline and post intervention overall scores was significant for paediatric practices (0.40, $P < .05$), small practices (0.64, $P < .01$), Vaccines for Children (VFC) practices (0.74, $P < .05$), and non-VFC provider practices (0.67, $P < .01$).	Yes except for family or large practices.

Llupia et al., 2010 (41)	EUR	Spain	Influenza	HCW	Low immunisation rates.	Active vaccination campaign promoting communication among HCW. Compared free mobile vaccination teams without and with strategies promoting HCW involvement by means of weekly educational and promotional messages through electronic mail, including two prize draws for vaccinated HCW and a web page including pictures of vaccinated HCW and all senior hospital management. Weekly uptake were publicised, the staff of mobile units was increased and their routes in the hospital were advertised.		Uptake was 23% (95% confidence interval [CI], 22.5%-24.9%) in the 2007-08 season and 37% (95% CI, 34.7%-37.4%) in 2008-09 season. The vaccination rate was highest in HCW aged > or =65 years and in physicians. The weekly vaccination rates were significantly higher for the 2008-09 season compared with the 2007-08 season except for the first and third weeks; for example, in week two, the rate was 1.7 HCW per 100 persons-week (95% CI, 1.3-2.1) in 2007-08, compared with 3.7 HCW per 100 persons-week (95% CI, 3.2-4.4) in 2009-09. Rate increases were concentrated in the first weeks of the program, with a peak occurring in week 3 during the 2007-08 season and in week 2 during the 2008-09 season.	Yes	n/a		
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Malmvall et al., 2007 (39)	EUR	Sweden	Influenza	Elderly	Low immunisation rates.	Multi-professional action group and designed a primary health care-based programme. This included free vaccination, an education programme targeting primary health nurses, mass media information through adverts in newspapers, local TV, posters and hand-outs and instituting and implementing a computerised registry with easy access to summary statistics by which each unit could compare its achievements with others.		During a four year period, the immunisation rate among all inhabitants of the county aged 65 years increased from 45% to 70%. All the 13 municipalities in the county increased their vaccination rate; their recent figures vary between 61% and 74%. The vaccination rate among people aged 65 years in Jönköping County is now the highest in Sweden.	Yes	n/a		
de Juanes et al., 2007 (50)	EUR	Spain	Influenza	HCW	Low immunisation rates.	Health promotion campaigns within hospital, designed to increase vaccination uptake over three consecutive vaccination campaigns (2001–2002 to 2003–2004). The health promotion tool used in 2001–2002 and 2002–2003 were informative posters distributed throughout the hospital. In the 2003–2004 season, the recommendation was also published in the internal bulletin and web site of the hospital. In addition, a physician and a nurse from the Department of Preventive Medicine visited all departments offering vaccination in the work place.		Uptake in the 2001-2002 campaign was 16% with uptake of 11.5% in nurses and 15% in physicians. In the 2002-2003 and 2003-2004 campaigns the overall vaccination uptake was 21% and 40%, respectively (p<0.01). Staff physicians and resident physicians reached 60 and 42% uptake rates in the 2003-2004 campaign but uptake in nurses and nursing assistant remained around 30% (p<0.01).	Yes	n/a		
Schechter et al., 2010 (108)	USA	AMR	Childhood	Community	The pain and distress associated with vaccination are disconcerting to	Educational outreach to reduce immunisation pain in office settings.	n/a				Significant changes from baseline were identified at one and six months after the intervention. At one month, parents were more likely to report receiving information	Yes



					children, their parents and health care providers. For a subgroup of children, these procedures dominate the entire medical encounter and cast a shadow over the relationships of the children with their health care providers.						(P = .04), using strategies to reduce pain (P < .01), learning something new (P < .01), using a ShotBlocker (P < .01), using sucrose (P < .01), and having higher levels of satisfaction (P = .015). At 6 months, all rates remained significantly higher than baseline findings (all P < .01) except for satisfaction. Clinician surveys revealed significant increases in the use of longer needles, sucrose, pinwheels, focused breathing, and ShotBlockers at 6 months.	
Sheikh et al., 2009 (109)	WP R	Australia	Childhood	Refugees	Problems of finance, language, health, culture, socio-economic deprivation. The lack of knowledge of the local healthcare services has compounded these challenges.	The impact of intensive health promotion to a targeted refugee population on utilisation of a new refugee paediatric clinic at the children's hospital at Westmead.	n/a				Effective in increasing attendance for target communities compared to the non-targeted communities (OR for African families attending clinic 3.0, 95% CI=1.5-6.2, p<0.001). Significant change in parental knowledge, attitudes and beliefs about infectious diseases after attending the clinic, including decreased	Yes



											stigma around tuberculosis, more awareness of the seriousness of some infections, and increased awareness of the role of immunisation in prevention of infectious diseases.	
Coady et al., 2008 (162)	AMR	USA	Influenza	Community	Influenza vaccination rates are particularly low among marginalised hard-to-reach urban populations such as substance abusers, undocumented immigrants, and homebound elderly.	Project VIVA: A multilevel community-based intervention to increase influenza vaccination rates among hard-to-reach populations in New York City.	n/a				Increased interest in receiving the influenza vaccine post intervention ($P<.01$). Being a member of a hard-to-reach population ($P=.03$), having ever received an influenza vaccine ($P<.01$) and being in a priority group for vaccination ($P<.01$) were also associated with greater interest in receiving the vaccine.	
Schensul et al., 2009 (31)	AMR	USA	Influenza	Adult	Hospitalisation and death rates due to influenza have increased over the past two decades, primarily among	Regular attendance at twice-a-week meetings for two months, followed by the development of a flu campaign. Volunteers learned that through participation they could help other building residents, acquire new experiences and lose their own fear of vaccination. Influenza Strategic Alliance (I.S.A.). –provide ongoing financial, scientific, and vaccination support. The I.S.A. met on a bi-monthly basis		The vaccination rate in the intervention building at post-test exceeded the study goal of 70% and showed a significant improvement over the control building.	Yes		Improvements in pro-vaccination knowledge, beliefs, and understanding of health consequences.	Yes

					adults 65 and over.	to discuss project strategy and resources. The desired outcomes were promotion of peer delivered pro-vaccination messages in the study area and continuing intervention programming. Members provided updates on vaccine availability, participated in training sessions, flu fairs, vaccination clinics and conference presentations; provided ongoing support and advocacy; and promoted the V.I.P. Project and the work of the V.I.P. Committee through regional network referrals and public forums. V.I.P. Committee members met the members of the I.S.A. at training sessions, learned about their resources, and were able to connect with I.S.A. members as needed. The training process was governed by a constructivist approach that linked science-based public health information and indigenous knowledge and beliefs.						
Spleen et al., 2012 (19)	AMR	USA	HPV	Parent	African American and Hispanic parents/guardians of 11–18 year old girls in an economically disadvantaged area of Los Angeles	60 minute PowerPoint presentation, Understanding HPV, which included time for group discussion. Guided by the Health Belief Model, the presentation was adapted from a previous ACTION Health HPV educational initiative for young women, 18–26 years of age. Two professional health educators from the local community delivered the educational intervention, which included information about HPV, its	↑	44.4% of participants reported that they started vaccination.	Yes	↑	HPV-related knowledge increased for all participants ($p < 0.0001$) and among parents ($p < 0.0001$). Intent to vaccinate daughters within one month increased among parents ($p = 0.002$). Of nine (23.7%) parents who completed the follow-up interview, 100% reported the	Yes

					County: only one quarter of adolescent girls had initiated HPV vaccination by mid-2008.	mode of transmission and causative effects on cervical cancer and genital warts, and HPV vaccine-related facts, including where the vaccine could be obtained, costs, insurance uptake, and economic eligibility for patient assistance programs.					intervention as helpful.	
Wallace et al., 2008 (69)	WP R	Australia	Pneumococcal	Elderly	Low awareness of the vaccine.	Television advertising to increase pneumococcal vaccination uptake among the elderly.	↑	During and immediately following the campaign; 702 more vaccines were ordered by North Coast immunisation providers than during the corresponding period in 2005, an increase of over 33%. This was considerably different to the experience in the remainder of NSW, where 7,190 fewer vaccines were ordered during June to September 2006 than in the comparable period in 2005, a drop of 28%.	Yes	n/a		
Pollack et al., 2011 (166)	AM R	USA	Hepatitis B	Asian Americans	High prevalence of HBV among Asian Americans but limited access to care due to knowledge impairment, & cultural, linguistic and	Pilot programme to provide HBV education, screening and vaccination and free or low cost treatment.	↑	No baseline data on vaccine uptake presented and not a population based sample.	n/a	n/a		




					financial barriers.							
Waisbord et al., 2010 (171)	AFR / EMR / SEAR	Afghanistan, India, Pakistan & Nigeria	Polio	Families of children < 5 years of age	Pockets of under-immunised children remain which are undermining eradication efforts.	<p>Review of specific communication activities to target vaccine decliners.</p> <p>India – use of community mobilisation coordinators visit houses with unimmunised children, follow-up pregnant women and identify hard-to-reach populations.</p> <p>Pakistan / Afghanistan – activities to target nomadic populations – establishment of cross-border vaccination posts; additional vaccination activities outside supplementary immunisation activities; mapping nomadic movements during campaigns and development of micro-plans; engagement of religious leaders to counter fatwabs against OPV; strategies to reach female caregivers in Afghanistan.</p> <p>Nigeria – increased national and local concern following increase in cases in 2008 helped to improve uptake in 2009.</p>	↑	communication activities correlated with changes in vaccine uptake – no specific evaluation of any intervention.	n/a	n/a		
Talbot et al, 2010 (29)	AMR	USA	Influenza	HCW in university hospitals	Sub-optimal uptake of influenza vaccination among health care workers.	Assessment of programmatic factors associated with vaccination of HCW in different university hospitals.	↑	Hospitals with weekend provision of vaccination (58.8% with vs 43.9% without; p=0.01); train the trainer programmes (59.5% with vs 46.5% without; p=0.005); report of vaccination rates to administrators (57.2% vs 48.1%, p=0.04) or to the board of trustees (63.9% vs	Yes	n/a		




								53.4%, p=0.01), letter to employees (59.3% vs 47.0%, p=0.01) and leadership support (57.9% vs 36.9%, p=0.01) all increased vaccination. Requirements to fill a declination form was not associated with vaccination (56.9% vs 55.1%, p=0.68).				
Gunn et al., 2007 (6)	AMR	USA	Hepatitis B (HB) vaccine	Men who have sex with men (MSM) and other clients attending an urban STD clinic	Low uptake rates of HB vaccine among high risk groups such as men who have sex with men (MSM).	Clients of an urban STD clinic were offered HB vaccination. Various strategies to optimise acceptance and uptake included informational counselling when the vaccine was offered (approximately 50% of all clients); active follow-up by case managers of high-risk drop-outs (over a 26 month period only).		66% of clients (69% of MSM & 68% of other clients) accepted vaccination. 55% received a second dose and 33% a third dose. Presence of Hepatitis counsellors increased vaccine acceptance by 15% (from 66% to 77%) [RR=1.15; 95%CI: 1.13-1.18; p<0.0001]. Clients who received counselling had higher acceptance (80%) compared to those who did not (74%) [RR=1.08; 95%CI: 1.05-1.12; p<0.0001]. 33% vaccine completion rate (43% among MSM compared to 32% among other clients; RR=1.4; 95%CI: 1.3-1.5; p<0.001). Direct contact with a case manager (telephone or in-person) increased completion rates among high-risk drop-outs (41%) compared to indirect contact (letter, phone message) (11%) (RR=3.7; 95%CI: 3.1-4.9; p<0.0001).	Yes	n/a		
Slaunwhite et al.,	AMR	Canada	Influenza	HCW	Acceptance of influenza vaccination	Cluster trial to study the effect of unit based champions on vaccine uptake, with hospital work units as		Vaccine uptake was higher (52%) in units with a champion compared to those	Yes	n/a		


2009 (30)					among HCW is low.	the unit of analysis. Work units were matched on previous year's vaccination rates, physical size and primary function. Champions encouraged co-workers to accept vaccination.		without (41%) (95%CI for increase 2.9-18.2; p<0.03). Units with a champion had a 10% increase in uptake from the previous year (95%CI: 4.8-13.6) from 44% to 54% (p<0.001); units without a champion had only slight increases (from 38% to 41%; p=0.25).				
Lahariya et al., 2007 (66)	SEA R	INDIA	Polio	Families of children < 5 years of age	Low uptake of vaccination during national immunisation days (NIDs).	Semi-structured interviews, focus group discussions and health education to increase participation in consecutive rounds of NIDs. IEC to all households regardless of whether they have a child of < 5 years. Engagement of local schools and shopkeepers in the area to motivate the community to participate in NID.		Prior to study most children (>60%) were immunised house to house rather than using polio booth. 59% of mothers did not use booths because they expect someone to visit the house to vaccinate child, 51% did not know date of next NID and 47% did not know location of booth. Only 20% of mothers knew that all children under five should get polio drops. Following IEC there was an increased response to NID. Uptake increased from 39% to 87%. <50% of caregivers were told next date of NID, only 23% were advised about routine vaccination and 32% did not know that polio was not a substitute for routine vaccination. Most caregivers did not know about cause or mode of transmission of polio.	n/a	n/a		
Shukr et al., 2010 (65)	SEA R	India	Polio	Families of children < 5 years of	Resistance to polio vaccination during NIDs.	See Characteristics of Studies p.94.		Of 404 reluctant parents, 168 (42%) declined vaccination despite counselling. 132 (32.5%) declined for religious	n/a			

				age				reasons.				
Szilagyi et al., 2011 (168)	AMR	USA	Routine adolescent vaccinations (meningitis, pertussis & HPV).	Adolescents aged 11 to 15 years	Low rates of immunisation and preventive care visits in urban adolescents.	Practice based immunisation navigators implemented a programme of vaccination tracking, reminder/recall and outreach/home visits to encourage vaccination among those delayed or under-vaccinated.	↑	Uptake rates were 44.7% for intervention group and 32.4% for control group (aRR=1.4; 95%CI: 1.3-1.5), immunisation rates for individual vaccines and for all three vaccines combined were 12 to 16 percentage points higher for the intervention than the control group. aRRs ranged from 1.2 to 1.5. Preventive care visit rates were 68% for intervention group & 55.2% for control (aRR=1.2; 1.2-1.3).	yes			
Schwarz et al., 2008 (11)	AMR	USA	HB	Homeless adolescents & children (2 to 18 years of age)	HB uptake rates are low in homeless youth and they are at increased risk of infection.	A shelter based HBV vaccine programme, including a culturally appropriate HBV video to increase HBV vaccine uptake and knowledge of HBV vaccine. All participants (caregivers and children) in both intervention and control group were also paid \$10 and were given gifts of cosmetics or sweets. Caregivers were given reminder cards with the date of the next appointment.	↑	Return rates for the second (59% v's 31%, p=0.05) and third (47 v's 18%, p=0.06) HBV dose improved in intervention compared to control group. Overall uptake increased from 68% to 85%. Among 13 to 18 year olds, uptake increased from 31% to 68%.	yes	↑	Knowledge scores of HBV improved in caregivers (p=0.01) and adolescents (p=0.05).	yes
Thomas et al., 2008 (210)	WPR	AUS	Pneumococcal conjugate vaccine	Hospital staff, GP staff and parents of aboriginal and Torres Strait Islander children in an urban	A PCV vaccination programme was introduced targeting Aboriginal children but uptake rates for this vaccine in this	Six actions: maximising identification of aboriginal infants by ward staff at three local hospitals; training sessions for all hospital staff Aboriginal Liaison officers (ALOs), community health centres and council vaccination staff in two health services, posters and info sheets mailed to all vaccination providers, personal contact between ALOs and parents, provision of info to parents by	↑	In the study area, vaccination increased from approximately 30% before the intervention to approximately 40% afterwards but remained below the 50% vaccination uptake of Aboriginal infants in the rest of the city.	n/a			

				setting	population were much lower than routine vaccines.	ALOs, placement of sticker in child health record by maternity ward staff to remind vaccine providers.						
Ballesta et al., 2009 (53)	WP R	AUS	Influenza	HCW	Low uptake of occupational flu vaccine by HCW.	Educational and marketing campaign to accompany the vaccination programme – promotional materials, common programme dates, standard education strategy, single data collection and consent form, single source of data on staff numbers, use of Flu Champions to promote vaccination at hospitals. Promotional posters, email notifications and postcard reminder with pay-slip. Mobile trolleys offered vaccination on the wards.	↑	Four out of five hospitals achieved uptake rates of >55% (48.8-76.5%) compared to none in the year before the intervention (29-51%).	Not assessed	n/a		
Bertinet al., 2007 (111)	AM R	USA	Influenza	HCW	Low uptake rates for occupational flu vaccine.	Employees required to log onto the intranet to register whether they have received the vaccine, whether they had contraindications or whether they declined. Those declining received education on vaccination. Administrators provided feedback on participation rates. Employees sent written notification of programme. Reminders provided through managers and newsletters.	↑	89% accessed intranet. 55% reported receiving the vaccine compared to 38% (p<0.0001) uptake for the previous year (but previous year there was a vaccine shortage and the programme was disrupted). 31% declined and 3% had contraindications.	yes			
Mayne et al., 2012 (25)	AM R	USA	HPV	Parents and clinicians of adolescent girls eligible for HPV	Low uptake rates of HPV vaccine & delayed vaccination.	An electronic medical record based HPV vaccine decision support intervention targeting clinicians (immunisation alerts, education and feedback) and families (phone reminders and referral to an educational website). Nested cohort study to survey parents of	n/a			↑	Family focused intervention was acceptable to parents and 46% remembered receiving the reminder call. The call prompted them to	n/a

				vaccination.		those enrolled on the impact and acceptability of the intervention.					seek information on and discuss the vaccine and to come to a decision. 77% of parents reported that their child's physician had discussed the vaccine with them. Parents of girls attending practices with the clinician focused intervention were more likely to report discussing the vaccine with clinicians at preventive visits (84% vs 70%; p=0.02).	
Friedl et al., 2012 (47)	EUR	Switzerland	Influenza	HCW	Low immunisation rates.	Vaccination offered free of charge, made available across multiple working days, brochures and flyers in magazine for hospital employees, posters at multi-sties, flyer in private mail of all employees, as well as a reminder with vaccination clinic hours, lectures by Infection Control Heads offered, Public Health Office info distributed, public vaccination by department heads and head nurses, vaccination offered at staff meetings, local ward initiatives encouraged to fit needs.	 	Overall vaccination rate remained low over the five-year period of the intervention (from 20% to 27%). Doctor's rates increased from 34% to 62% (p< 0.001). By the end of the study vaccination rates among doctors were higher than nurses (62% vs 14% p=0.001). Nurse's rates remained low, dropping from 18% to 15% (2003-2007).	Yes	n/a		
Llupia et al., 2013 (40)	EUR	Spain	Influenza	HCW	Barriers to vaccination including the fear of adverse effects, doubts	Four promotional videos using HCW as the main characters. The videos were shown on strategically placed screens and on the internet. Two posters were designed sequentially and were placed in all wards and hospital entrances.		The reach of the campaign was high (91.9%), and HCW rated it as positive (7.19 [standard deviation, 2.3] out of 10) but did not achieve increased uptake (34%; 95% confidence interval: 33.8-	No	n/a		






					about vaccine effectiveness, revaccination year after year, and underestimation of the severity of influenza.	Brochures with information on the transmission of influenza, the vaccine, and the risk groups. An adapted version was included in the pay slip of all HCW. A Web 2.0 site was launched that focused on influenza vaccination of HCW. Developed another site for the hospital's Intranet with photos of vaccinated HCW and other campaign information. Two types of incentives: a prize draw among vaccinated HCW and the "Get vaccinated for the good of others" initiative in collaboration with charities to which HCW were linked. The charities received a financial contribution of €1 per vaccinated HCW. HCW were informed of all new features of the campaign through weekly e-mails. HCW could be vaccinated free of charge by the occupational health service or by the mobile unit that visited all departments and that had a pager number that enabled them to respond to doubts or attend departments on demand for vaccination.		36.4). This was a decrease since 2009 (39%).				
Dialogue-based												
Hopfer et al., 2012 (24)	AMR	USA	HPV	Adult	Low immunisation rates.	Narrative intervention: content developed under guidance of culture-centric narrative theory. Intervention arms: control, communication sources of narrative message; peer only, medical expert only or a combination of the two).		Combined peer-expert narrative nearly doubled vaccination compared to controls (22% vs 12%).	Not Provided		Increased vaccine self-efficacy and intent.	Not provided
Link et	AM	USA	Childhood	HCW	Low	Paediatric residency training	n/a				Improvement in	Yes





al., 2010	R		d		knowledge levels.	using patient-based/experiential teaching.					performance between residency training years one and two but not between years two and three.	s
Lechuga et al., 2011	AMR	USA	HPV	Mothers across three cultural groups: Hispanic, non-Hispanic white, and non-Hispanic African-American	High ethnic/racial disparities in HPV and cervical cancer.	Message framing (gain versus loss).	n/a				Significant difference between baseline intentions and the loss frame $F(1,135)=6.75$, $p<0.05$, $d=0.98$. Intentions to vaccinate were higher for the loss frame ($M=6.51$, $SD=1.13$) than at baseline ($M=5.13$, $SD=1.63$). Baseline intentions were significantly different than the gain frame $F(1,135)=7.47$, $p<0.01$, $d=0.74$. Intentions to vaccinate were higher for the gain frame ($M=6.22$, $SD=1.28$) than at baseline ($M=5.13$, $SD=1.63$). A marginally significant ($p=0.06$) interaction	Yes

											<p>emerged between framing, order, and ethnic group. For the Hispanic group-significant main effect of framing $F(2, 92)=23.38, p=0.001, \text{partial } \eta^2=0.33$. Planned comparisons revealed that loss frame intentions ($M=6.68, SD=0.88$) were significantly higher than baseline intentions ($M=5.31, SD=1.58$), $F(1,46)=32.85, p<0.001, d=1.15$. In addition, the gain frame intentions ($M=6.42, SD=1.09$) were higher than baseline ($M=5.31, SD=1.58$), $F(1,46)=19.12, p<0.001, d=0.81$. The significant effect of framing was qualified by a marginally significant interaction of framing and order $F(2, 92)=2.88,$</p>	
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												<p>p=0.06, partial $\eta^2=0.06$. Mean intentions were highest under the loss frame (M=6.69, SD=0.55) when participants read the gain frame first followed by the loss frame. For the non-Hispanic white group, only a significant main effect of framing emerged $F(2,92)=17.28$, $p<0.001$, partial $\eta^2=0.27$. Planned comparisons revealed that loss frame intentions (M=6.32, SD=1.30) were significantly higher than baseline intentions (M=5.08, SD=1.83), $F(1,46)=19.43$, $p<0.001$, $d=0.78$. Gain frame intentions (M=6.17 SD=1.41) were also higher than baseline (M=5.08, SD=1.83), $F(1,46)=10.20$, $p<0.01$, $d=0.66$.</p>	
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											<p>For the African-American group, a significant main effect of framing emerged $F(2,92)=27.38$, $p<0.001$, partial $\eta^2=0.37$. Planned comparisons revealed a significant difference between baseline and the loss frame condition $F(1,46)=47.26$, $p<0.001$, $d=1.18$. Intentions were higher for the loss frame condition ($M=6.53$, $SD=1.15$) than at baseline ($M=4.98$, $SD=1.46$). There was also a significant difference, $F(1,46)=16.55$, $p<0.001$, $d=0.79$, between the gain frame and baseline. The gain frame intentions ($M=6.08$, $SD=1.33$) were higher than</p>	
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											baseline (M=4.98, SD=1.46). In addition, a significant difference, $F(1,46)=5.94$, $p<0.05$, $d=0.36$, between the gain versus loss frame was detected. Intentions were higher in the loss frame condition (M=6.53, SD=1.15) than in the gain frame condition (M=6.08, SD=1.32).	
Nasiru et al., 2012 (64)	AFR	Nigeria	Polio	Parent	Misconceptions/distrust of polio vaccine.	See Characteristics of Studies p.94.		Average monthly increase in the number of vaccinated children six months post-intervention (n=1047; 95% CI 647-2045, p=0.001).	Not Provided	n/a		
Andersson et al., 2009 (77)	EMR	Pakistan	DPT, measles	Community	Low immunisation rates.	See Characteristics of Studies p.94.		Measles uptake doubled in intervention clusters (OR 2.20, 95% CI 1.24-3.88). Intervention trebled odds of full DPT vaccination (OR 3.36, 95% CI 2.03-5.56).	Yes	n/a		
Porter-Jones et al., 2009 (75)	EUR	UK	MMR	Parent	Low immunisation rates.	(A) Normal management plus a teddy bear vs (B) Normal management alone. Teddy bear's t-shirt contained three items of information including tagline 'get the bear facts', website and telephone number.		No effect on uptake.	Not provided	n/a		
Tam et	AM	USA	Pertussis	Adult	Low	Education program for parents.		8% of participants had taken	Not		Increase in	Ye





al., 2009 (72)	R				immunisation rates.	Included: oral presentations about the facts of pertussis, information sheet.		up vaccination post-intervention.	provided		knowledge about and willingness to receive vaccination.	s
Saitoh et al., 2013 (211)	WP R	Japan	Maternal	Adult	Cost and lack of information of voluntary vaccines.	Perinatal education (mothers). (A) Prenatal education vs (B) Postnatal education vs (C) No education (control).		Higher immunisation rates in intervention groups than control at 3 months (34.3% vs 8.3%, p=0.005). No difference between intervention groups.	Yes		Higher intention in intervention groups (61.4% vs 33.3%; p=0.01); greater knowledge in intervention groups (mean +/- SD.: 3.4 +/- 1.8 vs mean SD.: 1.9 +/- 1.9; p=0.003).	Yes
Taylor et al., 2008 (96)	AM R	USA	Childhood	HCW	Low immunisation rates due to parental concerns.	Control – traditional education provided as part of a vaccines for children (VFC) site visit vs intervention: VFC site visit + Physician peer education.		No effect. Control mean rates (69.6%) and Intervention (71.4%) (p=0.94).	No	n/a		
Kepka et al., 2011 (103)	AM R	USA	HPV	Parent	Hispanic women have more than a 1.5-fold increased cervical cancer incidence and mortality compared to non-Hispanic white women in the United States.	Evaluation of a radionovela to promote HPV vaccine awareness and knowledge among Hispanic parents.	n/a				Parents who listened to the HPV radionovela (intervention group) scored higher on six knowledge and belief items. They were more likely to confirm that HPV is a common infection (70% vs. 48%, P = .002), to deny that women are able to detect HPV (53% vs. 31%, P = .003), to know vaccine age recommendations (87% vs 68%, P = .003), and to confirm multiple doses (48% vs. 26%, P = .03) than control group	

											parents. The HPV vaccine radionovela improved HPV and HPV vaccine knowledge and attitudes.	
Oche et al., 2011 (105)	AFR	Nigeria	DTP3	Parent	Low immunisation rates.	See Characteristics of Studies p.94.	n/a				↑ At baseline, 59 and 53% of the mothers had adequate knowledge of childhood immunisation in the intervention and control communities, respectively. However, following intervention, 69 and 51% of the mothers in the intervention and control communities, respectively had adequate knowledge. Similarly, at the post intervention phase of the study, DTP3 rose from 21 to 33% in the intervention community while a decrease in uptake from 26 to 20% was observed in the control community.	Not provided
Crosby et al., 2008 (112)	AMR	USA	HPV	Adolescent	Low knowledge of HPV infection.	Adolescents testing positive for HPV received a physician-delivered intervention designed to emphasise the association of high-risk HPV with cervical cancer and to promote protective behaviours.	n/a				↑ Modest differences, favouring the intervention, were observed. At follow-up, teens testing positive reported lower levels of risk-taking behaviour,	Not provided




											greater intent to return for next pap testing and greater intent to be vaccinated against HPV.	
Kennedy et al., 2008 (113)	AMR	USA	Childhood	Parent	Concerns over vaccine safety.	Development of vaccine risk communication messages using risk comparisons and mathematical modelling.	n/a				↑ Of survey participants who recalled the test messages, 50% (85/171) who received a "consequences of reduced uptake" message reported an improved opinion of vaccines. A greater proportion of participants receiving one or more intervention messages reported an improved attitude score from pre-to post-test compared with the control group for four of the five variables measured; however, differences were small and none were statistically significant. A mixed method approach was used to develop and test vaccine messages. The message describing potential consequences of reduced vaccination	No

											uptake had the greatest impact on improving concerned mothers' opinions of childhood vaccines.	
Butteri et al., 2010 (62)	AMR	USA	Influenza	HCW	Individual reluctance and barriers to achieve high acceptance rates of influenza vaccination among HCW.	15-minute in-service seminar called 'Flu in 15'. The in-service targeted all HCW with the goal of increasing flu vaccine acceptance among the staff. Personalised education was provided in small group settings.	↑	Although not cause and effect, there was an increase in HCW acceptance rate of the influenza vaccine from 65% in 2006-2007 to 73% in 2007-2008. Decreased trend in patient deaths attributed to complications of influenza with 4 deaths in 2006-2007 and no deaths in 2007-2008.	Yes	↑	Of the 58 participants who were asked if the in-service helped them understand why a flu vaccine is needed yearly, 15% responded "tremendously," 48% "a lot," 26% "some," 7% "a little," and 2% "no." 24% report that the program was effective in changing their behaviour to accept the flu vaccination for the first time. 49% responded that the in-service was effective in either changing their behaviour to accept the flu vaccination for the first time or reaccept it if recently declined in previous years.	Yes
Ansari et al., 2007 (63)	SEAR	India	Polio	Families of children < 5 yrs of age	Pockets of resistance to polio vaccination persist.	See Characteristics of Studies p.94.	↑	Of 1025 resistant households, 510 (49.76%) accepted vaccination after visits from medical interns. Of 515 remaining resistant households, 303 (58.83%) accepted vaccination after additional visit. 79.32% of	n/a	n/a		


								resistant households accepted vaccination, while 20.68% remained resistant.				
Incentive-based												
Maltezo u et al., 2012 (60)	EUR	Greece	Influenza	Adult	Parents did not want to get the vaccine and did not think they were at risk of contracting influenza.	Free of charge, post-partum vaccination at maternity hospital or neonatal unit.	↑	Vaccination rates increased from 44.7% to 73.7% among mothers and from 25.7 to 55.8% among fathers.	Not Provided	n/a		
Harris et al., 2011 (45)	AMR	USA	Influenza	HCW	Low immunisation rates.	On-site vaccination.	↑	Increase in vaccination rates between 13%-29% (p<0.05).	Yes	n/a		
Lee et al., 2008 (61)	AMR	USA	Influenza	HCW	Low immunisation rates.	Free on-site vaccination.	↑	Higher vaccination rates in both intervention vs control years (51% vs 28%; p=.049) and (45% vs 26%; p=0.022)	Yes	n/a		
Ofstead et al., 2013 (59)	AMR	USA	Influenza	Families	Low immunisation rates due to perceived economic and health costs.	Worksite vaccination programme to vaccinate industrial employees and their families. Customised educational messages (flyers, daily newsletter articles, posters) based on employees' beliefs and concerns about influenza and vaccination with a health coach. Employees developed cartoons to use in posters and newsletters. Incentives (snacks, hand sanitiser, prizes). Employers encouraged to reposition their influenza vaccination programme as part of broader community initiatives.	↑	Vaccination rates among insured employees and dependants increased significantly after the intervention (p < 0.001).	Yes		Customised education did not change beliefs.	No



Roberts et al., 2013 (95)	AFR	Zimbabwe	Childhood	Community	Sociocultural barriers (e.g., step-parents prioritising school attendance for their biological children rather than for their fostered children.	Unconditional cash transfers (UCTs) and conditional cash transfers (CCTs) on birth registration, vaccination uptake and school attendance in children. Managed by community committees who had experience of intervention delivery to vulnerable families through a network of local workers and volunteers. Every household enrolled in UCT collected US\$18 plus \$4 per child in the household from designated pay points every 2 months.		The proportion of children aged 0-4 years with complete vaccination records was 3.1% (-3.8 to 9.9) greater in the UCT group and 1.8% (-5.0 to 8.7) greater in the CCT group than in the control group.	Yes	n/a		
Cheema et al., 2013 (102)	USA	AMR	Influenza	HCW	Low immunisation rates.	Web-based survey (anonymous) asking whether a time-off incentive made a difference in decision to accept vaccination.	n/a				No effect.	Not provided
Barham et al., 2009 (97)	AMR	Nicaragua	Measles	Children aged 0 - 35 months	Hard-to-reach; Low immunisation rates.	Conditional cash transfers to health and education attainment. Intervention: received conditional transfers immediately vs control: received transfers 2.5 years later. Mothers had to bring their children to scheduled preventive health care appointments once a month for under two years of age, and bimonthly for those between two and five. NB: Vaccination was not a requirement for the transfer but was part of the service offered and health providers were paid to deliver vaccinations during the scheduled visits.		Uptake rates of greater than 95% for some vaccines (BCG, OPV3, and DPT3) at 12-23 months. Significant increase for MCV (91% in treatment vs 75% in control in 2001, 87% in treatment vs 83% in control in 2002) and FVC (84% in treatment vs 65% in control in 2001; 86% in treatment vs 75% in control in 2001 (children aged 12-23 months).	Yes	n/a		
Stitzer et al.,	AMR	USA	HBV as a simulation	Cocaine users	Wide spacing of	Use of monetary incentives to increase adherence to HBV		Adherence after week 8 was higher among intervention	Yes	n/a		




2010 (12)			of cocaine vaccination (Injections to address cocaine drug dependency).		vaccination schedule poses challenges to adherence to the schedule among drug users.	vaccination at fortnightly intervals, \$10 per visit, those in the intervention group received additional monetary payments up to a maximum of \$751.		group compared to controls (p=0.035). Intervention group attended 82% of weekly sessions compared to 64% in controls (p=0.107). 74% of intervention group compared to 51% of control group received injection on scheduled day (p=0.016).				
Reminder/recall-based												
Lemstra et al., 2011 (74)	AMR	Canada	MMR	Parent	Low immunisation rates (socio-demographic).	Telephone reminder system vs control vs telephone reminder and home visit.	↑	Results not provided for different intervention arms for control vs intervention – only available as an intervention region vs control region. MMR immunisation uptake increased (74.0% vs 67.4%) in 1 st year of intervention.	Yes	n/a		
Abbott et al., 2013 (84)	WPR	Australia	Childhood	Parent	Delayed immunisation due to socio-economic disadvantage.	Personalised calendars provided at last immunisation – designed for home, including date of next immunisation, photo of child and Aboriginal artwork.	↑	Increased timeliness of vaccination among intervention vs control (80% on time vs 57%) (p < 0.0001).	Yes	n/a		
Hicks et al., 2007 (86)	AMR	USA	Childhood	HCW	Static rates/incomplete/missed opportunities.	Language-appropriate reminder/order cards; discussions with staff and posters in patient care rooms (for missed opportunities).	↑	Increased complete vaccination rates (61.3% to 73.4%; p=0.4). No effect on missed opportunities.	Yes	n/a		
Muehleisen et al., 2007 (85)	EUR	Switzerland	Childhood	Parent	Low immunisation rates and delayed vaccination.	See Characteristics of studies p.94.	↑	Increased vaccination rates (at one month post-discharge) (27% vs 8% control; p<.001).	Yes	n/a		
Vora et al.,	AMR	USA	Childhood	Parent	Low immunisation	Outreach workers provide education immunisation at birth	↑	Higher immunisation rates at all age points (7, 13, 19, and	Not provided	n/a		

2009 (83)					n rates.	with mothers and develop a contact strategy for future reminders; missed appointments followed up and rescheduled; home visits when no contact made.		24 months) than control (city-wide counterparts). At final point (24 months), intervention at 92% up-to-date vs 49% (control).				
Moniz et al., 2013 (56)	AMR	USA	Influenza	Adult	Pregnant women unsure about or unwilling to receive influenza vaccination.	12-weekly text messages encouraging general pregnancy vs same plus influenza vaccination.		No effect (31% vs 33%; difference 1.7%, 95% CI -11.1 to 14.5%).	n/a	n/a		
Atchison et al., 2013 (73)	EUR	UK	Childhood	Parent	Low immunisation rates.	Standardised call/recall system based on parents being sent three reminders and defaulters being referred to a health visitor. Incorporated local and regional good practice approaches and designed for children aged 0-5 years due/overdue for their routine childhood immunisations.		Most children due or overdue immunisations were successfully captured by the first invitation reminder. After three invitations, between 87.3 % (MMR1) and 92.2 % (pre-school booster) of children identified as due or overdue immunisations successfully responded. Post-implementation uptake rates for DTaP/IPV/Hib, MMR1, MMR2 and the pre-school booster were significantly greater in the intervention practices. Similar findings were seen for PCV and Hib/MenC boosters.	No	n/a		
McElligott et al., 2010 (87)	AMR	USA	Childhood	Community	Reaching unimmunized children is becoming increasingly complicated with the addition of	Patient-held vaccination record.		Children with vaccination records more likely to be up-to-date (83.9% vs 78.6%; p<.0001).	Yes	n/a		





					new vaccines.							
Milkman et al., 2011 (57)	AMR	USA	Influenza	Adult	Low immunisation rates.	Prompts to form implementation intentions on realised behavioural outcomes. Free on-site clinics offered by a large firm to its employees. Employees eligible for study participation received reminder mailings that listed the times and location of the relevant vaccination clinics. Mailings to employees randomly assigned to the treatment conditions additionally included a prompt to write down either the date the employee planned to be vaccinated or the date and time the employee planned to be vaccinated.	↑	Vaccination rates increased when implementation intentions prompts were included in the mailing. The vaccination rate among control condition employees was 33.1%. Employees who received the prompt to write down just a date had a vaccination rate 1.5 percentage points higher than the control group, a difference that is not statistically significant. Employees who received the more specific prompt to write down both a date and a time had a 4.2 percentage point higher vaccination rate, a difference that is statistically significant.	See outcome	n/a		
Fiks et al., 2009 (58)	AMR	USA	Influenza	Children aged 5 to 19 years with asthma	Flu vaccination rates among children with asthma remain low.	Cluster randomised trial of 20 primary care sites to assess the impact of electronic health record based clinical alerts for influenza vaccine at all office visits for children with asthma on missed opportunities for vaccination in this population.	↑	Captured vaccination opportunities increased from 14.4% to 18.6% at intervention sites and from 12.7% to 16.3% at control sites. Vaccination rates improved 3.4% more at intervention sites. Up to date vaccination increased from 44.2 to 48.2% at control sites and from 45 to 53% at intervention sites (a 4% (-1.3-9.1%) improvement).	no	n/a		
Stockwell et al., 2012 (101)	AMR	USA	Meningococcal (MCV4), tetanus-	Parents of children aged 11 to 18	Low income families are at risk of under-	See Characteristics of studies p.94.	↑	Adolescents in the text reminder group more likely to receive MCV4 and DTaP at weeks 4 (15.4% vs 4.2%,	Yes	n/a		

			diphtheria-acellular pertussis (DTaP), Hib	years due either MCV4 or DTaP and parents of children under-immunised for Hib from clinics serving a mostly low-income minority population who have a cell phone.	immunisation especially if there are changes to the schedule or vaccine shortages.			<p>p<0.001; aOR=4.57 (95%CI: 1.83-11.42)), 12 (26.7% vs 13.9%, p<0.005; aOR=2.17 (95%CI: 1.23-3.82)) and 24 (36.4% v's 18.1%, p<0.001; aOR=2.48 (95%CI: 1.49-4.13).</p> <p>Parents who received text and mailed reminders more likely to attend recall session than those who received mailed reminder only (21.8% vs 9.2%, p<0.05).</p> <p>Attendance at recall at week four (aOR=3.77, 95%CI 1.74-8.16); week 12 (aOR=2.02; 95%CI: 1.21-3.36) and week 24 (aOR=1.77; 95%CI: 1.12-2.80).</p>			
Kharbanda et al., 2011 (16)	AMR	USA	HPV	Parents of adolescents aged nine to 20 years who were due their second and third dose of HPV.	Need to improve timing and completion of HPV vaccination.	Parents received up to three weekly text message reminders that their daughter was due her next vaccine dose.		<p>On time receipt of HPV vaccine occurred among 51.6% (95%CI: 42.8-60.4%) of those who signed up to the programme compared to 35% (95%CI: 29.6-40.2%) of those who did not. This compared to a 38.1% (95%CI: 35.2-41.0%) rate of on-time vaccination in those due their second and third doses in the six months before the intervention (p=0.003). Intervention subjects were more likely than controls (aOR=1.83; 95%CI: 1.23-2.71; p=0.002) and historical controls (aOR=2.03; 95%CI: 1.29-3.22; p=0.003) to receive</p>	Yes	n/a	






								their next dose on time. 64.5% (95%CI: 56.1-72.9) of those enrolled in the programme compared to 51.1% (95%CI: 45.6-56.7%) of those not enrolled (p=0.011) and 52.9% of historical controls (52.9%; 95%CI: 49.9-55.8) (p=0.014) received their vaccine within 4 months of the due date.				
Usman et al., 2009 (145)	EMR	Pakistan	DTP3	Parent	Both parental (larger family size, lower parental education, mother's lack of knowledge and motivation) and provider factors (distance of EPI centre from home) affect immunisation schedule adherence.	See Characteristics of studies p.94.		Significant increase of 31% (adjusted RR=1.31, 95% CI=1.18-1.46) in DTP3 completion was estimated in the group that received both redesigned card and center-based education compared with the standard care group.	Yes	n/a		
Lau et al., 2012 (156)	WPR	Australia	Influenza	University staff & students	Knowledge-based (e.g., lack of awareness) and system-based (e.g., inconvenient	See Characteristics of Studies p.94.		PCHMS users were 6.7% more likely than the waitlist to receive influenza vaccine (waitlist: 4.9% vs. PCHMS: 11.6%). PCHMS participants were also 11.6% more likely to visit the health service	Yes	n/a		

					ce) barriers associated with accessing health services.			provider (waitlist: 17.9% vs PCHMS: 29.5). Greater use of the PCHMS was associated with higher rates of vaccination and health service provider visits.				
Other												
Gerend et al., 2012 (18)	AM R	USA	HPV	Adult	People's decisions to engage in health protective behaviours are influenced by psychological factors (e.g., attitudes, beliefs, intentions).	Gain-framed, loss-framed or control video.		No effect on HPV vaccine uptake.	No	n/a		
Girard et al., 2012 (82)	UK USA Australia Sweden Norway Finland, The Netherlands	EUR, AMR, WPR	DTaP, hep.B	Parent	Public and HCW fear over side effects.	Mandatory vs recommended vaccination strategies.		Both strategies equally effective (achieving uptake above 94%).	Not Provided	n/a		
Brigham	AM	USA	MCV4,	Adolesce	Low	Control: no specific outreach made		Increased immunisation rates	Yes	n/a		


et al., 2012 (100)	R		Tdap, Varicella (Adolescent)	nt	immunisation rates.	vs (A) Parent or guardian called to say adolescent overdue (Parent only) vs (B) Phone call reminder both parent and adolescent (Parent/Adol).	<p>in both intervention arms, as compared with the control group (7.1% for Control, 14.4% for Parent Only, and 14.5% in parent/adolescent, $P = .09$). The unadjusted odds of receiving one or more vaccines during the 4-week follow-up period were 2.20 times higher (95% CI 0.99 - 4.89) in the parent only group and 2.22 times higher (95% CI 1.00–4.94) in the parent/adolescent group compared with controls. The odds of receiving immunisation were higher in the parent/adolescent group (aOR=2.27; 95%CI: 1.00-5.18) but not at one year. Trend towards increased vaccination in parent only group (OR=2.20; 95%CI: 0.89-4.56). As treated analysis: four weeks after intervention: parent only contact (OR=5.31; 95%CI: 2.66-10.63) and parent and adolescent contact (OR=4.72; 95%CI: 1.62-13.79). One year after intervention: OR= 2.40 (95%CI: 1.51-3.82) for parent only and 3.78 (95%CI: 1.68-8.52) for parent and adolescent.</p>				
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Cox et al., 2012 (5)	AMR	USA	Hepatitis B (Adult)	Adult	Perceived inconvenience or discomfort of vaccine (barriers).	Self-predication intervention - using an audio-computer-assisted self-interview (A-CASI), participants asked to predict their future acceptance of HBV vaccination as part of a series of other vaccination-related questions (e.g., beliefs, behaviours, demographics).		Among high-barrier patients, who typically have very low vaccination rates, the intervention significantly increased vaccination acceptance (OR=2.59; 95% CI: 1.56, 4.25; p<.001). No significant change for low-barrier patients.	Yes	n/a		
Fu et al., 2012 (88)	AMR	USA	Routine childhood vaccines	Parents, HCW	Under immunisation of poor, single-parent household, African American, inner city children.	Quality improvement measures: collaboration with community stakeholders (e.g., supply orders, contact details of patients); provider reminder/recall and assessment and feedback (e.g., software); expanding access in clinical settings (e.g., dedicated vaccination clinics, opportunistic); standing orders (e.g., physician approval before any vaccinations given); client reminder/recall systems (e.g., telephone calls, postcards); educational interventions (e.g. Posters in all sites, reminder forms for doctors to fill out for parents listing immunisations required/dates); vaccination programs in WIC settings (e.g., attendees at WIC referred directly to clinic for immunisation).		Immunisation uptake improved from 71% to 87% (p<.0001); uptake increased at all six health centres; Timely vaccination rates improved from 65% to 79% (p<.0001) and increased significantly at four of the six centres. Achievement sustained beyond 18 months at health centres.	Yes	n/a		
Wright et al., 2012 (17)	AMR	USA	HPV	Adult	Low immunisation rates.	Post-partum vaccination after delivery in hospital, at six week visit and at a third dedicated vaccination visit.		41.3% received one dose; 23.3% received two doses; 30.7% completed series of three doses.	Not provided		50.4% reported that they would not have otherwise asked about vaccination and feedback was very positive: 97.2% thought the	Not provided




											vaccination was worthwhile and 98.6% convenient and were happy they participated (99.3%).	
Harris et al., 2011 (45)	AMR	USA	Influenza	HCW	Low immunisation rates.	Mandatory requirements for vaccination.	↑	Increases in vaccination rates between 31%-49% (p<0.005).	Yes	n/a		
Sasakiet al., 2011 (79)	AFR	Zambia	DPT3 and measles	Parent	Accessibility	Introduction of outreach services.	↑	Increase in vaccination uptake for DPT3 (from 75.7%) to 87.3%) and measles (66.8% to 76.1%).	No	n/a		
Babcock et al., 2010 (146)	AMR	USA	Influenza	HCW	Low immunisation rates.	Mandatory vaccination.	↑	Increased vaccination rates (98.4% post-intervention; pre-intervention rates not reported).	Not provided	n/a		
Eckrode et al., 2007 (70)	AMR	USA	Pneumococcal	Elderly	Low immunisation rates.	Inpatient immunisation program including standing orders and assessment by registered nurses vs standard (physician assessment and written vaccination orders for each patient).	↑	Rates improved from 0% to 15.4% (x2 = 56; p=.00).	Yes	n/a		
Taddio et al., 2013 (107)	AMR	Canada	Childhood	Parent	Vaccination pain puts children at risk for long-term harms including the development of needle fears and subsequent healthcare avoidance.	Educational pamphlet and video for parents at the point of care.	n/a			↑	Parents' performance on the knowledge test improved (p<0.001) from the baseline phase to after review of the pamphlet and again from the pamphlet review phases to after review of the video. Over 80% parents said they were 'very likely' to act on the information.	Yes
Polgree	AM	USA	Influenza	HCW	Low	Mandatory vaccination.	↑	Increase in mean vaccination	Yes	n/a		




n et al., 2008 (142)	R				immunisation rates.			rates (over 22 hospital sites) (11.6%) (p<.001).				
Watson-Jones et al., 2012 (154)	AFR	Tasmania	HPV	Adolescent	Intro of new vaccine.	Class-based vs age-based vaccine delivery.		Higher uptake for each dose in class-based schools (dose 1: 86.4% vs 82%; p=.30; dose 2: 83.8% vs 77.8%, p=.05; dose 3: 78.7% vs 72.1%, p=.04).	Yes	n/a		
Gowda et al., 2013 (163)	AMR	USA	MMR	Parent	Safety concerns.	(A) Education web pages individually tailored to address parents' specific vaccine concerns vs (B) web pages similar in appearance but with untailed information.	n/a				More positive vaccination intentions after viewing educational info (tailored 58% vs untailed 46%) and greater magnitude of change in intention (1.08 vs 0.49).	Yes
Ernsting et al., 2013 (160)	EUR	Germany	Influenza	Adult	Addressing belief systems.	(A) Email-based leaflet on enhancing intention formation to vaccinate (standard group - focus on motivational factors e.g., risk perceptions) vs (B) email on assisting self-regulation (focus on motivational and volition factors e.g., planning and written testimonials by role models, investigating interference of compensatory health beliefs - self-defence strategy to justify non-adherence).		No overall group effect of intervention.	No		Indirect effect of intervention .35 (SE = .16; 95% CI = .06, .71; R2 = .56) - associated with planning (b = .67, SE = .14; p<.001) and planning predicted behaviour (b = .50, SE = .14; p<.001). Self-efficacy did not operate as a mediator; intervention (self-regulatory strategies) were only able to oppose CHB to a certain degree.	Yes
Krawczyk et al., 2012 (152)	AMR	USA	HPV	Adult	Low vaccination knowledge and	HPV pamphlet vs HPV video (both contained information about incidence, transmission, and consequences of HPV, efficacy and	n/a				Written and video interventions led to higher knowledge (p<.05) and intentions	Yes




					intentions.	safety of vaccine; video by senior male HCP) vs control (information about healthy lifestyle choices to prevent cancer) [guided by Health Belief Model (HBM)].					(p<.005) than the control.	
Riphagen et al., 2013 (149)	EUR	Netherlands	Influenza	HCW	Low immunisation rates.	Programme of education tools developed around identified behavioural determinants of vaccination for this group including: awareness of personal risk for infection, awareness of risk of infecting patients, belief that vaccination reduces the risk of infecting patients, usefulness of vaccination knowledge of health council's advice, vaccination of HCW to ensure continuity of care and because of their duty to do no harm, belief that people around me think it's important, willingness to get vaccinated if available at a convenient time.	↑	Vaccination uptake intervention for seasonal influenza and first two doses of pandemic > control (p<0.05 for all).	Yes	n/a		
Vanderpool et al., 2013 (161)	AMR	USA	HPV	Adult	HPV vaccination diffusion in the U.S has been inequitable, HPV vaccination goals are not being met and adherence to the full threedose regimen is suboptimal.	Women watched a 13-minute educational DVD, entitled "1-2-3 Pap,". Design and development of the DVD was guided by the IMB. The intervention design included specific health information relevant to the target health behaviour and specific to the population; personal motivation and normative cues; and skills training to increase efficacy. The DVD included risks of HPV and HPV-related harm, encouraged women to consider the benefits of vaccination and pap tests, informed patients about the necessity to complete the vaccine series, motivated series completion, enhanced self-efficacy	↑	Women assigned to the intervention were 2.44 times more likely than women in the usual care group to complete the series. Positive intent to complete the vaccine series was indicated by 64.3% of the women (n=220). Just over one-third (37.8 %) of the sample completed the three does series. Positive intent was indicated by 58.2% of those randomised to the intervention condition and 70.9% in the control condition (p=.014). Nearly half the women (43.3%)	Yes	n/a		



						for series completion and helped women overcome personal obstacles to series completion. The DVD had cues to action delivered by a local Appalachian, young female TV news reporter. Also featured young women, a nurse practitioner and a physician from the target community. They discussed eastern Kentucky cervical cancer statistics, HPV infection and its relation to cervical cancer, HPV vaccination, and pap testing. It used a mixture of video footage, narrative and informational content sequences, still shots and written captions.		randomised to the DVD intervention completed the three dose series, whereas 31.9% of women assigned to the comparison group completed the series, for a percent relative difference of 35.7% (p=.03).				
Luthy et al., 2013 (164)	AMR	USA	Childhood	Parent	Pain and anxiety related to vaccines.	Parents and children were put into three groups-control, DVD distraction, vapo-coolant spray. After vaccination, parents evaluated the child's pain and anxiety.	n/a				No significant difference in the parent's perception of their child's pain or anxiety was found between the two treatment groups and the control group. Parents commented that the DVD distraction method seemed helpful before and/or after vaccination but not during vaccination and parents appreciated the distraction.	No
Chan et al., 2013 (159)	AMR	Canada	Childhood	HCW	Negative experiences with needles in childhood	Education and training, educational resources and support for the implementation of the guideline in the intervention sites. A two hour in-person education session was	n/a				Confidence and satisfaction with ability to reduce pain increased (P=0.016 and P<0.001,	See outcome






				<p>may lead to the development of needle fears and health care avoidance behaviours in the future, including immunisation noncompliance. Despite the potential negative consequences of immunisation injection pain and the availability of effective and safe analgesic interventions, immunizers often use a procedure-focused approach due to misconceptions about the importance of</p>	<p>held at each intervention site. Public health nurses (PHNs) were educated about pain-relieving strategies through a PowerPoint presentation and practice scenarios. Consequences of untreated immunisation pain, how the strategies were developed, scientific evidence supporting the effectiveness of the strategies and misconceptions about the strategies from immunisers and parents were presented and discussed. The session was given by a nursing manager trained by the BCCDC to deliver the content and to answer questions. Sucrose supplies were provided to intervention health units (distraction agents such as toys, books, etc., are already routinely available at all health units). Online support was provided for nurses to clarify concepts and answer questions regarding implementation of the information included in the guideline.</p>				<p>respectively) within the intervention group. Willingness to use new strategies also increased ($P < 0.001$). No significant differences were observed in the control sites ($P \geq 0.19$ for all analyses). Intervention sites reported a significant increase in the post implementation phase in overall use of at least one of the four new strategies recommended in the guideline (49.8% to 77.6%; +27.8% [95% CI 19.6% to 35.4%]; $P < 0.001$); control sites did not report significant increase (84.7% to 90.1%; +5.4% [95% CI -0.01% to 11.8%]; $P = 0.09$). At the intervention sites, there was a significant increase (de novo) in sucrose use and an increase in breastfeeding. In children >4 years of age, use of tactile stimulation increased significantly. Provider-led distraction was significantly increased</p>	<p>me</p>
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					alleviating pain and a lack of knowledge about the effectiveness and safety of pain-relieving strategies.						overall. The overall mean number of new strategies used in intervention sites increased (0.53 to 1.1, mean difference = +0.58 [95% CI 0.49 to 0.71]; P<0.001) but did not change in control sites (1.1 to 1.1, mean difference = +0.03 [95% CI -0.08 to 0.13]; P=0.63).	
Marek et al., 2012 (155)	EUR	Hungary	HPV	Adolescent	Low level of understanding of HPV infection and vaccination.	One-off 45-min education intervention (delivered by health educator, didactic presentation, Q&A, hand-outs with key messages) vs control.	n/a				Increased awareness of infection and relationships with cervical cancer (7.9 %-> 22.1%, p<0.05); increased awareness of the existence of vaccine (61.3 %-> 85.9%) (p=0.000).	Yes
Gainforth et al., 2012 (158)	AMR	USA	HPV	Parent	Low intentions to have children vaccinated.	Message framing and parents' intentions to have their children vaccinated against HPV.	n/a				Gain-framed messages seemed to persuade mothers of sons to speak to a doctor about the vaccine (p < .05). Framing effects were not significant for other outcomes.	Yes
Jimenez-Garcia et al., 2012 (153)	EUR	Spain	Influenza	Elderly	A high proportion of non-vaccinated high-risk persons think they did not qualify for	Age-based strategies.		Spanish autonomous regions which had reduced the age limit had higher uptake for all age groups analysed regardless of the presence of associated chronic conditions than AR which continued vaccination for those ≥ 65 y. The greatest	No	n/a		


					the vaccination and report having good health.			differences appeared in individuals aged 60 to 64 (36.9% vs 24.4% for individuals without chronic conditions, 59.1% vs. 52.9% for those with chronic conditions and 43.3% vs. 32.3% for the entire age group). Multivariate analysis showed that those AR which lowered the age limit increased total uptake for all age groups, specifically among individuals with chronic conditions aged 60 to 64 y (IRR 1.18; 95% CI, 1.01-1.54) and ≥ 65 y (IRR 1.07; 95% CI, 1.00-1.14).				
Kennedy et al., 2011 (137)	WP R	China	HPV	Adult	Negative attitude towards HPV vaccine.	Educational flyer.	n/a				98.4% reported they would electively receive HPV vaccination and would also recommend that their daughters be vaccinated.	n/a
Sales et al., 2011 (151)	AM R	USA	Influenza	Parent	Negative parental influenza vaccination attitudes and intentions.	Rural parents' vaccination-related attitudes and intention to vaccinate middle and high school children against influenza following educational influenza vaccination intervention.		Parents who participated in the intervention reported significantly higher influenza vaccination rates in their adolescents, relative to a control group, as well as increased vaccination rates post-intervention participation relative to their baseline rates. Intervention participants reported greater intention to have their adolescent vaccinated in the coming year compared to	Yes		Significant differences were observed post intervention in perceived barriers and benefits of vaccination.	Yes






								control parents.					
Cox et al., 2010 (138)	AMR	USA	HPV	Parent	Negative parental influenza vaccination attitudes and intentions.	Behavioural interventions to increase HPV vaccination acceptability among mothers of young girls.	n/a					Both risk presentation format and rhetorical questions had an overall positive effect on mothers' intention to vaccinate their daughters. However, the interventions appear to be more effective when used separately than when used in combination.	Yes
Nan et al., 2012 (212)	AMR	USA	HPV	Adolescent	Concerns that vaccine encourages promiscuity and vaccine safety and effectiveness concerns which intensified as the vaccine was mandated.	Research examines how young adults' attitudes towards HPV vaccination and their intentions to get the vaccine are influenced by the framing of health messages (gain vs loss and time orientation (i.e., the extent to which people value immediate vs distant consequences of their decisions.	n/a					Overall persuasive advantage for loss-framed messages. Attitudes and behavioural intentions toward HPV vaccination were found to be more favourable among future-minded individuals. Moreover, an interaction between framing and time orientation was found to predict persuasive outcomes. Present-minded participants responded more favourably to the loss-framed message, whereas future-minded participants were equally persuaded by both frames.	Not provided
Gust et	AM	USA	Childhood	Parent	Negative	Compared attitudes of parents who	n/a					Although the	N



al., 2009 (139)	R				attitudes of parents who filed/considered filing an exemption to school immunisation and/or would not have their child immunized if it were not required by law.	filed or considered filing an exemption to school immunisation requirements and/or would not have their child immunised if it were not required by law (cases) to controls. Developed and evaluated a brochure intervention for parents considering exemption.					brochure did not significantly improve parents' immunisation attitudes compared to controls, most parents who received the intervention reported a positive impression.	o
Doherty et al., 2008 (140)	AMR	USA	HPV	Adolescent	College students know little about HPV.	Explored the effect of a web-based intervention on participants' knowledge of HPV and attitudes towards HPV vaccination.	n/a				At immediate and long-term follow-up, the intervention group had better knowledge of HPV and more positive attitudes toward HPV vaccination than the control group. There were some gender differences in response to the intervention; increases in knowledge of HPV were greater in men, while changes in attitudes toward vaccination were larger in women.	Not provided
Marshall et al., 2007	AMR	USA	Childhood	HCW	The number of vaccines represented	Use of combination vaccines.		Unadjusted uptake rates for DTaP, IPV and the 4 DTaP: 3 IPV: 1 MMR, 4 DTaP: 3 IPV: 1	Not provided	n/a		

(169)					by the routine childhood immunisation schedule poses a logistical challenge for providers and a potential deterrent for parents.			MMR: 3 Hib: 1 varicella, and 3 DTaP: 3 IPV: 3 Hib series were higher in the combination cohort. Receipt of at least one dose of a combination vaccine was independently associated with increased uptake for each of these vaccines and vaccine series when controlling for gender, birth quarter, race, rural versus urban residence and historical provider immunisation quality. No difference in historic provider uptake rates (54.1% for combination cohort versus 53.8% for reference cohort, P 0.5602).				
Jackson et al., 2010 (170)	EUR	UK	MMR	Parent	Controversy over the safety of the combined MMR vaccine dented parents' confidence in the vaccine, reflected in a sharp fall in uptake.	Web-based MMR decision aid.		Most parents (88%) reported vaccinating their child.			The decision aid was acceptable to parents and considered useful in supporting their informed decision-making. There was a statistically significant increase in parents' knowledge over time and statistically significant decrease in decisional conflict for the MMR decision.	Yes
Phommathansy et al., 2010 (165)	Sear	Laos	Diphtheria	Parent	Vaccinations have not been distributed throughout Laos due to	Planned instruction and handbooks.		When considering the number of children receiving first and second vaccinations against diphtheria, pertussis, neonatal tetanus and polio, the group of mothers who	No		After intervention, the comparison of mean scores on knowledge between intervention and control groups	Yes




					poor health knowledge and health belief problems.			received planned instruction all brought their children to receive the vaccinations according to schedule. In the control group, two mothers did not bring their children to the health centre in accordance with the vaccination schedule. The group of mothers who received planned instruction for third vaccinations against diphtheria, pertussis, neonatal tetanus, and polio, all brought their children to receive vaccinations according to the planned schedule. Whereas, three mothers in the control group did not.			showed a significant difference ($t = 4.34, p < .05$), and the comparison of health beliefs mean scores between both groups also displayed a significant difference ($t = 1.85, p < .05$).
Klein et al., 2009 (147)	AMR	USA	Childhood	Parent	Pregnant women's concerns about immunisation.	Comparison of response to a new vaccine information pamphlet with current CDC vaccine information statement.				 	Among those mothers reviewing both, 61% preferred the new pamphlet for its visual appeal ($P < 0.0001$) and ease of understanding ($P = 0.005$). Overall, mothers expressed increased confidence and fewer concerns regarding multiple injections after reviewing the pamphlet. However, older, more-highly educated mothers were less likely to report improved vaccine


										confidence after reviewing either the pamphlet or the vaccine information statement. Mothers in all three groups stated a preference for receiving the vaccine information during pregnancy or prior to the actual immunisation visit.	
Boivin et al., 2008 (144)	EUR	France	Childhood	HCW	The multiplicity of vaccine injections during childhood leads to iterative painful and stressful experiences which may lead in turn to anticipated pain and then possibly to a true needle phobia.	A multifactorial strategy against needle pain. Combining pharmacological and non-pharmacological approaches during vaccination: preliminary application of an aesthetic patch, preferential use of specified vaccines, child education by the parents and the doctor, parental accompaniment and child distraction with soap bubbles during the procedure compared to usual care.				A significant decrease in pain was obtained using the multifactorial strategy, as assessed by self-reported VAS ($P < 0.0001$). This was confirmed by another self-report scale (the facial pain scale revised: $P = 0.005$), as well as with hetero-evaluations by GPs and parents [Children's Hospital of Eastern Ontario Pain Scale: $P = 0.0007$; GPs VAS ($P < 0.0001$), parents VAS ($P < 0.0001$)].	Yes
LaVela et al., 2008 (141)	AMR	USA	Influenza & Pneumococcal	Adult	Negative perceptions, knowledge, intentions and beliefs regarding respiratory vaccinations	Development and testing of a vaccination message targeted to persons with spinal cord injuries and disorders.	n/a			 Positive changes in beliefs from pre- to post-test on multiple items related to knowledge, severity, and self-efficacy and response efficacy. There were no	






											changes in perception of personal susceptibility to these diseases.	
Levi et al., 2007 (136)	AMR	USA	n/a – all routine vaccines	Vaccine providers, residents of paediatric and family medicine training programmes.	Increasing parental resistance to routine childhood vaccination.	CD-ROM based tutorial to improve vaccine providers ability to address and respond to parental concerns about vaccination by improving knowledge about 1) resistance to vaccination, 2) adverse effects and 3) attitudes towards parental resistance	n/a				91% of post-intervention responses were correct compared with 50% pre-intervention. 89% of post-test responses on adverse events were correct compared to 56% pre-test. Evidence of a change in attitude to parents who are reluctant to vaccinate, based on post-test compared to pre-test responses.	Yes
Palmore et al., 2009	AMR	USA	Influenza	Health care providers	Low vaccination rates among health care providers.	Mandatory vaccination policy and tracking of non-compliant employees for follow-up using an electronic enrolment and vaccination tracking system.		10.8% increase in the mean number of doses administered during previous three years. 88% uptake among employees with patient contact; 1.3% had contraindications & 10.7% declined.	n/a			
Baudier et al., 2007	EUR	France	MMR, tetanus, polio & influenza	General population	Low rates of vaccination.	Introduction of an annual vaccination week, supported by a media campaign and communications to physicians and the public. Comparison of number of applications for health care insurance reimbursement for vaccinations pre and post introduction in the two months following the vaccination week.		>5% increase in applications for reimbursement in following first years vaccination week and >10% in second year.	Yes		Awareness of vaccination among the public and health care providers increased.	n/a
Slavin	AM	USA	Influenza	Health	Low flu	American Nurses Association		Four of the five examples	n/a			

2008	R			care personnel (esp. nurses)	vaccination rates among HCW.	compiled best practices to improve acceptance and accessibility for seasonal flu campaigns targeted at health care personnel using practices deployed in the five best programmes. Practices included education and promotional activities, promotion by hospital leaders, mandatory computer based training on flu vaccination, increased temporal and geographical availability of the vaccine, prizes and small incentives, email reminders and enhanced efforts to monitor vaccine uptake.		reported uptake rates in excess of 60%. The fifth reported a 27% increase in flu vaccine uptake compared to the previous year.				
McCarthy et al., 2013	WP R	Australia	Influenza	Pregnant women	Concerns about efficacy and safety of flu vaccine for mother and foetus are barriers to vaccination among pregnant women.	Educational program for maternity staff and pregnant women implemented in 2011 to improve staff and patient awareness of the benefits, efficacy and safety of flu vaccine for both mother and infant. ANC notes were stamped with reminder messages; vaccine supplies were increased at the hospital & information on flu vaccine was disseminated to GPs in a newsletter. New mothers interviewed on postnatal wards of tertiary care obstetric hospital in 2010 & 2011 about whether flu vaccine offered and given and reasons for or against vaccination during pregnancy.		Uptake increased from 30% in 2010 to 40% in 2011 (p=0.03). Vaccine was offered more frequently in 2011 (62.5%) compared to 2010 (37%). Integrating flu vaccine with hospital based antenatal care could increase uptake to as high as 78%.	Yes	Not assessed	Lack of awareness and concerns about risk were cited less often as barriers after the educational campaign. Absent or inconsistent advice from healthcare workers & lack of easy access are persisting barriers to vaccination.	n/a
Miller et al., 2011	AM R	USA	Influenza	Healthcare workers (HCW)	Low flu vaccination rates among HCW.	Survey of 998 acute care hospitals about institutional requirements (required receipt or declination of flu vaccine with or without consequences for vaccine refusal) and impact on vaccine uptake		Among hospitals with institutional requirements for vaccination, mean coverage increased from 62% in the pre-requirement season to 76.6% in the post-	Yes			



						among HCW.		<p>requirement season – a single season increase of 14.7% (95%CI: 12.6-16.7). Hospitals with consequences for vaccine refusal (p=0.003), that were located in urban settings (p=0.01) and those with lower pre-requirement coverage (p<0.0001) had greater single season increases.</p>				
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Rakita et al., 2010	AMR	USA	Influenza	HCW	Low flu vaccination rates among HCW	HCW were required to receive flu vaccination. Those who declined for medical or religious reasons were required to wear a mask at work during flu season.		Vaccine uptake two years before programme started was 54% and in year before was 30% due to a vaccine shortage. Following introduction of the regulations, uptake increased to 97.6% in year one and was >98% in subsequent 4 years of study. 0.7% were allowed to decline for medical or religious reasons. 0.2% declined and left the medical centre.	n/a			
Ribner et al., 2008	AMR	USA	Influenza	HCW	Low vaccine uptake among HCW.	Introduction of a form to document vaccine consent, medical contraindications and vaccine declination. Additional promotional activities (encouragement by management, increased availability and ease of access to the vaccine and free t-shirts) were also undertaken.		Coverage increased from 43% before introduction to 67% after. Vaccine acceptance increased by 55%. 20.6% of employees declined vaccination. A further 11.4% opted out completely. 19% of those who declined expressed a fear of getting influenza from the vaccine.	n/a			
Gerend et al., 2007	AMR	USA	HPV	Undergraduate women.	Significant relationships between HPV vaccine acceptability and most Health Belief Model (HBM)	Use of gain vs loss framed messages to promote acceptance of vaccine. Subjects were given a leaflet to read using either message type and then asked about their intention to be vaccinated.	n/a				Effect of message was moderated by risky sexual behaviour and approach-avoidance motivation. Loss	n/a



					constructs (i.e., perceived susceptibility, perceived benefits and effectiveness, perceived barriers, and physician recommendation).						framed message led to greater HPV vaccination intentions but only among those with multiple sexual partners or partners who infrequently used condoms. Loss frame advantage also observed in those with high avoidance motivation.	
Karanfil et al, 2009	AMR	USA	Influenza	HCW	Low uptake of seasonal influenza vaccination among HCW.	Introduction of mandatory flu vaccination for all HCW and associated physicians. Exemptions for medical or religious reasons; otherwise staff contracts were terminated and physician privileges removed for flu season.		HCW: Almost 100% compliance reported. Vaccine uptake was 98.5%, 1.4% exempt. 0.01% terminated. Physicians: 93% uptake, 4% had administrative privileges removed, the rest were exemptions.	n/a			







Fiks et al., 2007	AMR	USA	Routine childhood vaccines (DTaP, Hib, IPV, MMR, HB, PCV, varicella)	Children aged < 24 months	Vaccination rates remain below national targets and inequities in uptake persist.	Use of an electronic health record reminder system to identify children with immunisation delay to exploit all opportunities for vaccination and to improve uptake rates.		Captured vaccination opportunities increased from 78.2 to 90.3% at well visits (risk difference = 12.2%; 95%CI: 11.2-13.1) and from 11.3 to 32% at sick visits (risk difference 20.7%; 95%CI: 19.3-22.1). Up-to-date vaccination rates at 24 months of age increased from 81.8% to 90.1% (risk difference 8.3%; 95%CI: 5.9-10.7). Timing of vaccination improved in intervention group.	Yes			
Banda ly et al., 2009	EUR	France	Influenza	HCW	Low uptake of flu vaccine among HCW.	A 2006 survey of health care workers in a short stay medical unit to understand the reasons for the acceptance or refusal of vaccination and to assess the impact of national recommendations on coverage.		Vaccine uptake in the department was 30% (compared to 15% in 2002 in the general population of HCW and 48% in 2005 in the general population).	Not assessed			
Jurask ova et al., 2011	WPR	AUS	HPV	Female university students aged <27	Stigma around STIs could mean that HPV vaccine would be less acceptable if its importance was framed in relation to genital warts.	159 women were randomised to receive one of two variations of a fact-sheet describing HPV vaccine as 1) preventing cervical cancer or 2) preventing cervical cancer and genital warts.		Uptake at 2 months of follow-up was 37% and was not influenced by framing.	Not assessed		Low HPV knowledge (22%) and high HPV vaccination intention (79%). Information framing did not influence vaccination intention.	Yes
Helms et al., 2011	WPR	Aus	MMR, Varicella, HB, DTP but not influenza	HCW	Low uptake rate of vaccines among HCW and nosocomial outbreaks of VPDs.	Policy directive in New South Wales requiring all employees to be vaccinated against specified VPDs. Qualitative study to determine what factors promote implementation of this policy in the public sector healthcare setting, among four	n/a				Successful implementation of mandatory vaccination associated with effective communication,	Not assessed

						stakeholder groups (central health department, hospitals, health professional associations and universities).				support of clinical leaders, provision of free vaccine, access to occupational health services, including vaccination and presence of appropriate data collection and reporting systems. Achieving high uptake is more difficult in existing employees and with smaller institutions.		
Van Buyn der et al., 2011	WPR	AUS	Influenza	Parents of children aged 6 to 59 months	A cluster of flu related deaths in toddlers prompted the implementation of a programme of vaccination for children aged 6 to 59 months. Parental resistance and low uptake was expected.	A marketing campaign to address barriers to vaccination in order to maximise uptake. Newspaper advertisements, poster displays, radio advertisements, direct marketing to child care centres and a linked series of web-sites. Parents were surveyed to assess reasons for vaccination. Campaign assess using a telephone survey, interviews with parents of symptomatic children , review of demand for vaccine & monitoring temporal trends in the flu notification rate in that age-group.	↑	Based on data from the telephone survey, the coverage rate, standardised to the local population was estimated at 52% for first dose and 36% for second. Peak uptake in dose one was in the week the media campaign started. No evidence that the second phase of the campaign boosted uptake of dose two. Uptake and timing of second doses probably due to appointments for the dose made at the time of initiation of vaccination.	Not assessed	↑	Parents who decided to vaccinate their children included a high-proportion who found the media messages informative (82.6%) and believable (77%). They were also concerned with severity of flu, believed the vaccine to be safe and vaccination was	Not assessed

								The influenza notification rate halved from the previous year (RR=0.54; 95%CI: 0.43-0.68).			recommended by either a trusted HCW or family source.	
Hsu et al., 2010	AMR	USA	Hep. B	Adult	Asian Americans are disproportionately affected by Hepatitis B. Knowledge and awareness of prevention strategies such as receiving hepatitis B vaccination are factors associated with occurrence of hepatitis B and liver cancer.	Examination of baseline characteristics and educational intervention, infection status, and missing responses of at-risk Asian Americans.	n/a				The mean pre- and post-test scores were different by group (P < 0.01). All groups had significantly improved knowledge of prevention (F = 7.65, P < 0.01). Age and race were positively related to immunisation status, with older participants more likely to get vaccinated (OR = 1.02, CI = 1.00-1.03), as were Chinese, Korean and Vietnamese.	Yes
Hu et al., 2011	WPR	China	HPV	Women aged 18-25	Low HPV awareness.	Education intervention on HPV infection, HPV related disease and prophylactic HPV vaccine	n/a	n/a	n/a		Almost all women (98.4%, 311/316) were willing to be vaccinated, regardless of whether they had heard of HPV. Nearly all women (98.7%, 312/316) would	Not provided



					of vaccination teams			total number of children vaccinated after negotiation was 294.				
Gage (183)	AFR	Niger	Polio	Community, NGO, religious leaders,	Lack of respect and courtesy displayed by HCW towards clients has repercussions on the acceptance of vaccines.	See Characteristics of included studies p.94.	↑	Perceived reduction in the number of new cases of AFO.	Not provided	↑	Change in attitude towards recognising polio immunisation as important for promoting children's health.	
Rotary International, 2007 (172)	SEAR	India	Polio	Community	Negative past experiences and misgivings about vaccination.	See Characteristics of included studies p.94.	↑	5% increase in immunisation uptake from booths. Doctors administered vaccines at 19 households due to good will from the previously held medical check-up camps.	Not provided	n/a		
ECDC, 2012 (176)	EUR	Slovenia	Influenza	HCW, Community	Slovenian citizens are considered to have a negative attitude towards vaccines in general.	See Characteristics of included studies p.94.	↓	Did not convince people to get vaccinated.	Not provided	↑ ↓	Successful in terms of knowledge and information sharing. However, The social media component achieved low utilisation and became a source of negative social media rumours.	
Rakek, Van Eerden,	AMR	USA	Influenza & DTP, hepatitis	HCW	Patient's concerns related to immunisation	Gastroenterologists were surveyed for awareness of vaccine recommendations and current practice prior to and following the introduction of a proforma. Rates of immunity	↑	Vaccination against hepatitis B, varicella, Influenza, and pneumococcus was	Not provided	n/a		


2010 (186)			tis B, varicella, Pneumococcus, human papillomavirus, tuberculosis, hepatitis C		n during pregnancy.	and the proportion of patients receiving the recommended screening and vaccinations were documented.		recommended in 67%, 2.5%, 75% and 69% of the patients respectively. Of these, 42%, 39%, 66% and 49% patients followed the recommendations and were vaccinated.				
Temoka, 2013 (177)	AMR	USA	Childhood	Community	Parents refuse or delay vaccination for their children for socio-economical, medical, religious and/or philosophical reasons.	Articles and other written documentations on the benefits and side effects of vaccines. A standardised system that identifies and tracks patients who need vaccines. Vaccination standing order. Electronic record reminder system, letter, phone calls. Made access to clinic easy such as seeing clients on day they make an appointment and 'walk-ins'. If a patient needs medical advice for child, they can make appointments at the clinic and can receive vaccination. Did not force 'Hesitants' to vaccinate but educated and talk about vaccines every two or three visits.		The rate for four or more doses of DTaP vaccine 98.2% versus 95% for the national rate. For one or more dose of MMR; 99.1% versus 91.5% nationally. Three or more doses of Hib were 100% versus 90.4% nationally. Four or more doses of pneumococcal conjugated vaccine; 97.3% versus 83.4% nationally. Three or more doses of hep. B; 100% versus 91.8%. Also increased for Hep A and VAR.	Not provided (no use of figures before intervention was implemented to compare).	n/a		
Paradise et al., 2013	USA	AMR	Influenza	HCW	Low uptake of annual influenza vaccine.	Seasonal flu immunisation mandated as condition of employment. Leveraged an internal media blitz with repetitive emails and videos on screens around the hospital. Formal exemption		Baseline: 65%. In the four years since mandatory flu immunisation was	Not provided			

(175)						process for persons with medical or religious concerns. Nursing administration and pharmacy coordinated.		instituted: 99% immunisation rate.				
Gargano et al., 2013a (180)	AMR	USA	Adolescent	Adolescents	Parental and adolescent attitudes are important in determining vaccine uptake.	11 schools were randomized to receive: Arm 1) an educational brochure targeted toward parents, Arm 2) the parent brochure plus a teacher-delivered intervention targeted toward students, or Arm 3) no intervention. Students, parents, and teachers were active participants in the development and implementation of all intervention materials. The three steps in the development of the intervention were 1) formative research through a series of focus groups with parents, adolescents, and teachers to ascertain existing attitudes related to each recommended adolescent vaccine and the disease(s) it protects against; 2) material development based on theoretical framework (Health Belief Model and social norms), focus group findings, literature review, and previous work; and 3) a final round of focus groups with parents, adolescents, and teachers to obtain feedback regarding the prototype intervention materials.	n/a				Most respondents said the brochure increased their knowledge about adolescent vaccination (93%). In Arm (2, significant increases among middle school students. Significant increase in middle- and high-school students who recognised the four vaccines recommended for adolescents (p 0.001) and who were interested being vaccinated (p 0.01).	Yes
UNICEF, 2011 (184)	EMR	Afghanistan	Polio	Community, HCW	Geographically isolated populations. Limited capable human resources. Difficult to reach women and actively engage them in the programme. Limited commitment	See Characteristics of included studies p.94.	 	Southern Region: -Community Mobilisers are well accepted by the community and many have played critical roles in converting refusals. -Turnover of staff in the PCN is frequent and erratic. Whenever a high level of uptake is attained in a particular cluster that cluster is not	Not provided	  	Southern Region: -The IEC tools are text heavy and are not understood by many community members, including influencers and women. -At Spin Boldak, campaign awareness and vaccination- both seemed to be progressing well. Western Region:	Not provided

					t at some levels and the monetisation of communication activities amongst partners.			considered by the Partners to be high risk anymore and the PCN is disbanded. Once staff have been suddenly let go, they contribute to a rising resistance for the programme, many also take higher paying jobs, causing sporadic spikes in refusal from one round to the next.			-Communication activity plans were being utilised but not at a high enough insertion rate to be effective.	
UNICEF, 2013 (174)	EMR AFR	Afghanistan, Pakistan, Nigeria	Polio	Community, HCW	Security Threats, political and cultural challenges.	Global Polio Eradication Initiative (GPEI) - advocacy, administration.	↑	Between September 2012 and April 2013 50% more children who had never received a dose of OPV were reached.	Not provided	n/a		
Dialogue												
Archer & Cottinham, 1996 (185)	SEAR	Bangladesh	Polio	Women	Mothers did not trust vaccinations	REFLECT (Regenerated Freirean Literacy through Empowering Community Techniques) - detailed analysis of local issues and development of own learning materials. Discussion of immunisation based around vaccination cards which most women already had at home.	↑	After discussing immunisation in the REFLECT centre the women concerned have got their children immunised.	Not provided	n/a		
Kershaw et al., 2011 (178)	AMR	Canada	Childhood	Community	Disparities in immunisation uptake rates between children based on where they live.	See Characteristics of included studies p.94.	↑	Immunisation uptake rates among two-year-olds for MMR increased 6.1% from 2007 to 2009 in SHR. Immunisation uptake rates among two-year olds for DaPTP-Hib (Diphtheria, Polio, Tetanus Toxoid, Pertussis, and Haemophilus	See outcome	n/a		



								<p>Influenza type B) increased 3.4% from 2007 to 2009 in SHR.</p> <p>-Some of the sub-groups experienced a slight decrease for both MMR and DaPTP-Hib between 2008 and 2009.</p> <p>- Foster children - 2009 MMR rates were 28.6% less than SHR and whose 2009 DaPTP-Hib rates were 33.6% less than SHR.</p> <p>-Children from the six low-income neighbourhoods were less likely to have up-to-date immunisations for both MMR and DaPTP-Hib than children from the non-core neighbourhoods. These differences were statistically significant for all seven years studied. Although not yet significant, the gap between the core and non-core neighbourhoods does appear to be decreasing.</p> <p>-Children from Saskatoon were less likely to have up-to-</p>				
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								date immunisations for both MMR and DaPTP-Hib than children in the rural region. However, this difference was only statistically significant for four of the seven years.				
BBC World Service, 2009 (179)	AFR	Sudan	Childhood	Refugees	Lack of awareness and education about vaccines.	Radios and immunisation-specific broadcasts in familiar language giving opportunity for feedback.		Increase in vaccination (50%).	Not provided	n/a		
Other												
Kester et al., 2013 (181)	USA	AMR	HPV	Community	Low awareness of the benefits of vaccination and intention to vaccinate.	Individuals were randomised to one of two groups: survey completion followed by education (control group) or education followed by survey completion (intervention group). The educational component consisted of a 5-10 minute review of HPV by an HPV educator. Areas covered included HPV transmission, HPV-related diseases, HPV detection, risk factors for infection, prevention of HPV infection, HPV vaccination, and additional references for HPV-related resources and services.	n/a				Individuals who received education before survey completion had significantly higher HPV knowledge scores (M = 9.10; SD = 1.773) compared to those who completed the survey before education (M = 6.98; SD = 2.899; F = 22.53, p < .001). Of those individuals who had not yet initiated vaccination (n = 79), the intervention group had a significantly higher intention to vaccinate (86%) as compared to the control group (67%)	Yes

											(OR = 3.09; 95% CI = 1.02–9.36; p < .05).	
Pagan et al., 2013 (182)	AMR	USA	HPV	Adolescents	Low awareness of the benefits of vaccination and intention to vaccinate	Peer sexual health educators known as Teen Community Health Advisors (CHAs). Before implementing Teen CHA activities, students completed a 52-item survey comprised of questions from the Health Information National Trends Survey and the Youth Risk Behaviour Survey and assessed sexual health behaviours and knowledge. The CHAs then developed HPV educational activities which included class skits, posters, school-wide announcements and incorporation of HPV-related topics into routine peer interactions. The students were reassessed 12 weeks after program initiation for changes in HPV knowledge, HPV vaccination status, and awareness of CHA-related activities.	n/a				At baseline, 58.4% reported having heard of HPV compared to 67.5% at follow-up (p = .02). After the educational activities, students were more likely to have heard of the Teen CHA program (p < .001) and acknowledge that HPV is sexually acquired (p = .042). More students at follow-up reported that HPV causes genital warts (p = .05). While not significant, there was an increase in the number of students who knew that HPV was associated with the development of certain cancers (p = .11). At follow-up, students were more likely to have heard of the HPV vaccine (p = .007) but not necessarily more likely to have received it (p = .18).	See outcome

Grey Literature Reproductive Health






Ref	Region	Country	Reproductive Health Technology	Target ppln	Issue	Strategies	Primary outcome	Details	Significant	Secondary outcome	Details	Significant
Multi-component												
UNFP A, 2008a (194)	AMR	Nicaragua	Condom, Pills, Injectables, IUDs, Implants	Religious leaders, community, government	Socially and culturally unacceptable for a woman to acquire condoms.	IEC campaign of audio-visual and internet technologies; workshop with journalists addressing issues related to sexual and reproductive rights; workshop on gender.	↑	Political and financial commitment.	Not provided	n/a		
UNFP A, 2008b (194)	AFR	Burkina Faso	Condom, Pills, Injectables, IUDs, Implants	Religious leaders, government, community, HCW, Journalists	Socially and culturally unacceptable for a woman to acquire condoms.	Multi-media campaign: mass media, group media (theatre plays, video screening) and group communication (focus group discussions) across the country, in French and six local languages.	n/a			↑	Access > 60% of population	Not provided
UNFP A 2007a (199)	EUR	Georgia	Non specific	Community, HCW	Adults influence young people's access to sexual and reproductive health (SRH) information and services, as well as their ability to make healthful decisions.	Project staff met with the bishop and village priests – who did not participate in training but suggested themes to be addressed in the forum theatre which addressed social issues that influence health. Trained youth and adults (including teachers); change agents to inform members of the community about reproductive health.	↑	Increase contraceptive use / preventive behaviour.	Not provided	↑	Pro-FP social and structural change (communication between stakeholders). Knowledge increase.	
UNFP A, 2005a	SEAR, WPR	East and South-East Asia,	Male and female condoms,	HCW, community, religious	Gender inequality and cultural vulnerability constitute challenges	Muslim scholars invited to help provincial health officers explain the	↑	Increased contraceptive use.	Not provided	↑	Positive shift in perceptions of gender roles.	Not provided





(197)		Bangkok, Thailand	IUDs	leaders	to achieving the MDGs all of which are inextricably linked to reproductive health.	advantages of family planning to Muslim couples. Men as potential partners and advocates. Seminars, training courses, information dissemination, male reproductive health association. Male community health workers on tricycles deliver advocacy and IEC/Behavioural Change communication messages, male clinics in rural health units and district hospitals.						
UNFP A, 2005b (197)	SEAR, WPR	East and South-East Asia, Bangkok, Thailand	Male and female condoms, IUDs	HCW, community, religious leaders	Gender inequality and cultural vulnerability constitute challenges to achieving the MDGs all of which are inextricably linked to reproductive health.	Special Committee on reproductive health and Family Management, headed by the House of Islamic Opinion of Central Mindanao - technical inputs provided by Muslim doctors. Political management: secured alliances with the Islamic leaders. Broadened the role of field workers to include a national network of village-level family planning groups including women and NGOs and putting family planning on the political agenda.	n/a				Positive religious and political shift; fatwah endorsed, political commitment/programme organisation.	Not provided
UNFP A, 2005c (197)	SEAR, WPR	East and South-East Asia, Bangkok, Thailand	Male and female condoms, IUDs	HCW, community, religious leaders	Gender inequality and cultural vulnerability constitute challenges to achieving the MDGs all of which are inextricably linked to reproductive health.	Provided information on safe sex and promoted male and female condoms among young girls working in entertainment industries; prevention strategies, negotiating skills, peer education.	n/a				Buy-in from proprietors.	Not provided






						Built alliances with owners of entertainment establishments.						
Cohen & Burger 2000a (195)	AFR	Senegal	Male condom	Men	Men's role in sexual and reproductive health is overlooked.	Religious leaders interpreted the Quran and its precepts regarding sexuality, family planning and reproductive health and developed audiocassettes on reproductive health based on Islamic beliefs. Imams address family planning and sexuality in their sermons, particularly with men.	↑	Increased contraceptive use from 4% in 1993 to 8% in 1997.	Not provided	n/a		
Cohen & Burger 2000b (195)	SEAR	Bangladesh	Male condom	Community	Men's role in sexual and reproductive health is overlooked.	Field workers collaborated with male and female opinion leaders in the village to teach about contraceptive methods, answer questions, distribute contraceptives and make referrals. Encouraged men and women to talk with spouses about family planning. Used existing rural communication networks.	↑	Increase contraceptive use from 38% to 56% in villages with field workers and discussion groups and from 26% to 32% in villages with field workers only.	Not provided	n/a		
MEM A kwa Vijana , 2008a (201)	AFR	Tanzania	Condom	Community	Gap between young people's knowledge and their reported attitudes and Behaviour regarding HIV prevention.	Training and supervision of HCW in government health facilities to provide youth-friendly sexual and reproductive health services. Training and supply of youth community-based condom promoters and distributors.	↑	Condom use higher in both males and females in intervention communities in 2001/2 and 2007/8, though only strongly significant for reported condom use	See outcome	↑ █	Positive shift in provider knowledge and attitude but only short term	No

								with a non-regular partner among young women in 07/08 survey.				
UNFP A, PATH, 2008a (196)	EUR	Turkey	Condom	Women	Women have diverse reasons for not using contraception including concerns about side effects, religious strictures against family planning, and the belief that they are unlikely to become pregnant, or issues related to cost or access.	HCW interviewed clients about their need for family planning, offering routine services, such as children's vaccinations and check-ups and provided referrals to family planning unit.	↑	Increase in adoption of contraception. Of 435 clients with an unmet need for contraception, referrals to the family planning unit led to 40% of them adopting a method the same day.	Not provided	n/a		
UNFP A, PATH, 2008b (196)	AMR	Haiti	Condom	Women	Women have diverse reasons for not using contraception including concerns about side effects, religious strictures against family planning, and the belief that they are unlikely to become pregnant, or issues related to cost or access.	Voluntary counselling and testing centre integrated family planning along with other primary care services; all clients seeking an HIV test were screened for contraceptive and other health needs.	↑	Increase in acceptance of contraception. Three family planning units with 19% new clients.	Not provided	n/a		
Dialogue-based												
UNFP A, 2010 (200)	AMR	Guatemala	Non-specific	Community	Indigenous peoples, and particularly indigenous women have the worst socio-demographic indicators and the largest inequalities in	Community educators - both men and women, selected from their own communities to work with pregnant women, families and community members. Trained in reproductive	↑	Increase contraceptive use.	Not provided	↑	Improved male: female communication	Not provided

					terms of access to social services.	rights and family planning, worked as 'cultural brokers', decoding information for rural community members and drawing men into the education processes.						
UNFP A, 2008c (194)	AFR	Ethiopia	Condom, Pills, Injectables, IUDs, Implants	Religious leaders, community, government	Socially and culturally unacceptable for a woman to acquire condoms.	Advocacy workshops included religious and community leaders: open dialogue and encouraged use of daily religious teachings to encourage men's involvement and support family planning services.	↑	Repositioned family planning as positive; Muslim leaders preached about pro-family planning.	Not provided	n/a		
Jones et al., 2008 (202)	AFR	Ethiopia	Male condom	Men	Social norms, beliefs and institutional barriers prevent vaccination of girls.	Discussion group. Trained male mentors held weekly meetings at community level with groups of young men, who were given information and held dialogue on gender relationships, caring for children and family, sexual and reproductive health. Challenged attitudes towards gender relations and child care, reproductive health and condom use.	↑	Positive shift in social norms / gender relations.	Not provided	n/a		
UNFP A, 2010 (198)	SEAR	Nepal	Male and female condom, IUD, Pills	Women	Husband's acceptability of contraception.	"Choose a Future" programme: marginalised Nepali girls learned about their bodies to understand their health needs and develop the capacity to make health-related requests and decisions. Participants met for two hours, five days a week, for	↑	Positive shift social norms / gender relations.	Not provided	n/a		

						ten weeks.						
UNFP A, 2005 (197)d	SEAR, WPR	East and South-East Asia, Bangkok, Thailand	Male and female condoms, IUDs	HCW, community, religious leaders	Gender inequality and cultural vulnerability constitute challenges to achieving the MDGs all of which are inextricably linked to reproductive health.	Post-abortion care (PAC) counselling and family planning counselling.	n/a				Positive shift in provider attitude.	Not provided
Khany a-Africa n Institute for Community-Driven Development, 2007 (203)	AFR	Kenya, Lesotho, South Africa and Uganda	Male condom	Community	There is a need to improve models and methods for effective delivery of services at scale for poor people. This represents a significant challenge to policy-makers and programme designers, governments and NGOs involved in service delivery.	Youth peer educators and roundtable discussions with community members and government officials to dialogue on advocacy.		Condom use increased, unwanted pregnancies decreased.	Not provided		Change in knowledge, attitudes and practice.	Not provided
UNFP A, PATH, 2008c (196)	AFR	Tanzania	Condom	Women	Women have diverse reasons for not using contraception including concerns about side effects, religious strictures against family planning, and the belief that they are unlikely to become pregnant, or issues related to cost or access.	Integrated services e.g., family planning.		Increase in uptake and long-term use of family planning. 90% of women who were offered contraceptive counselling and services during post-abortion care adopted a method and most were still using it one year later.	Not provided	n/a		
Other												
UNFP	WPR	Mongolia	Condom,	Religious	Socially and culturally	Advocacy Group for RHCS		Political shift	Not	n/a		

A, 2008d (194)			Pills Injectables, IUDs, Implants	leaders, government , community, HCW, Journalists	unacceptable for a woman to acquire condoms.	formed, supported and membered by MOH, senior officials and members of parliament: developed RHCS Advocacy Strategy. Subsequent consultations meetings with Ministries of Health and finance to build better understanding on RHCS and general commitment to increase government resource.		pro-family planning.	provided			
UNFP A 2007b (199) 38b	EUR	Georgia	Non specific	Community, HCW	Adults influence young people's access to sexual and reproductive health (SRH) information and services, as well as their ability to make healthful decisions.	Social marketing tools for information dissemination.	n/a				Better access for >60% of the population.	Not provided
PATH, 2012 (213)	AFR	Zambia	Female condom	Government, HCW, NGOs	Convincing countries to adopt new products, development of products that fill needs of countries, dissemination of product information, subsidisation through financing support and supporting procurement and logistics.	Active and well-connected reproductive health unit leader who is also spokesman for the MOH.	n/a				Political shift pro- family planning.	Not provided
MEM A kwa Vijana , 2008b (201)	AFR	Zimbabwe	Condom	Community	Gap between young people's knowledge and their reported attitudes and Behaviour regarding HIV prevention.	Participatory, active learning methods with interventions in schools, health services and broader community; intervention delivered by trained		No change in sexual risk- taking behaviour; decreased current/past	Not provided		Increase knowledge/self- efficacy re: decision-making (girls only).	Not provided

						secondary school leavers who live and work in study communities.		pregnancies.				
MEM A kwa Vijana , 2008c (201)	AFR	Tanzania	Condom	Community	Gap between young people's knowledge and their reported attitudes and behaviour regarding HIV prevention.	Teacher-led, peer-assisted in-school sexual and reproductive health education.	n/a			 	Knowledge increase but little attitude change.	Not provided
Were et al., 2009 (214)	AFR	Rwanda	Male condom	Community	The digital divide prevents those with no access to Information and Communication Technology (ICT) resources and electricity supply from accessing the benefits of participation in the knowledge-based society.	Digital materials/e-health for delivery in schools.	n/a				Five out of six of the schools never used materials as teachers deemed it too lurid. Sense of alienation on side of frontline implementers.	n/a
FHI360, (no date) (204)	AFR	Kenya, Tanzania	None specific	Adolescent	Limited knowledge about methods. Myths and misconceptions. Concerns for youth considering clinic settings: – Privacy and confidentiality – Costs – Convenience of locations/hours – Provider biases.	Automated, interactive, on-demand SMS system provided basic information about a full range of short-acting and long-acting contraceptive methods. Messages communicated facts about contraceptive methods and addressed common misconceptions. Family planning clinical locator database allowed users to locate nearby clinics.		Increase in family planning use (nominal).	Not provided		Increase in knowledge (nominal).	Not provided

Appendix 6: Reference table – Coding guidance – Vaccine hesitancy

Examples of strategies mapped to each determinant of the vaccine hesitancy matrix are listed below:

Determinant	Definition	Example
Contextual Influences		
<i>Communications and Media Environment</i>	Communication techniques, including traditional and social media	Debates, group discussion, multi-media campaigns, theatre plays and video screening
<i>Influential leaders</i>	Religious leader(s) or national/local celebrity promotes the cause	Sensitisation and education campaign for adolescents and parents by Baptist convention
<i>Historical influences</i>	Providing positive local evidence by community groups to address concerns	No strategies found for this determinant
<i>Religion/culture/gender/socio-economic'</i>	Culturally sensitive approach, using 'on the ground' communication/community participation techniques	Workshops, narrative intervention - content developed under guidance of culture-centric narrative theory
<i>Politics/policies</i>	Highlights the responsibility of states in addressing the issue of vaccine hesitancy	Mandatory vs recommended strategies
<i>Geographic barriers</i>	Aims to address geographical barriers to accessing vaccines, usually in rural areas	Introduction of outreach services
<i>Pharmaceutical industry</i>	Aims to address issues relating to the pharmaceutical industry regarding negative perceptions of the industry and issues with supply	Vaccination records offered by a pharmacy
Individual/social group Influences		
<i>Experience with past vaccination</i>	Aims to address a negative experience with a past vaccine	Educational pamphlet and video for parents at the point of care
<i>Beliefs, attitudes about health and prevention</i>	Engaging communities in questioning social norms	Roadside film show conducted in communities by mobile vans. Films

	regarding health and prevention	focus on known misconceptions about vaccines and targeted beliefs about the cause of diseases and the negative attitude towards vaccination
<i>Knowledge/awareness</i>	Dissemination of key facts and healthcare worker personal experience to raise awareness of vaccines and increase knowledge	Brochures in magazine for hospital employees, posters, flyer in private mail of employees, reminder with vaccination clinic hours, lectures by Infection Control Heads, Public Health Office information distributed
<i>Health system and providers-trust and personal experience</i>	Addresses issues of trust regarding the health system	Staff training, skills and supervision
<i>Risk/benefit (perceived/heuristic)</i>	Aims to address and talk through what members of the public perceive as risks and to highlight the benefits of vaccines	Quality improvement activities, educational interventions to improve patient acceptance of vaccinations, educational interventions for staff
<i>Immunisation/ as a social norm</i>	Engaging with communities so that certain products are more widely accepted	Serial vaccination campaigns, mobile carts, mandatory declination, peer-to-peer vaccination efforts
<i>Vaccine and Vaccine-specific issues</i>		
<i>Risk/Benefit (scientific)</i>	Aims to address what members of the public perceive as risks, such as adverse events following immunisation and to highlight the benefits of vaccination	Educational sessions about mode of transmission. In-situ tutorials in work places, brochures and posters contact numbers of infection control unit representatives for any inquiry, management and reporting. Education for patients through focused sessions, hand-outs, brochures and posters
<i>Intro of new vaccine/formulation</i>	Aims to address concerns arising after the introduction of new vaccine	One-to-one webinar between clinical coordinators and State Immunisation Branch
<i>Mode of administration</i>	Aims to address issues surrounding the means to which a vaccine is administered	Education session, HCW education about pain-relieving strategies through presentations and practice scenarios. Online support provided for nurses to clarify concepts and answer questions

<i>Mode of delivery</i>	Aims to address issues of convenience of the vaccination schedule	Free of charge, post-partum vaccination at maternity hospital or neonatal unit
<i>Reliability and/or source of vaccine supply</i>	Addresses issues of vaccine supply	Geographic Information System (GIS) mapping, partner with private third-party billers, immunisation registries
<i>Vaccination schedule</i>	Addresses issues arising due to parents missing/not understanding the time schedules for different doses of various vaccines	Mail/telephone reminders, offering vaccines at more convenient locations, providing vaccinations at work
<i>Costs</i>	Aims to address the issue of high costs (financial and other) of receiving vaccination	Vouchers, incentive schemes, free workplace vaccination
<i>Role of healthcare professionals</i>	Highlights the role of HCW as influencers of client vaccination decision-making.	Encourage HCW to increase their knowledge of vaccines and vaccine safety, have an approachable and sensitive manner.

Appendix 7: Reference table – Coding guidance – Reproductive health technologies (RHT)

Examples of strategies mapped to each determinant of the vaccine hesitancy matrix are listed below:

Determinant	Definition	Example
Contextual Influences		
<i>Communications and Media Environment</i>	Communication techniques, traditional and social media	Communication campaign with audio-visual and internet technologies; workshop with journalists addressing issues related to sexual and reproductive rights and gender
<i>Influential leaders</i>	Religious leader(s) or national/local celebrity promotes the cause	Project staff meet with the bishop and village priests who suggest themes such as social issues that influence health that should be addressed
<i>Historical influences</i>	Providing positive local evidence by community groups to address concerns	No examples found for this search
<i>Religion/culture/gender/socio-economic'</i>	Culturally sensitive approach, using communication/community participation techniques	Both men and women, selected from their own communities to work with pregnant women, families and community members. Trained in reproductive rights and family planning. Communicate information for rural community members, including men in the education processes.
<i>Politics/policies</i>	Highlights the responsibility of states in addressing the issue of reproductive health technology hesitancy	Active and well-connected reproductive health unit leader who is also spokesman for the Ministry of Health (MOH)
<i>Geographic barriers</i>	Aims to overcome geographical barriers in accessing reproductive health technologies, usually in rural areas	Introduction of outreach services
<i>Pharmaceutical industry</i>	Aims to overcome contextual issues of the pharmaceutical industry regarding negative perceptions of the industry and issues with supply	No examples found for this search

Individual/social group Influences		
<i>Experience with past reproductive health technology</i>	Aims to address a negative experience with a past reproductive health technology	No examples found for this search
<i>Beliefs, attitudes about health and prevention</i>	Engaging communities in questioning social norms regarding health and prevention	Discussion group approach targeted at married men in rural villages. Trained male mentors hold meetings at community level with groups of young men, who are given information and hold dialogues on gender relationships, caring for children and family, sexual and reproductive health.
<i>Knowledge/awareness</i>	Dissemination of key facts and healthcare worker personal experience to raise awareness of reproductive health technologies and increase knowledge.	Seminars, training courses, information dissemination, male reproductive health association. Male community health workers on tricycles deliver advocacy and IEC/Behavioural Change communication messages, male clinics in rural health units and district hospitals.
<i>Health system and providers-trust and personal experience</i>	Addresses issues of trust regarding the health system.	Training and supervision of health workers in government health facilities to provide youth-friendly sexual and reproductive health services. Training and supply of youth community-based condom promoters and distributors.
<i>Risk/benefit (perceived/heuristic)</i>	Aims to address and talk through what members of the public perceive as risks and to highlight the benefits of reproductive health technologies	Teach women to become familiar with their bodies and to gain confidence using vaginal methods. Female condoms sold with noisy bibe bibe beads, an erotic accessory that women wear around their hips. The rustle of the polyurethane during sex is now associated with the clicking of the beads—and so, a turn-on. Providers convey accurate, unbiased information. Better integration with other health programs.
<i>Reproductive health technology as a social norm</i>	Engaging with communities so that certain products are more widely accepted	Youth peer educators and roundtable discussions with community members and government officials
RHT (Vaccine) and RTH-specific (Vaccine-specific) issues		
<i>Risk/Benefit (scientific)</i>	Aims to address and talk through what members of the public perceive as	No examples found for this search

	risks and to highlight the benefits of reproductive health technologies	
<i>Intro of new reproductive health technology</i>	Aims to address concerns arising after the introduction of new reproductive health technology	No examples found for this search
<i>Mode of administration</i>	Aims to address issues surrounding the means to which a reproductive health technology is administered, such as due to fears of pain caused by the IUD	Sensitisation - community members, religious leaders and groups of women and youth convened for education activities including drama programs, premarital consultations and peer educators. Adolescents are escorted to the health centre for family planning services.
<i>Mode of delivery</i>	Aims to address issues of access and convenience surrounding reproductive health technologies.	Field workers collaborate with male and female opinion leaders in the village to distribute contraceptives and make referrals.
<i>Reliability and/or source of vaccine supply</i>	Addresses issues of reproductive health technology supply	No examples found for this search
<i>Vaccination schedule</i>	This determinant cannot be applied to the reproductive health search.	n/a
<i>Costs</i>	Aims to address the issue of high costs (financial and other) of receiving reproductive health technologies.	Toll-free information line, reachable from any phone promoted through the national radio system
<i>Role of healthcare professionals</i>	Highlights the role of healthcare workers as influencers of client vaccination decision-making.	Health providers interviewed clients about their need for family planning, offering routine services, such as children's vaccinations and check-ups and provided referrals to family planning unit.

