TECHNICAL REPORT

Systematic literature review of the evidence for effective national immunisation schedule promotional communications

Insights into health communication

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This systematic literature review was commissioned by the European Centre for Disease Prevention and Control (ECDC) as one of the outputs of the Framework Partnership Agreement Grant/2009/007 'Establishing a programme for dissemination of evidence-based health communication activities and innovations on communicable diseases for country Support in the EU and EEA/EFTA, 2009–12', with a consortium of universities comprised of the Health Promotion Research Centre at the National University of Ireland Galway, as the lead coordinating centre, and the Institute for Social Marketing, University of Stirling, Scotland, and the University of Navarra Clinic, Pamplona, Spain.

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Contents

Abbreviations

ANOVA	Analysis of variance
ARCS	Armenian Red Cross Society
BCG	Bacillus Calmette-Guerin vaccine
CI	Confidence interval
CME	Continuing Medical Education
DTP	Diphtheria, tetanus, pertussis vaccination
EBL	Evidence Based Librarianship
ECDC	European Centre for Disease Prevention and Control
EIW	European Immunization Week
EPI	Expanded Programme on Immunization
GP	General practitioner
HBM	Health Belief Model
HBV	Hepatitis B vaccination
HCW	Healthcare worker(s)
HPV	Human papillomavirus
HCDCP	Hellenic Centre for Disease Control and Prevention
IMCI	Integrated Management of Childhood Illnesses
MMR	Measles, mumps, rubella vaccination
NGO	Non-governmental organisation
NHS	National Health Service
NICE	National Institute for Health and Clinical Excellence
NIS	National Immunisation Schedule
OPV	Oral polio vaccine
OR	Odds ratio
PBC	Perceived behavioural control
PSA	Public service announcement
PT	Prospect Theory
RB	Relative benefit
RCT	Randomised controlled trial
RR	Risk ratio (relative risk)
SARS	Severe Acute Respiratory Syndrome
SEK	Swedish Krona
SD	Standard deviation
STAI	State-Trait Anxiety Inventory
TPB	Theory of Planned Behaviour
UNICEF	United Nations Children's Fund
WHO	World Health Organization

Executive summary

Introduction

A systematic literature review examined the published evidence on the effectiveness of European promotional communications for national immunisation schedule (NIS) vaccinations. The review was commissioned by the European Centre for Disease Prevention and Control (ECDC) and conducted by the Institute for Social Marketing at the University of Stirling.

The purpose of the review

'Immunisation hesitancy' has negatively impacted population uptake of routine immunisation. A substantial body of evaluated communication activity promoting nationally indicated routine immunisation has been published. This systematic review of the evidence aims to: collate and map the types of promotional communication that have been used; assess the quality of the evaluative research reporting on these promotional communications; and assess the applicability of this evidence to immunisation policy, strategy and practice priorities. The analysis and findings are intended to provide a current status report on the evidence, and evidence gaps for good practice in national immunisation promotional communications, thus supporting countries in their communication activities for the prevention and control of communicable diseases.

Review methods

Systematic review methods were used. Systematic review methodologies are designed to be comprehensive, transparent, and replicable, and to minimise selection bias. Systematic reviews follow a detailed protocol, specified in advance, which fully documents all steps and decisions involved in the process.

The initial search aimed to identify English and non-English language academic and grey literature, in printed and electronic formats, reporting on the evaluation of European interventions and published from 2000 to 2011. Sensitivity analysis found the exclusion of non-English language reports was unlikely to substantively change the review results, and therefore the final review did not include non-English language literature. Search results were screened for relevance by a team of researchers, in two screening stages, using pre-set exclusion criteria. Summaries of the included studies were summarised in data extraction tables. Studies were coded and analysed thematically.

The studies were assessed and scored for quality, validity and applicability. A weight of evidence assessment was also conducted on the higher scoring studies in order to identify those studies that provided the most convincing evidence of impact/no effect. The review analysis and conclusions place greatest emphasis on the higher scoring studies but the evidence from lower scoring studies is also included where this is judged to add to understanding of current promotional activity and its acceptability, feasibility and/or effectiveness.

Review results

Overview

Thirty three studies were included in the final review. Twenty two reported on interventions promoting influenza vaccination, and eleven related to childhood vaccine preventable diseases. Target audiences included parents; health care workers; children/young people; patient risk groups; and the general public. Three communication approaches were identified: mass communications; personalised communications; and education and training provision. In addition, a number of interventions included elements of improved service delivery. A small number of experimental studies captured in the review examined the effect of message framing on intentions to immunise.

Fifteen of the 33 evaluation studies captured in the review were rated as high validity studies on the basis of the quality, validity and applicability appraisal process. Seven high scoring studies reported convincing evidence of positive effect and eight reported no evidence of effectiveness.

The heterogeneity of intervention and evaluation methods, along with the small number of studies assessed as having high validity for the purposes of this review and reporting convincing evidence of impact, limits the conclusions that may be drawn from the review. The review provided a map of current practice and identifies some promising areas of practice that are suggested for further development and testing for effectiveness. The review also highlights some significant gaps in the evidence base. The pre-specified research questions that guided the review process are used as the framework to report a summary of these results below.

Audiences that have been targeted by national immunisation schedules promotional communications

The review identified little evidence of evaluated large-scale public health communications that aimed to respond to and address immunisation hesitancy and associated underlying changes in public perceptions.

The majority of studies included in the review evaluated promotional interventions for influenza vaccination. A substantial number of interventions captured by the review targeted health care workers. The second most common target groups were selected patient risk groups, in most instances, the elderly. Some interventions simultaneously targeted health care workers and patient risk groups.

This evidence suggests that interventions targeting health care workers can improve vaccine uptake rates in both health care workers themselves, and in patient risk groups. The evidence also indicates that targeting health care workers in combination with patient risk groups may be an effective strategy to increase immunisation uptake in patient risk groups.

Interventions promoting childhood vaccines were mainly aimed at parents. A small number of campaigns aimed at young people, that promoted human papillomavirus (HPV) vaccination and rubella vaccination were also identified.

Studies targeting the general public were experimental message framing studies, or reported on large-scale multi-component interventions that included communications.

Communication methods and approaches that have been used to promote or reinforce national immunisation schedules vaccination uptake

A variety of approaches and communication methods and channels were identified. The heterogeneity of the interventions in the review probably reflects the fact that communications for immunisations cover a broad scope involving multiple target audiences, vaccinations and settings. It may also reflect the fact that there is limited evidence for 'what works' in promoting immunisation.

The approaches used in the interventions included in the review can be broadly categorised as:

- mass communication (distribution of universally targeted information to undifferentiated or large segments of the population at the same time).
- personalised communication (which in some way aims to make a personally relevant appeal to individuals, for example using direct contact or individually addressed correspondence).
- training/education

The categories are not mutually exclusive, and many interventions combined more than one approach.

The analysis indicated that exclusively mass communications-based interventions can improve vaccine uptake, and that combining mass communications with other approaches can contribute to effectiveness, but is not essential. An exclusively personalised approach strategy or combining personalised with other intervention components was not found to be associated with positive effect. However, the evidence did indicate that face-to-face communications can be an effective component of promotional communications for immunisations for target audiences who had demonstrated vaccine-resistant behaviour.

Training and education, mainly for healthcare workers was used as a communication adjunct and to supplement other promotional communications activities in a number of included studies. The evidence for the effectiveness of training and education on improved vaccine uptake for both healthcare workers themselves and patient risk groups was mixed but promising and warrants further research.

An examination of the various communication channels used across the evaluated interventions did not find any clear pattern in terms of which channels are associated with effectiveness. For example, print materials (including letters, leaflets and posters) were used in many of the evaluated interventions. An equal mix of positive and no effect outcomes were reported for these interventions. Similarly, personally addressed invitations were a widely used strategy but mixed outcomes were reported, and there was no overall trend.

Many of the interventions captured by the review attempted to address personal and structural barriers to immunisation, as well as communicating the benefits. The evidence indicates that improved service delivery is associated with positive intervention effect, but is neither necessary nor sufficient on its own.

The duration and intensity of exposure of the target audience/audiences varied across the interventions captured in this review, depending on the intervention design. One-off contact was associated with lower levels of effectiveness than interventions that achieve (or attempt to achieve) multiple contacts with the target audience.

Theoretical underpinnings that have been used to inform communication methods and approaches

The following behaviour theories and models were used in the design and interpretation of the intervention impact of a small number of included studies:

- Prospect Theory
- Theory of Planned Behaviour
- Health Belief Model
- Leventhal's Common Sense Model of Lay Illness Representation

Message framing studies that compared gain-framed and loss-framed messages were based on Prospect Theory which predicts that presenting the same information about risk in different ways affects people's perspectives, preferences and actions. Vaccination is usually perceived as a preventive behaviour from which the decision maker gains (better long-term health), but one experimental study tested the theory that vaccination may be perceived as a risk-taking behaviour and that a loss-framed message would therefore be more persuasive. This small study did find a loss-framed message to be more persuasive than a gain-framed message.

The review found little evidence that the Theory of Planned Behaviour or the Health Belief Model were appropriate, effective frameworks for the design of pro-immunisation communication interventions. The authors of a small study that used Leventhal's Common Sense Model of Illness Representation to interpret and apply formative research in the design of communication materials did report positive results for knowledge improvements and intention to immunise.

Despite the absence of explicitly stated theoretical underpinnings in most of the interventions included in the review, it was clear that many are implicitly based on the information deficit model. This review, in line with a substantial body of existing research, found no evidence that improved knowledge resulted in improved vaccine uptake or even intention to be vaccinated.

Only five of the 33 evaluations reported that the interventions were developed on the basis of formative research that informed the theoretical basis for change. Some of these studies did not report the results of the formative research. The three studies that did report on baseline perceptions and knowledge found common barriers to immunisation were doubts about the necessity of immunisation and/or its efficacy to prevent infection; fear of side-effects; and practical difficulties in receiving immunisation.

Settings and communication channels that have been used to promote or reinforce national immunisation schedules vaccination uptake

Collectively, the included studies reported on interventions in 12 European countries, including some where long-term deterioration of healthcare systems had impacted immunisations coverage. However, most were interventions aimed at reaching high priority groups demonstrating vaccine-hesitant behaviour (not responding to initial invitations and opportunities to be immunised).

The interventions included in the review were mainly implemented in hospitals, nursing homes, general practice centres and other healthcare facilities. A smaller number were implemented via community and school settings. No trends in choice of setting and effectiveness were identified except for influenza communication interventions and only when combined with improved immunisation access.

The review identified two large-scale communications interventions intended to change prevailing culture. Both interventions reported positive impacts, although neither reported any measure of statistical significance.

The evidence for effectiveness of communication initiatives in changing or reinforcing knowledge, attitudes and behaviours towards national immunisation schedules

All 15 of the studies with high validity scores used immunisation uptake as a main measurement outcome. Of these studies, seven reported convincing evidence of positive effect and eight reported no evidence of effect.

Interventions that included an aim to promote more favourable attitudes to immunisation did not report any evidence of more pro-immunisation attitudes. The experimental studies that examined message framing did report some positive effects on attitudes but these were small-scale.

The review found that interventions aiming to improve knowledge levels were usually successful, but did not demonstrate any positive effects on vaccine uptake or intention to be vaccinated.

Some interventions that aimed to improve knowledge levels of healthcare workers through education and training however, did report evidence of improved rates of vaccine uptake.

In summary, there is good evidence that a range of promotional communications can positively change knowledge, attitudes and behaviours. The evidence for increased immunisation uptake is particularly promising for health care workers, patient risk groups (including the elderly), and seasonal flu vaccine promotions. However many of the interventions captured by the review combined communication channels and methods, so it is not possible to identify which types of communication initiatives are most effective, or to estimate their contribution to overall intervention effect. In addition, many interventions included structural change to make immunisations more accessible (e.g. reduced cost, more accessible clinics), further complicating attempts to determine the net contribution of communications.

The impact of campaign communications promoting national immunisation schedules on public acceptance and vaccine uptake rates

Public acceptance of immunisation and public confidence in immunisation are clearly key factors determining immunisation uptake, but as noted by authors of some of the included studies, high immunisation coverage rates are not an incentive for individuals to be immunised.

Promotional communications are, of course, only one of the many information sources influencing public attitudes towards immunisation. Information, and misinformation, about immunisations is increasingly more accessible online and through the broadcast media. A simple online search for information about routine childhood immunisations can return hundreds of websites that claim, for example, that the mumps, measles and rubella (MMR) vaccination is linked to autism in children. The wide availability of such misinformation undoubtedly has a negative effect on public confidence in immunisation.

None of the studies captured by this review directly assessed the impact of promotional communications on public confidence in, or acceptance of, national immunisation schedules. Indirectly, some studies provide some insight into mechanisms for promotional communications to influence public acceptance. One study found evidence that social networks in the workplace setting could improve social support for communications. One study reported that high levels of public awareness and information seeking was not associated with any increased intention to be vaccinated.

Research on whether framing herd immunity messages to emphasise more relevant personal benefits, such as protecting family and friends, could improve public acceptance would be a valuable contribution to the knowledge base.

Conclusions: strategic implications and recommendations

Communication interventions should be based on clearly stated theoretical frameworks

Conceptually explicit theoretic foundations for intervention design and implementation are needed. Evaluation should aim to measure multiple outcomes as well as the strength and nature of any identified association. Vaccine-related knowledge, attitudes, perceptions and behaviour are all useful indicators of effectiveness. The information gained from rigorous evaluation will support evidence-based development of pro-immunisation communications practice

Communication interventions that can support population scale behaviours are a priority

Interventions need to be based on macro-level theories of behaviour change as well as models of individual level behaviour choices. Given that immunisation coverage must occur at population level for public health objectives and benefits to be fully realised, effective communications planning, and immunisation service delivery, must aim to understand individual choice perspectives, as well as the social dynamics that shape social norms, values and culture.

Immunisation advocacy

Credible and trusted champions for immunisation and visible proof of action can help to build support and trust in vaccination efficacy and safety, as well as raise awareness of the benefits. Informed and motivated health care workers can become important advocates and champions for immunisation in the healthcare setting. Other opinion formers may also be influential and be able to reach out to different target audiences. Involving multiple stakeholders and opinion formers may help to build public confidence and acceptance for national immunisation schedules. Sustained, multi-methods campaigns which are associated with improved vaccine uptake may also contribute to more favourable public attitudes.

Information provision

Knowledge improvement is associated with higher vaccination uptake amongst some groups. It is less clear if information approaches can help to shift behaviour in all groups. The most personalised information exchange, face-to-face communication, is associated with improved vaccine uptake amongst patient risk groups demonstrating vaccine-hesitant behaviour.

There is strong evidence from research on risk perception and communication, that transparency in sharing of risk information is helpful in building trust. Information content and style is likely to be more effective if based on formative research and systematic piloting of communication initiatives.

Education and training

Health care workers are responsive to education and information, and its effectiveness may extend to patient risk groups as well as health care worker audiences. The effectiveness of training and education is enhanced when combined with improved service delivery – that is making the vaccines more available in the same setting as the education (or information) provision.

Expertise in communication

Changing and reinforcing voluntary behaviour is challenging, and poorly conceived, and executed communications may exacerbate vaccination hesitancy. Professional experience in the design, delivery and evaluation of promotional communications and associated service provision can achieve positive attitudes towards immunisation and improved vaccination uptake.

1. Introduction

1.1 Rationale for review

'Immunisation hesitancy', along with publically articulated concerns about national immunisation schedules (NIS) policies has had a negative impact on vaccination uptake. This has resulted in some resurgence of vaccine preventable diseases, and the occurrence of clustered outbreaks [1].

The social and cultural origins of these trends are complex but some of the factors that appear to contribute to them include:

- an active anti-vaccine advocacy movement and increasing public discourse questioning the legitimacy and competency of experts to advise and mobilise resources for the prevention and control of vaccine-preventable communicable disease.
- technology-aided rapid dissemination of information and misinformation.
- limited awareness of the consequences of immunisation avoidance or delay, as severe illness as a result of vaccine-preventable disease is seldom seen first-hand
- increasing public mistrust of expert opinion and recommendations including public health advice [2].

Passive dissemination of scientific evidence regarding the safety, efficacy and population-wide benefits appears to be insufficient as a counter-response to underlying resistance and scepticism to routine immunisation. Ill-conceived or insufficiently tested and developed communications intended to promote NIS may be ineffective, and at worst could exacerbate immunisation hesitancy and resistance in this highly charged and dynamic communications environment [3, 4]. A substantial body of evaluated communication activity promoting nationally indicated routine immunisation has been published. A systematic review of the evidence provides the opportunity to collate and map the types of promotional communication being used; assess the quality of the evaluative research reporting on these promotional communications; and assess the applicability of this evidence to immunisation policy, strategy and practice priorities. The analysis and findings therefore represent a current status report on the evidence and evidence gaps for good practice in national immunisation promotional communications.

A systematic review of interventions to increase influenza vaccination rates in people over 60 years old was published in 2010 [5]. Although there is some overlap in the evaluations of interventions included in the two reviews, objectives and therefore research questions are distinctly different. This review examines European evidence; the previously mentioned review by Thomas et al [5] included interventions from around the world. Thomas et al's [5] review includes only interventions to increase uptake of influenza vaccination in people over 60, while the scope of this review is not age-restricted. Thomas et al [5] reviewed interventions to increase community demand; interventions to increase access; and provider- and system-based interventions. This review examined promotional communications for all nationally endorsed immunisation programmes.

Communications practice and audience response to communications activity is context-sensitive. Geographic context is particularly relevant as this impacts disease prevalence, health systems, cultural interpretation and the scale and nature of socio-economic disruption created by communicable disease outbreaks. This review is intended to support European communications for the prevention and control of communicable disease. The review therefore has focused exclusively on the European evidence base. It is the first systematic review examining the effectiveness of national immunisation schedule promotional communications.

1.2 Objectives of the review

The review aimed to answer the following research questions:

- Which audiences have been targeted by NIS promotional communications?
- Which communication methods and approaches have been used to promote or reinforce NIS vaccination uptake?
- What theoretical underpinnings are used to inform communication methods and approaches?
- Which settings and communication channels have been used to promote or reinforce NIS vaccination uptake?
- What is the evidence for effectiveness of communication initiatives in changing or reinforcing knowledge, attitudes or behaviour towards NIS?
- What is the evidence for impact of NIS communication initiatives to control relevant communicable disease?
- What impact have campaign communications promoting NIS had on public acceptance and vaccine uptake rates?

1.3 Structure of the review

To answer these questions within the European context, a full systematic literature search was conducted, according to a pre-specified protocol. Methods are described in Section two and the protocol is included in appendix 1. The methods section describes the systematic search, relevance screening and critical appraisal methodologies employed. Data extraction tables were prepared for all final included studies and these are included in appendix 7.

Included studies were coded and analysed thematically, and the results of this are presented in section three. The results are presented as target audience grouping, namely: health care workers; patient risk groups; parents; children and young people; and the general public. This method of organisation is used because there is an established body of evidence that the most effective behaviour change and/or behaviour reinforcing communications are shaped by audience rather than by behavioural goal [6, 7], and thus this pooling of evidence maximises the opportunities for insight into effective pro-immunisation communications.

Section four uses the pre-specified research questions to structure the interpretive discussion of results. Greater weighting is given to the studies with higher validity scores, but other studies also provide useful insights and are included in the discussion where they can contribute to a broader, more comprehensive perspective.

Section five provides a summary of main findings, with the emphasis on convergence of evidence and significant gaps in the evidence base. The strategic implications for future communication practice and evaluation of practice that may be drawn from the review findings are also presented in this section.

2. Methods

2.1 Background

Systematic literature review methods were used to identify, analyse and synthesise data. Systematic reviews are designed to be comprehensive, transparent, and replicable, and to minimise selection bias. Systematic review methods are intended to capture and synthesise the research evidence to answer pre-specified research questions. Systematic reviews therefore follow a detailed protocol, which is specified in advance, and which fully documents all steps and decisions involved in the process [8].

2.2 Criteria for considering studies for the review

Types of literature

Published academic and grey literature (including theses) in printed or electronic formats were eligible for inclusion. Unpublished literature was also eligible although the review team did not systematically search for this. Studies published from 2000 to 2011 were eligible for inclusion.

Database searches were not limited by language, although all the search terms used were English language. Some academic databases hold non-English language studies with English-translated titles and abstracts, and these were included in first-round relevance screening.

Types of studies

European studies that reported on any national immunisation schedules policy for mainstream and selected populations intended to support 'herd immunity' (i.e. excludes non-routine health needs such as overseas travel; temporary and extra-ordinary lifestyle at-risk groups etc.) were eligible for inclusion. Experimental and pilot studies of communications promoting nationally scheduled vaccination were also eligible for inclusion. All included studies reported evaluation, experimental, quasi-experimental, or interrupted time series data on vaccine-uptake or likely behavioural precursors.

Types of participants

Evaluations of interventions that included human populations of all age groups were eligible for inclusion, provided the study included or impacted on subjects or populations (the general public and health or medical professionals) in the following European countries and their territories: Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, Vatican City, Abkhazian, Abkhazia, Ajaria, Ceuta, Melilla, Channel Islands, Chechnya, Corsica, Crimea, Dagestan, Faroe Islands, Gibraltar, Greenland, Ingushetia, Isle of Man, Kabardino-Balkaria, Kaliningrad, Kalmykia, Karachay-Cherkessia, Kosovo, Nagorno-Karabakh, North Ossetia and South Ossetia.

Types of outcome measures

The primary outcome of interest for the review was change in measured immunisation uptake rates.

Relevant secondary outcomes included measured changes in the target audience's knowledge, attitudes and other behavioural determinants related to the immunisation schedule and the promotional communication used. For example, measures of campaign awareness (spontaneous or prompted); knowledge or comprehension of key communication messages; and intention to immunise.

2.3 Search strategy

Database searches

Evaluation reports and studies were searched for using electronic literature databases and targeted internet searches. An example of the type of search terms used in the databases' title, abstract and keywords field is included in appendix two. This strategy was adapted to each database's search terminology, or simplified for a database if it did not support that depth of research. The following databases were searched:

Subscription only databases

- BIOSIS Previews (via Web of Knowledge)
- Business Source Premier (via EBSCOHost)
- CINAHL (via EBSCOHost)
- Health Source (via EBSCOHost)
- Maternity and Infant Care (via OvidSP)
- Medline (via PubMed)
- PsycINFO (via EBSCOHost)
- Social Services Abstracts (via CSA Illumina)
- Web of Science (All citation databases - Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index, Conference Proceedings Citation Index- Science, Conference Proceedings Citation Index- Social Science & Humanities)

Open access databases and websites

- Campbell Library of Systematic Reviews
- Centre for Reviews & Dissemination
- The Cochrane Library
- Copac National, Academic, and Specialist Library Catalogue
- EU Bookshop
- ECDC (European Centre for Disease Prevention and Control)
- ECDC Competent Bodies websites
- GAVI Alliance (Global Alliance for Vaccination and Immunisation)
- HealthComm Key (Emory Center for Public Health Communication database)
- ICA Health Communication (a Johns Hopkins University database)
- Index to Theses
- Karlsruhe Virtual Catalog KVK
- OpenSIGLE (System for Information on Grey Literature in Europe)
- Social Care Online
- VACSATC (Vaccine Safety – Attitudes, Training and Communication)
- WHO (World Health Organization)
- Zetoc

The open access databases and websites were searched using selected terms from the literature search strategy.

Internet searches

Using selected terms from the literature search strategy, the Google search engine advanced search facility was used to identify relevant grey literature and academic publications available online.

Hand searches

Two journals – *Vaccine* and *Infection Control and Hospital Epidemiology* - were hand searched from 2000 onwards to identify further relevant studies that were neither indexed by the databases nor identified by the search strategy. These journals were selected based on preliminary analysis of the studies that passed first-round screening, which showed that they contained the largest number of potentially relevant studies.

2.4 Data collection and analysis

Storage:

Search results were imported into the systematic review software EPPI-Reviewer 4, and duplicates removed.

Selection of studies:

In the first stage of study selection, the titles and abstracts of the studies stored in EPPI-Reviewer 4 were screened against the exclusion criteria listed in figure 1 by four reviewers. Second round screening applied the same exclusion criteria to the full text of identified studies.

Exclusion criteria:

Figure 1. Specified exclusion criteria

Specified exclusion criteria
• Off topic – does not relate to human immunisation • Published before 2000 • Not a primary study (e.g. review, editorial, background discussion, economic evaluation using secondary data, modelling study) • Study does not evaluate the effect of promotional communication to inform and influence decisions regarding routine immunisation • Study does not report a behavioural or behavioural precursor outcome[1] • Study does not partially or wholly include or impact on populations from specified European countries/territories[2]

Minimising bias and sensitivity analysis

To ensure consistency of decisions, all reviewers were trained and assessed for inter-rater reliability. Inter-rater reliability tests were conducted at the first and second round relevance screening, data extraction, and quality and applicability appraisal stages. Eighty-five per cent was applied as the minimum inter-rater reliability score for all stages. Reviewers sought a second opinion from a third reviewer in the event of any discrepancies.

All potentially relevant English language studies included after first-round relevance screening were obtained in full text where possible. Technical translation of non-English language studies is a time-consuming and high cost exercise. A sample of non-English language studies still included after first-round screening were reviewed using online translation software (Google translate) of full text. This prospective assessment indicated that approximately 40% of the non-English language evaluation studies would be eligible for inclusion after second-round relevance screening. Sensitivity analysis of the 40% of non-English language eligible studies was conducted and indicated that their inclusion would not substantively expand scope or further reduce any selection bias of the review. The review team decided therefore not to make any further attempts to obtain full text technical translation of non-English language studies.

Systematic review cannot make up for latent publication bias in the evidence base, and this must also be considered in the analysis and interpretation of results. Publication bias refers to the over-reporting of studies which produced statistically significant results and the under-reporting of studies which found null and negative effects, resulting in a non-random sample of available studies.

Quality, validity and applicability appraisal

Systematic review methods cannot make up for poor quality of primary research. Therefore an assessment of the strengths and weaknesses of the studies captured in the systematic review is essential. Additionally, many of the studies identified were not originally intended to answer the research questions of this review. There are therefore limitations regarding the validity and applicability of some studies to the review.

In the original protocol, National Institute for Health and Clinical Excellence (NICE) [9] guidelines were proposed for quality and validity appraisal. However, after thoroughly reviewing the nature of included studies, the review team judged the NICE checklists to be insufficiently sensitive and inappropriate as a tool to assess the quality, validity and applicability of the collated research evidence. After considering and piloting a range of alternative appraisal tools, the review team found Glynn's [10] critical appraisal tool for library and information research, EBL (Evidence Based Librarianship) Critical Appraisal checklist, to be the an appropriate and sufficiently flexible quality

[1] Behavioural or behavioural precursor /determinants include, but are not restricted to: immunisation uptake rates, intention to immunise, promotional campaign awareness (spontaneous or prompted), knowledge or comprehension of key communication messages, acceptance of communication messages and other attitudes.

[2] See 'Types of Participants' in Section 2.2

appraisal tool for this review. The tool provides a comprehensive and in-depth checklist against which reliability, validity and applicability of each study could be appraised and scored. The process from here on in is described as Quality and Applicability Appraisal, and overall assessment is reported as the validity score. For the purposes of this review, evaluations rated at 70% or greater validity were classified as high review validity score, and evaluations scoring less than 70% were classified as low review validity.

Weight of evidence assessment

Weight of evidence assessment was used to classify interventions as evidence of positive effect or no evidence of effectiveness. A formal meta-analysis was considered, but the quality and volume of statistical data available in the studies identified was not sufficient to conduct a combined quantitative analysis. Furthermore, many of the research questions required qualitative analysis and an iterative approach to interpretation of results. The results of analysis are therefore reported in narrative form.

Weight of evidence assessment provided a standardised framework for the narrative reporting of the effectiveness of evaluated interventions. Weight of evidence assessment was only applied to intervention evaluations that achieved a high validity score (i.e. ≥70%).

Population-level behaviour interventions tend to produce small effect sizes [11]. Large sample sizes are required to detect small effects at statistically significant levels. Some interventions which are underpowered (i.e. sample size is too small to detect effects at statistically significant levels) may report positive effects at greater than the accepted 5% probability level. More experimental studies which can control for or eliminate some of the real-life variables that influence effect size, and increase sample size requirement may produce statistically significant results but their validity in real world settings may be limited.

For the purposes of this review, a pragmatic approach to assessing evidence of effectiveness was adopted to maximise learning and insight from the included studies. A well-established guide to interpretation of effect sizes across a wide range of statistical test methods was used to interpret and grade magnitude of effect [12]. Interventions that reported positive one or more statistically significant knowledge, attitudes or behaviour change were graded as convincing evidence of positive effects. Interventions which reported no evidence of positive effects, or a single measure of positive effect at significance level of >5% were graded as no convincing evidence of effectiveness.

The results of the weight of evidence assessment are presented in appendix 5.

Data extraction

Data extraction of the studies was carried out by two reviewers who were trained and checked for inter-rater reliability. See appendix 7 for the data extraction tables for the 33 included studies.

Ethics approval

Ethics approval was not required as no primary research was carried out.

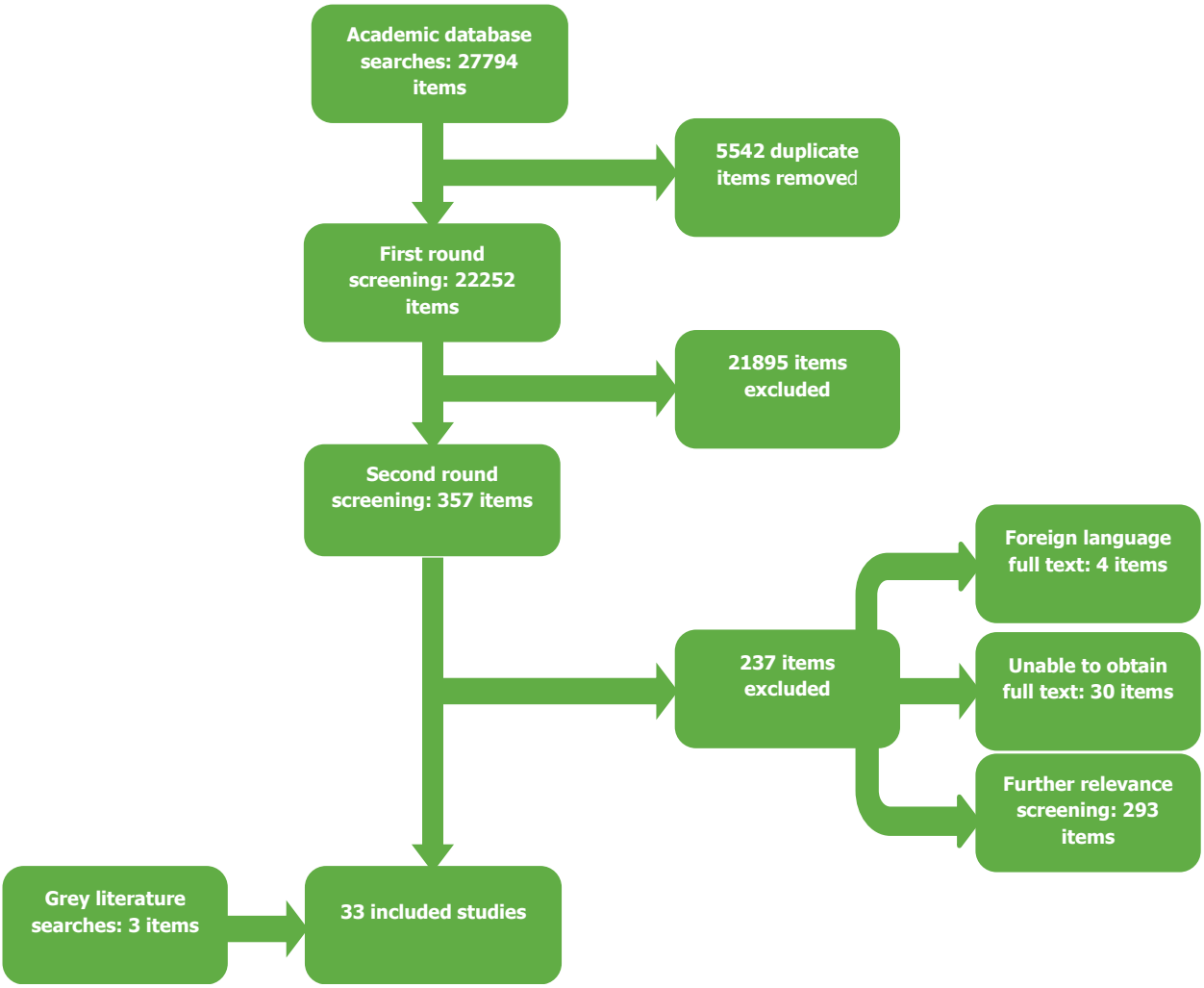
3. Results

3.1 Literature search overview

Figure 2 illustrates the literature search process. After de-duplication and first-round relevance screening, 357 items met initial inclusion criteria. Thirty of these were excluded because full text reports were unavailable, four were excluded because they were non-English language, and 293 items were excluded following more in-depth relevance screening (a list of these studies is provided in appendices 3 and 4). Grey literature searches identified a further three studies that met inclusion criteria. Hand searching did not identify any additional studies to those identified by the database searches. Thus, a total of 33 evaluation studies were included in the review (see appendix 7 for study details).

All 30 studies that were unavailable in full text were in languages other than English. The sensitivity analysis (section 2.4) reported that the non-availability of these studies is unlikely to have substantively altered final results or conclusions of the review

Figure 2. Literature Search Results



3.2 Basic outline of included studies

Of the 33 studies included in the review, 22 related to influenza vaccination, and 11 related to childhood vaccine-preventable diseases. Target audiences included parents; healthcare workers (HCWs); children/young people; patient risk groups; and the general public. The interventions had three main types of approaches; mass, personal, and education/training. In addition, a number of interventions included elements of improved service delivery. A small number of experimental studies captured in the review examined the effect of message framing on intentions to immunise.

Fifteen of the 33 evaluation studies captured in the review were rated as high validity studies on the basis of the quality and applicability appraisal process [13, 14, 16, 17, 18, 20, 23, 25, 26, 29, 30, 31, 32, 33, 39] and the remaining 18 were rated as low validity.

Of the 15 high validity studies, seven had convincing evidence of positive effect [13, 17, 19, 21, 25, 26, 27], while eight reported no evidence of effectiveness [14, 15, 16, 18, 20, 22, 23, 24].

3.3 Target audience: healthcare workers

In 16 of the 33 interventions included in the review, HCWs were a target audience for promotional communications [21, 15, 28, 13, 19, 27, 29, 25, 30, 31, 22, 32, 16, 24, 33, 34]. Of these 16 interventions, HCWs were the only target group for 11 interventions, [21, 15, 28, 19, 27, 30, 31, 22, 32, 16, 34], while five studies evaluated interventions with multiple target groups, of which HCWs were one [13, 29, 25, 24,33].

Most of the promotional communications interventions targeted specific types or groups of healthcare workers:

- hospital physicians [13]
- nursing home staff [15, 27, 32]
- primary health care staff [15, 22, 32, 34]
- primary health care nurses [25]
- general practitioners [28, 25]
- 'private doctors' [32]
- hospital HCWs (including physicians, nurses, nursing assistants and ancillary staff) [21, 19, 30, 31, 32]
- staff of socio-medical institutions and services [29]
- hospital paediatric HCWs [16]
- red Cross volunteers [24]
- 'health professionals such as public health nurses and pharmacists' and 'students of different health professions' [33]

Vaccinations

Fourteen of the 16 interventions that targeted HCWs promoted influenza vaccination [21, 15, 28, 13, 19, 27, 29, 25, 30, 31, 22, 32, 16, 33]. The intervention evaluated by Siriwardena et al [22] included promotional communications for pneumococcal vaccination as well as for influenza vaccination.

Thompson and Harutyunyan [24] evaluated an intervention that promoted a combination of childhood immunisations (measles, hepatitis B, BCG and oral polio vaccine), as did Uskun et al's [34] study (hepatitis B, DTP and oral polio vaccine).

Settings

- Spain [21, 19]
- United Kingdom [15, 22]
- The Netherlands [28, 27]
- Sweden [25, 32]
- Greece [30]
- France [31]
- Switzerland [13, 29, 16, 33]
- Armenia [24]
- Turkey [34]

Five interventions took place in hospital settings [21, 19, 30, 31, 16], one intervention took place in nursing homes [27], four interventions were delivered in primary health care settings e.g. general practices or clinics [28, 13, 22, 32], one intervention was delivered in both nursing homes and in primary health care facilities [15] and one intervention was delivered in meeting/training centres [34]. Some interventions had multiple settings. One intervention was delivered in training centres, schools and via local community networks and channels [24]. Three interventions were largely community-based, but also used meeting/training/education facilities [29, 25, 33].

Communication methods and approaches

Twelve of the interventions used a training/education approach that targeted HCWs [15, 28, 13, 27, 29, 25, 31, 22, 32, 24, 33, 34]. These education/training interventions varied in format:

- visit from a public health nurse who, as well as raising awareness of the campaign, provided information on safety and efficacy of vaccination including side effects and contraindications, and attempted to allay anxiety and correct misconceptions [15]
- continuing medical education (CME) and small-group (SG) consensus meetings for GPs and practice assistants [28]
- one and a half hour training workshop for physicians [13]
- two plenary one hour information meetings by a specialised nurse of the local municipal health centre with a presentation on influenza and influenza vaccination [27]
- 'information meetings' for staff of socio-medical institutions and services [29]
- annual educational meetings for nurses [25]
- 'education sessions' for hospital units with low immunisation uptake [31]
- 'educational outreach' visit from a general practitioner [22]
- three hour 'information and education' sessions which HCWs were invited to attend [32]
- sixteen hour programme to train volunteers to be peer health educators [24]
- 'on-job training activities' for health professionals and 'teaching to students in different health professions' [33]
- intensive three-day workshops for primary health care staff [34]

Seven interventions used mass promotional communications to target HCWs [21, 15, 19, 30, 31, 16, 33]. A variety of mass communication strategies were used:

- mass distribution of promotional materials (e.g. information sheets, leaflets, other educational materials) [21, 15, 30]
- publication of promotional information in staff newspaper/newsletter/bulletin [21, 31]
- poster promotion [21, 19]
- mass mail-out of personalised promotional/information letters [31, 16, 33]
- mass promotional emails [19]

For three of the interventions for which HCWs were one of multiple target groups, it was not clear from the description of the intervention which of the methods/approaches targeted HCWs, and which targeted other groups [29, 25, 24]. Specifically, it was unclear whether the following mass approaches targeted HCWs:

- mass distribution of promotional materials [29, 25, 24]
- mass media [25, 24]
- poster promotion [25, 24]

Two interventions used peer performance feedback [13, 25]. One intervention included outreach visits to hospital departments by a physician and a nurse from the Department of Preventative Medicine to directly offer immunisation to HCWs in the workplace [21].

Communication channels

Many of the interventions used a variety of communication channels (some of which targeted audiences other than HCWs), while some had only one communication channel:

- print materials, face-to-face communications, website, HCW newsletters/newspapers/bulletins [21]
- face-to-face communications [15, 22, 32, 34]
- print materials, face-to-face communications [28]
- print materials, face-to-face communications, prompts (reminder stickers on medical records) [13]
- print materials, face-to-face communications, website, email [19]
- print materials, face-to-face communication, website, video [27]
- TV, newspaper, print materials, face-to-face communications, website, press conferences [29]
- TV, newspaper, print materials, face-to-face communications, a web-based registry to facilitate peer performance monitoring and comparison [25]
- print materials [30]
- print materials, personal invitations, face-to-face communication, HCW newsletters/newspapers/bulletins [31]
- face-to-face communication, personal invitations [16]
- TV, radio, print materials, face-to-face communication and promotional materials such as puzzles, bibs and notepads [24]
- TV, print materials, face-to-face communications, posters, website, press conferences [33]

Theoretical underpinnings

The Health Belief Model (HBM) was implicit in the design of the intervention described by Dey et al [15], and the author's discussion suggests the theory's inadequacy may explain the intervention's lack of effect.

Evidence for impact on knowledge, attitudes and behaviour

For all 16 interventions targeting HCWs, immunisation uptake was an outcome measure [21, 15, 28, 13, 19, 27, 29, 25, 30, 31, 22, 32, 16, 24, 33, 34]. Overall:

- seven showed significant positive effect of intervention [21, 28, 13, 19, 27, 31, 33].
- three showed positive effect of intervention, but there was no measure of statistical significance [25, 30, 32].
- three studies showed significant positive effect of intervention among some sub-groups, but the effect was not significant in other sub-groups [22, 32, 16]
- one study showed no significant effect of intervention [15]
- two studies showed significant positive effect of intervention on uptake of certain immunisations, but not others [24, 34]

Seven of these 16 evaluation studies focused on immunisation uptake in HCWs [21, 15, 19, 27, 30, 31, 16]. Of these seven studies:

- four showed significant positive effect of intervention [21, 19, 27, 31]
- one study showed positive effect of intervention, but there was no measure of statistical significance [30]
- one study showed significant positive effect of intervention among physicians, but no significant effect among other HCWs [16]
- one study showed no significant effect of intervention [15]

The remaining nine evaluation studies measured immunisation uptake in groups other than HCWs.

- Thompson and Harutyunyan's [24] study measured immunisation uptake in children and revealed a positive intervention effect for one vaccination - diptheria, tetanus and pertussis vaccine (DTP)/polio but the positive effect was not significant for other vaccinations.
- The study by Uskun et al [34] also measured immunisation uptake in children and revealed significant positive intervention effect for all of the childhood vaccinations evaluated except one, for which there was a negative effect.
- Hak et al's [28] evaluation focused on immunisation uptake in the general population, and showed a significant positive intervention effect.

Six evaluations focused on immunisation uptake in the elderly and other patient risk groups [13, 29, 25, 22, 32, 33]. Of these six studies:

- Humair et al's [13] evaluation and Toscani et al's [33] evaluation measured immunisation uptake in the elderly and showed significant positive effect.
- Malmvall et al's evaluation [25] and Stenqvist et al's [32] evaluation measured immunisation uptake in the elderly and showed positive effect, but did not report measures of significance.
- Siriwardena et al's [22] evaluation measured immunisation uptake in the elderly and in medical risk groups. The study revealed positive significant effect in some sub-groups, but non-significant positive effect in other subgroups, and negative significant effect in one subgroup.
- Luthi's [29] study measured immunisation uptake in the elderly, and found no significant effect of intervention, except for a significant positive effect in one sub-group (age 65–69 years).

Uskun et al's [34] evaluation also included HCW knowledge as an outcome measure, and showed significant positive intervention effect. In the evaluation by Stenqvist et al [32], knowledge of a key communication message among the elderly was an evaluated outcome measure. There was a positive effect of intervention on knowledge, but there was no measure of significance. One evaluation also included promotional campaign awareness as an outcome measure (29). For details see data extraction table.

Quality and applicability appraisal and weight of evidence assessment

Nine of the 16 studies that targeted HCWs achieved a high validity score in the quality and applicability appraisal (i.e. ≥70%) [21, 15, 13, 27, 19, 25, 22, 16, 24].

Of the nine studies with high validity scores that targeted HCWs, five had convincing evidence of positive effect [13, 19, 21, 25, 27].

Overall findings

- Just under half of all interventions included in the review had HCWs as a target audience.
- A third of interventions included in the review had HCWs as the only target audience.
- The majority of interventions that targeted HCWs were intended to promote influenza vaccination.
- Most of the interventions targeting HCWs took place in the work setting i.e. healthcare facilities such as hospitals, GP practices, nursing homes.
- The majority of interventions that targeted HCWs used a training/education approach.
- There was an absence of theoretical basis for the interventions targeting HCWs.
- Of the interventions that targeted HCWs, just under half were concerned with promoting immunisation uptake in HCWs themselves, while slightly more than half were concerned with promoting immunisation uptake in groups other than HCWs (mainly patient risk groups).
- Most evaluations demonstrated positive impacts on immunisation uptake among HCWs themselves and among other groups.
- Of the nine high quality studies, four had a significant positive effect on immunisation uptake. The remaining five studies reported a mix of positive significant effect and non-significant effects (subgroups), no significant effect, or positive effect with no measure of significance. Only one of these studies revealed negative effect of intervention, and this was only in one sub-group only.
- Of the nine high quality studies that targeted HCWs, five had convincing evidence of positive effect.

3.4 Target audience: patient risk groups

For the purpose of this review, the elderly are categorised as a 'risk group'.

In 11 of the 33 interventions, specific patient 'risk groups' were a target audience [26, 17, 14, 13, 29, 25, 23, 20, 35, 36, 33].

Patient risk groups were the only target audience in six of these 11 studies [26, 17, 14, 23, 35, 36], while the other studies had more than one target group, [13, 29, 25, 20, 33].

- 'risk groups' varied across interventions, and some interventions targeted more than one 'at risk' group:
- general practice registered patients aged 75 and over [26]
- general practice registered patients aged 75 and over not living in nursing/residential homes or sheltered accommodation [17]
- low-risk general practice patients aged 65–74 [14]
- patients aged 65 and over visiting a primary care clinic [13]
- general population of people aged 65 and over [29, 25, 35, 36, 33]
- 'medical risk groups for influenza' [25]
- general practice registered patients aged 65 and over who were not immunised in a previous immunisation campaign [23]
- adults aged 40–59 (those most at risk for diphtheria mortality) [20]
- people with diabetes, asthma, chronic heart or chest complaints, chronic kidney disease, lowered immunity due to disease or treatment such as steroid medication or cancer treatment, or any other serious medical condition [35]
- people with medical conditions such as asthma, diabetes, heart, liver renal, immunosuppressant and other diseases [36]
- care workers [36]
- poultry workers [36]
- people with chronic conditions or immunosuppressant, and families of the latter [33].

The interventions can be more simply classified into those that targeted the elderly and those that targeted other patient risk groups:

- Ten interventions targeted the elderly [26, 17, 14, 13, 29, 25, 23, 35, 36, 33]
- Five interventions included other risk group targets [25, 20, 35, 36, 33]

Vaccinations

Ten of the 11 interventions that targeted patient risk groups promoted influenza vaccination [26, 17, 14, 13, 29, 25, 23, 35, 36, 33]. One intervention promoted pneumococcal vaccination in addition to influenza vaccination [35]. Porter et al's [20] study evaluated an intervention to promote diphtheria immunisation.

Settings

- United Kingdom [26, 17, 14, 23, 35, 36]
- Sweden [25]
- Switzerland [13, 29, 33]
- Russia [20]

The interventions targeting patient risk groups can be classified as those which were community-based, those that were based in a healthcare facility, and those that were coordinated by healthcare facilities, but did not necessarily take place there (e.g. HCW home visits to general practice patients, postal or telephone invitation from general practice):

- community based [29, 25, 20, 35, 36, 33]
- healthcare facility based [13, 25, 36]
- coordinated by healthcare facilities [26, 17, 14, 23]

Note that two interventions had more than one 'setting' [25, 36].

Communication methods and approaches

Seven interventions used mass promotional communications to target patient risk groups:

- mass media [14, 29, 25, 20, 35, 36, 33]
- mass produced printed promotional materials [13, 20, 36, 33]

Four interventions used a personalised approach:

- home visit from HCWs [26, 17, 23]
- invitation letter [17, 14, 23]

The interventions evaluated by Luthi et al [29] and by Toscani et al [33] both included information for patient risk groups through relevant organisations e.g. associations for the elderly [29].

Communication channels

All of the interventions used a combination of communication channels (some of which were targeted at audiences other than patient risk groups):

- face-to-face communication [26]
- invitation letters, face-to-face communication [17]
- TV, print materials, invitation letters [14]
- print materials, face-to-face communications, prompts (reminder stickers on medical records) [13]
- TV, newspaper, print materials, face-to-face communications, website, press conferences [29]
- TV, newspaper, print materials, face-to-face communications, a web-based registry to facilitate peer performance monitoring and comparison [25]
- print materials, invitation letters, face-to-face communications [23]
- TV, radio, newspaper articles/advertising, print materials, [20]
- TV, radio, newspaper articles/advertising [35]
- TV, radio, print materials, posters [36]
- TV, print materials, posters, face-to-face communications, website, press conferences [33]

Theoretical underpinnings

None of the interventions that targeted patient risk groups had explicitly stated theoretical underpinnings.

Evidence for impact on knowledge, attitudes and behaviour

For nine of the 11 interventions that targeted patient risk groups, immunisation uptake was an outcome measure [26, 17, 14, 13, 29, 25, 23, 20, 33].

All nine studies revealed a positive intervention effect:

- Four showed significant ($p<0.05$) positive effect [17, 14, 13, 33]
- Two showed positive effect, but this did not reach statistical significance [29, 23]
- Three showed positive effect, but did not provide a measure of significance [26, 25, 20]

(*Sub-group analysis in this study showed a statistically significant positive effect in age group 65–69 years)

For one intervention, knowledge and understanding of key communication messages was an evaluated outcome measure [35]. The evaluation revealed that the intervention had a positive effect on knowledge and understanding of key communication messages, but there was no measure of significance.

Campaign awareness was an evaluated outcome measure for two of the interventions [29, 36]:

In the evaluation by Luthi et al [29], 52.7% of respondents from the target audience were aware of the campaign.

In the Scottish Executive, [36] study awareness of the then current campaign was compared to awareness of previous years' campaigns. Spontaneous awareness among the target audience was 65%, lower than previous years (69% and 79%). Prompted awareness among the target audience was 68%, also lower than previous years (72% and 90%).

Quality and applicability appraisal and weight of evidence assessment

Seven of the 11 evaluations of interventions that targeted patient risk groups achieved a high validity score in the quality and applicability appraisal (i.e. ≥70%) [26, 17, 14, 13, 25, 23, 20].

Of the seven studies with high validity scores that targeted patient risk groups, four had convincing evidence of positive effect [13, 17, 25, 26].

Overall findings:

- A third of all interventions included in the review had risk group(s) as a target audience.
- Many of the interventions that targeted patient risk groups also had another target audience (mainly HCWs).
- The majority of interventions that targeted patient risk groups were specifically intended to promote influenza immunisation in the elderly.
- There was an absence of theoretical basis for the interventions that targeted patient risk groups.
- Some of the interventions that targeted the elderly took a personal approach e.g. personal invitation letters, home visits from a HCW. Evaluations of these interventions demonstrated positive impact on immunisation uptake.
- Of the seven high validity score evaluations, in which immunisation uptake was the outcome measure: three had overall significant positive effect of intervention; three had positive effect, but no measure of significance, and one had no significant effect.
- Of the seven studies with high validity scores that targeted patient risk groups, four had convincing evidence of positive effect.

3.5 Target audience: parents

In seven of the 33 interventions included in the review, parents were a target audience for promotional communication [37, 38, 39, 18, 20, 40, 24]. Of these seven interventions, there were five interventions where parents were the only target audience [37, 38, 39, 18, 40], while two interventions had multiple target audiences, of which parents were one [20, 24].

Five of the interventions targeted specific groups of parents:

- mothers of daughters aged 8–16 years [38]
- parents of children aged six months to five years (i.e. eligible for first or second dose MMR vaccination) [39]
- parents of infants aged 21–24 months who had not received first dose MMR vaccination [18]
- parents of children aged eight months being seen for a routine health assessment (i.e. children eligible for first dose MMR vaccination) [40)]
- 'caretakers' of children aged under five years, pregnant and lactating women, and new parents [24]

Porter et al's [20] evaluation study stated that mothers were a target audience for the intervention.

In Abhyankar et al's [37] study, participants were members of the public who were asked to imagine that they were a parent considering vaccinating their child.

Vaccinations

Evaluation of all seven interventions that targeted parents examined effectiveness of promotional communications for routine childhood immunisations:

- four interventions promoted MMR vaccination [37, 39, 18, 40]
- one intervention promoted HPV vaccination [38]
- one intervention promoted routine childhood immunisations, in particular diphtheria immunisation [20]
- one intervention promoted routine childhood immunisations for infants and older children (measles, hepatitis B, BCG and OPV) [24].

Settings

- Ireland [38]
- United Kingdom [37, 39, 18, 40]
- Russia [20]
- Armenia [24]

Three interventions targeted parents in the community [39, 18, 20]. The intervention evaluated by Porter-Jones et al [40] is also likely to have been in the community setting, as it was delivered through health visitors, although this is not explicitly stated. One intervention was delivered in schools, training centres as well as via local community networks and channels [24]. The intervention evaluated by Fahy and Desmond [38], and the intervention evaluated by Abhyankar et al [37] both took place in experimental settings.

Communication methods and approaches

Two large-scale interventions included mass promotional communications activities:

- large-scale mass media campaign [20]
- mass media awareness campaign as part of a multi-faceted intervention that included personalised communications and a training component [24]

Two of the interventions took, or included, a personalised approach:

- personalised invitation to parents of children who had not been vaccinated by the appropriate age [18]
- counselling sessions for parents led by community-based peer health educators as part of a multi-faceted intervention [24]

Both Fahy and Desmond's [38] study, and Abhyankar et al's [37] study experimentally evaluated the effect of message framing on parental attitudes to immunisation.

Jackson et al's [39] study evaluated a decision aid to assist parental decision making about immunisations.

Porter-Jones et al's [40] study evaluated the use of promotional material distributed to parents of infants eligible for routine immunisation.

Communication channels

The interventions used a variety of communication channels that targeted parents. Most of the interventions used more than one method of communication.

- print materials [38]
- online communication – web-based decision aid [38]
- print materials, personal reminder letter to parents [18]
- TV public service advertisements, radio public service announcements, newspaper articles/advertising, print materials [20]
- information website, promotional materials (parents were given a teddy bear for their child with campaign information printed on it), telephone information line [40]
- TV spot, radio spots, face-to-face communication and promotional give-aways such as puzzles, bibs and notepads [24]

Theoretical underpinnings

Two evaluations described an intervention targeting parents that had explicitly stated theoretical underpinnings [37, 38].

See Discussion section 4.3 for further details.

Evidence for impact on knowledge, attitudes, behaviour

Three evaluations measured changes in uptake of childhood immunisations [18, 40, 24].

- The study by Thompson and Harutyunyan [24] revealed a positive intervention effect for one vaccination (DTP/polio), but the positive effect was not significant for other vaccinations.
- Positive non-significant effects of intervention were found for the interventions evaluated by Mason and Donnelly [41], and Porter-Jones et al [40].

Porter-Jones et al's [40] evaluation study also reported the number of intervention website hits, and the number of calls to the telephone information line by parents as an outcome measure. The intervention website received few hits, and the telephone line received no calls.

One evaluation measured change in parental knowledge [39]. The intervention had a significant positive effect on parental knowledge about the MMR vaccine, measles, mumps and rubella. Jackson et al's [39] study found no significant intervention effect on parental intentions to have their child/children immunised.

Abhyankar et al's [37] evaluation and Fahy and Desmond's [38] evaluation both measured the effect of message framing on different aspects of parental attitudes to immunisation and intentions to have their children immunised.

- Fahy and Desmond [38] found no significant effect of message frame on parental intentions to have their children immunised. There was no significant effect of message frame on parental attitudes, subjective norms/normative beliefs, perceived behavioural control (PCB).
- Abhyankar et al [37] found significant effect of message framing, with stronger intentions among those who read the loss-framed message. The study found no significant effect of message framing on parental attitudes, subjective norms/normative beliefs, or perceived behavioural control (PCB). The evaluation also measured the effect of message framing on perceived outcome efficacy and found significant effect of message framing such that greater perceptions of outcome efficacy were reported in women who read the loss-framed message.

Quality and applicability appraisal and weight of evidence assessment

Three of the seven evaluations of interventions that targeted parents achieved a high validity score in the quality and applicability appraisal (i.e. ≥70%) [18, 20, 24]. None of the studies with high validity scores that targeted parents had convincing evidence of positive effect.

Overall findings

- A fifth of interventions included in the review targeted parents.
- Interventions that targeted parents were promoting childhood immunisations.
- Evaluation of message-framing interventions that targeted parents had mixed results in terms of impact on parental intentions to have their children immunised. One study suggests that loss-framed messages may be more effective than gain-framed messages (however this study had <70% validity).
- Evaluation of the impact of an MMR decision aid for parents demonstrated significant positive impact on knowledge, but not on intention to have their children immunised (however, this study had <70% validity).

3.6 Target audience: children and young people

Three interventions targeted children and young people [42, 43, 44]. Corrigan [42] targeted young people aged 17–19; Gottvall et al [43] targeted school students, with a mean age of 16; and Lloyd et al [44] targeted only girls, aged 13–16, with a mean age of 14.3 years.

Vaccination

Two of the three interventions were promotional initiatives for human papillomavirus (HPV) [43, 44]; and Corrigan [42] examined promotional communications in childhood vaccinations, in particular rubella.

Settings

- Sweden [43]
- UK [44]
- Belarus [42]

Both promotional communications for HPV were delivered in school settings [43, 44]; and Corrigan [42] was set within the community.

Communication methods and approaches

For the interventions targeting children in schools, one was an educational intervention, involving a classroom lesson, distribution of information folders, and an invitation to visit the project's website [43]; and one was an experimental investigation of the emotional and cognitive impact of an HPV information leaflet [44].

Corrigan (2006) evaluated the response of young people aged 17–19 years targeted through mass media channels as one component of a wider community intervention .

Communication channels

Both interventions targeting HPV used print materials. Lloyd et al [44] randomised students to receive one of three leaflets, relating to HPV, chlamydia, or the environment, which students had five minutes to read, before completing a questionnaire.

In addition to using print, the Gottvall et al [43] intervention included: a one hour lesson on HPV and preventive methods, with special focus on vaccination and condom use; using presentations; practical skills training; discussion; and an invitation to visit the project's website, where students could take part in an online quiz about HPV.

Theoretical underpinnings

The Gottvall et al [43] intervention was based on the health belief model (HBM). According to the HBM, people will take action to prevent a health condition: if they consider themselves to be susceptible to that condition; if they believe it would have potentially serious consequences; if they believe that a course of action available to them would be beneficial in reducing either their susceptibility to or the severity of the condition; and if they believe that the anticipated barriers to, or cost of, taking the action are outweighed by its benefits.

Lloyd et al's [44] intervention was based on formative research designed and interpreted according to Leventhal's common sense model of lay illness representations.

Evidence for impact on knowledge, attitudes, behaviour

Gottvall et al [43] and Lloyd et al [44] reported a significant ($p< 0.05$) increase in knowledge scores.

Corrigan [42] reported some positive improvements in knowledge but no statistical analysis was reported. These included increased awareness of immunisation as a means of preventing infectious disease; that rubella immunisation provides protection against rubella infection and that rubella vaccination protects unborn children from congenital rubella syndrome. The study also reported some decreases in the proportion of the survey population reporting understanding the benefits of rubella vaccination. The study presented data descriptively and no statistical analysis was reported.

Two studies measured intentions to immunise [43, 44]. Gottvall et al [43] reported no differences before and after their intervention, and Lloyd et al [44] reported no differences between groups receiving HPV, chlamydia, or environmental information (p=0.048).

The HPV information leaflet was rated positively and this rating was significant in comparison to the environmental information leaflet used as a comparative control. There were no differences in these ratings between the HPV information leaflet and the Chlamydia information leaflet [43].

Corrigan [42] reported 55% campaign awareness overall amongst youth survey respondents (other age groups were not surveyed).

Quality and applicability appraisal and weight of evidence assessment

None of the evaluations of interventions that targeted children and young people achieved a high validity score in the quality and applicability appraisal (i.e. ≥70%).

Weight of evidence assessment is not applicable as none of the interventions achieved a validity score of greater than 70%.

Overall findings

- Less than a tenth of the interventions included in the review targeted children/young people.
- These interventions all targeted teenagers and promoted vaccinations that are indicated in this age group (HPV, rubella).
- Two evaluations demonstrated that provision of information had significant positive impact on young people's knowledge about HPV, but no impact on their intentions to be immunised.

3.7 Target audience: general public

Four interventions targeted the general public [45, 42, 46 and 24]. Thompson and Harutyunyan [24] included communications specifically targeting teachers, HCWs, and parents as well as the general population, and Corrigan et al [42] included communications aimed at youth aged 17–19 years as well as the general population.

Vaccinations

Two of the four interventions were promotional communications for influenza vaccination [45, 46]; one was for rubella [42]; and one promoted a combination of routine childhood immunisations, including measles, hepatitis B, BCG, and OPV [24].

Settings

- UK [46]
- France [45]
- Belarus [42]
- Armenia [24]

Two interventions were experimental [45 and 46].

One intervention was delivered solely at the local community level [42]; and one intervention was delivered in schools, training centres as well as via local community networks and channels [24].

Communication methods and approaches

One of the experimental studies compared relative effectiveness of loss and gain-framed messages [46]. The other experimental study examined the effect of social norms feedback and expert opinion on individual attitudes /intentions to vaccinate [45].

Both large-scale interventions used mass communications to promote vaccination uptake [42 and 24]. Thompson and Harutyunyan [24] also used personalised communications and a training component. Personalised communications involved counselling sessions for 5000 carers of children aged under five, and World Health Organization (WHO)/United Nations Children's Fund (UNICEF) guided training on child health was provided to HCWs and teachers.

Communication channels

Both interventions using mass communications employed a wide range of communication channels:

TV, radio, newspaper, cinema advertisements [42]

TV, radio, print, face-to-face, and promotional give-aways such as puzzles, bibs, notepads distributed through health centres, schools and kindergartens [24]

Knowledge, attitudes, behaviour

Chanel et al [45] reported no differences in intentions to immunise after each of the first four norms feedback stages. There was a significant ($p<0.05$) positive change after the final stage, which involved a 25-minute round table session including a brief presentation and a question/answer session, with two experts who were pro-vaccination.

Natter et al [46] examined the comparative effects of the provision of information on perceptions of flu risk in the general population with and without vaccination protection. Researchers reported the provision of information of non-immunisation risk levels, combined with absolute or relative risk reduction as a result of vaccination, resulted in higher intention to immunise and perceptions of flu vaccine effectiveness than risk reduction information only. Relative risk reduction information presented in isolation was slightly less effective and the provision of absolute risk reduction was least effective.

Thompson and Harutyunyan [24] reported a significant ($p<0.05$) increase in DPV/polio immunisation. Immunisation rates and measles uptake for the proportion of children who were up-to-date with all vaccinations in the Armenian regime also increased but were not statistically significant.

Corrigan [42] reported 55% awareness of the campaign overall amongst youth survey respondents (other age groups were not surveyed). The study also reported some positive improvements in knowledge. These included increased awareness of immunisation as a means of preventing infectious disease; that rubella immunisation provides protection against rubella infection; and that rubella vaccination protects unborn children from congenital rubella syndrome. The study also reported some decreases in the proportion of the survey population reporting understanding of the benefits of rubella vaccination. The study presented data descriptively and no statistical analysis was reported.

Quality and applicability appraisal and weight of evidence assessment

Only one of the evaluations of interventions that targeted the general public achieved a high validity score in the quality and applicability appraisal (i.e. ≥70%) [24].

The only intervention targeting the general public that achieved a high validity score reported no convincing evidence of effectiveness.

Overall findings

- Half of the interventions that targeted the general public were experimental studies, while the other interventions were large-scale mass communication campaigns.
- The evaluation of social norms feedback found this approach had no effect on intentions to immunise (note this study had <70% validity).
- The evaluation of risk communication found that the provision of information of non-immunisation risk levels, combined with absolute or relative risk reduction as a result of vaccination, resulted in higher intention to immunise and perceptions of flu vaccine effectiveness than risk reduction information only (note this study had <70% validity).
- Large-scale mass communication interventions that target the general public can have a positive impact on attitudes towards immunisation and immunisation uptake.

3.8 Message framing

Approach

Three studies examined message framing [37, 38, 46].

Abhyankar et al [37] and Fahy and Desmond [38] evaluated the effect of gain-framed versus loss-framed messages. Natter and Berry's [46] study evaluated the effect of the provision of combinations of information on risk perception in relation to flu. The effects of information on baseline unvaccinated risk levels, relative and absolute risk reduction from immunisation on intention to immunise, and perceptions of vaccination effectiveness were tested.

Chanel et al's [45] study evaluated the effect of social norms feedback and expert opinion on intention to vaccinate.

Vaccinations

Of the four studies, two focused on the effect of message framing in the context of childhood immunisations:

- MMR [37]
- HPV [38]

The other two studies focused on the effect of message framing in the context of influenza immunisation [45; 46].

Target audience

Both interventions that focused on childhood immunisations targeted parents [37, 38]. The interventions evaluated by Chanel et al [45] and Natter and Berry [46] targeted adult members of the general public.

Setting

- United Kingdom [37, 46]
- Ireland [38]
- France [45]

All four studies were experimental.

Communication channels

Three of the interventions evaluated used print materials e.g. printed questionnaire, information sheet, experimental booklet [37, 38, 46]. The intervention evaluated by Chanel et al [45] used electronic communications to provide feedback but was not strictly a communication channel.

Theoretical underpinnings

Two evaluations described message framing interventions that had explicitly stated theoretical underpinnings [37, 38]. See discussion section 4.3 for details.

Although Natter and Berry [46] did not refer to any specific theory, their study did have a hypothesis. See discussion section 4.3 for further details.

Evidence for impact on knowledge, attitudes and behaviour

Fahy and Desmond [38] found no significant effect of message framing on parental intentions to have their children immunised. There was no significant effect of message framing on parental attitudes, subjective norms/normative beliefs, perceived behavioural control (PBC).

Abhyankar et al [37] found significant effects of message framing, with stronger intentions among those who read the loss-framed message. The study found no significant effect of message framing on parental attitudes, subjective norms/normative beliefs, or PBC. The evaluation also measured the effect of message framing on perceived outcome efficacy and found significant effects of message framing such as greater perceptions of outcome efficacy in women who read the loss-framed message.

Chanel et al [45] reported no differences in intentions to immunise after each of the first four norms feedback stages. There was a significant ($p<0.05$) positive change after the final stage, which involved a 25-minute round table session including a brief presentation and a question/answer session, with two experts who were pro-vaccination.

Natter et al [46] examined the comparative effects of the provision of information on flu risk in the general population with and without vaccination protection. Researchers reported the provision of information of non-immunisation risk levels, combined with absolute or relative risk reduction as a result of vaccination, resulted in higher intention to immunise and perceptions of flu vaccine effectiveness than risk reduction information only. Relative risk reduction information presented in isolation was slightly less effective and the provision of absolute risk reduction information was least effective.

Quality and applicability appraisal and weight of evidence assessment

None of the evaluations of message framing interventions achieved a high validity score in the quality and applicability appraisal (i.e. above 70%).

Weight of evidence assessment is not applicable as none of the interventions achieved a validity score of 70% or more.

Overall findings

- The message framing interventions included in the study that targeted parents focused on childhood immunisations (HPV, MMR), while interventions that targeted the public more generally focused on influenza immunisation.
- Both message framing studies that compared gain-framed and loss-framed messages had theoretical underpinnings (Prospect Theory, Theory of Planned Behaviour).
- Evaluation of message-framing interventions had mixed results in terms of impact on parental intentions to have their children immunised. One study suggests that loss-framed messages may be more effective than gain-framed messages (however this study had <70% validity). Neither evaluation found significant effect of message frame on parental attitudes, subjective norms/beliefs or perceived behavioural control.
- The evaluation of social norms feedback found this approach had no effect on intentions to immunise (note this study had <70% validity).
- The evaluation of risk communication found that the provision of information of non-immunisation risk levels, combined with absolute or relative risk reduction as a result of vaccination, resulted in higher intention to immunise and perceptions of flu vaccine effectiveness than risk reduction information only (note this study had <70% validity).

4. Discussion

4.1 Audiences that have been targeted by national immunisation schedules promotional communications

Prioritisation and targeting of audience/audiences for NIS promotional communications appears to be primarily determined by the vaccination being promoted, and to a lesser extent audience characteristics and their response to baseline efforts to encourage immunisation. The review identified little evidence of evaluated large-scale public health communications that aimed to respond to, and address immunisation hesitancy and associated underlying changes in public perceptions. The review did identify a small number of experimental and qualitative studies that aimed to explore and identify effective communications amongst audiences likely to be immunisation-hesitant. The balance of target audiences and public health prioritisation captured in this review probably reflects the time lag between practice and published research during the last decade.

The majority of studies included in the review evaluated promotional interventions for influenza vaccination. Control of influenza has been a public health priority in many countries, due to the potential catastrophic impacts of an influenza pandemic on population health, and the serious disruption that influenza can cause to health systems. In most European countries, influenza is not a routine universal immunisation; rather it is indicated for specific patient groups, such as the elderly and people with chronic health conditions, who are at increased risk of complications due to influenza. Studies have shown that influenza immunisation of the elderly and other patient risk groups can reduce morbidity, hospitalisation and mortality associated with the virus [47]. Hence, a substantial number of interventions captured by the review directly targeted selected patient risk groups to promote immunisation uptake.

In many European countries, influenza immunisation is also recommended for HCWs. There are three main reasons for this: HCWs are at risk because they are occupationally exposed to influenza; HCWs can transmit the virus to patients, and there is evidence that vaccinating HCWs may lead to reduced morbidity and mortality among patients [48]; and HCW absenteeism associated with illness due to influenza can cause significant disruption to health services. The substantial number of interventions targeting HCWs almost certainly reflects a risk management objective behind the promotion of influenza immunisation. Five of the evaluations with high validity scores captured by the review evaluated interventions that targeted HCW to increase influenza immunisation uptake in this group [21, 15, 19, 27, 16]. Three of these interventions had convincing evidence of positive effect [21, 19, 27], and two reported no evidence of effectiveness [15, 16].

A number of interventions to promote influenza immunisation also targeted HCWs as a strategy to increase uptake among the higher risk patient groups, particularly the elderly as described above. Three evaluations with high validity scores, reported on interventions that targeted HCWs to increase influenza immunisation rates in patient risk groups [13, 25, 22]. Both interventions that targeted HCWs as well as patient risk groups reported evidence of positive effect [13, 25], while the intervention that targeted only HCWs to increase uptake in the elderly reported no evidence of effectiveness [22]. This evidence suggests that interventions targeting HCWs in combination with patient risk groups may be an effective strategy to increase immunisation uptake in patient risk groups. However, the sample size is too small to draw any firm conclusions. Also, the mechanism by which any effect may have been achieved is not clear because of the multi-component nature of the interventions. In addition, the two interventions reporting convincing evidence of positive effect included improved service delivery, [13, 25] and this must also be considered in any interpretation.

Four evaluations with high validity scores targeted the elderly and not HCWs [26, 17, 14, 23]. Half reported convincing evidence of effectiveness [26, 17], while half reported no evidence of effectiveness [14, 23].

Overall, no clear pattern in terms of combination/choice of target audience is apparent for effective interventions that promoted influenza immunisation. The sample is too small to draw any firm conclusions, but the evidence reviewed here does suggest that further research on the effectiveness of combining the targeting of HCWs along with patient risk groups is warranted.

Several evaluations of interventions included in the review targeted parents. These interventions were intended to promote childhood immunisations. Routine childhood immunisations are not compulsory in most European countries. Immunisation uptake is therefore dependent on parents making an active decision to have their child immunised. Parental confidence in the safety of childhood immunisations is a key factor influencing uptake. Controversy surrounding the safety of childhood immunisations is one of the factors that has led to a fall in uptake, and a resulting increase in the incidence of vaccine-preventable disease among children. This happened, for example, in the UK in 1998, when a now discredited study published in the Lancet suggested that the MMR vaccination was linked to autism and Crohn's disease. This negatively affected parental confidence in the safety of the MMR vaccination, and uptake decreased resulting in increased incidence of measles. As a result, measles, which had become rare in the UK, once again became a public health problem. More than half of the studies included in the review that targeted parents evaluated interventions to promote MMR vaccination in the wake of the drop in parental confidence in the vaccination in the UK.

Children and young people were an audience for only a few of the studies included in the review. Generally, childhood immunisations are indicated for children too young to have any input into the decision-making process, so parents tend to be the target audience for promotional communications. However, there are some immunisations indicated for young people old enough to have an active input into the decision-making process, or where they themselves are old enough to make the decision to be immunised e.g. HPV, rubella. HPV immunisation has recently been included in the routine immunisation schedule for adolescent girls in a number of European countries. For example, in 2008 the UK introduced a national programme to vaccinate girls aged 12–13 against HPV, and a 'catch-up' campaign to offer the vaccination to girls aged 14–17 [49]. Parental consent is requested for vaccinations administered to girls under 16, but individuals under 16 can be vaccinated without parental consent at the discretion of medical staff, if they can demonstrate appropriate understanding [44]. In 2005, there was a national campaign in Belarus to increase rubella immunisation rates in young people aged 17–19, due to low levels of immunisation in this age group [42]. The campaign targeted this age group directly, as they are old enough to make the decision to be immunised. None of the studies targeting children/young people were able to fully evaluate impact on immunisation rates, and there were mixed results in terms of impact on knowledge and attitudes.

Few interventions captured in the review targeted the general public. The experimental studies with participants from the general public were both formative evaluation studies [45, 46]. Natter and Berry's [46] study explores the ethical challenges of sharing risk information with the public to facilitate informed decision-making with regards to immunisation, while Chanel et al's [45] study explores the effect of social-norms feedback on immunisation intentions. It is notable that both studies looked at these issues with reference to influenza immunisation, possibly reflecting an emerging public health interest in developing better strategies for public communication on protecting against influenza.

The interventions included in the review that targeted the general public were both large-scale interventions [42, 24]. Both incorporated structural components, and attempted to improve access to immunisation as well as communications activities. Both of these interventions were from Eastern European countries with relatively weak health system infrastructures. In countries with stronger health systems, as well as providing immunisation services, the health systems themselves are the method of diffusion of information about immunisation e.g. through midwives or general practitioners, and efforts to improve vaccination rates may be focused on hard-to-reach groups rather than the general public. However, in countries with weaker health systems or where health systems have broken down, there may be limited awareness of the requirements for immunisation among the general public (as well as limited access). In these circumstances, efforts to increase immunisation rates may take a more generalised approach and measuring the marginal contribution of communications to overall strategy impact is a significant challenge.

4.2 Communication methods and approaches that have been used to promote or reinforce national immunisation schedules vaccination uptake

The review includes interventions that took a variety of approaches and used a range of communication methods and channels to promote immunisation. The heterogeneity of the interventions in the review probably reflects the fact that communications for immunisations cover a broad scope involving multiple target audiences, vaccinations and settings. It may also reflect the fact that there is limited evidence for 'what works' in promoting immunisation.

The approaches used in the interventions included in the review can be broadly categorised as:

- mass communication (distribution of universally targeted information to undifferentiated or large segments the population at the same time).
- personalised communication (which in some way aims to make a personally relevant appeal to individuals, for example using direct contact or individually addressed correspondence).
- training/education

The categories are not mutually exclusive, and many interventions combined more than one approach. For example, the intervention evaluated by Thompson and Harutyunyan [24] involved mass communication activities (TV and radio spots etc.), as well as personalised communications activities such as counselling sessions for parents. The intervention evaluated by Sartor et al [31] combined mass advertising with personally addressed letters to hospital physicians. Some interventions, however, relied on a single communication method. For example, the intervention evaluated by Hull et al [14] attempted to increase immunisation uptake in the elderly by telephone appointment invitations only, while the intervention evaluated by Arthur [26] consisted of a single communication method (nurse home visit), although this was combined with enhanced service delivery (influenza immunisation available at home visit).

The categories are not always clearly delineable. In particular, it is not always possible to categorise an intervention, or an aspect of an intervention, as 'mass' or 'personalised'. An intervention that took a 'mass' approach may have been perceived as relevant and personal by the audience, particularly if segmentation was used e.g. in method of establishing contact. For example, the intervention evaluated by Llupia et al [19] included educational and advertising messages which were emailed to HCWs on a weekly basis. The recipients may have perceived this form of communication to be personal and relevant even though the messages were sent as part of a mass campaign.

In terms of 'mass' communications, the interventions captured in the review include a range of communication channels including TV and radio broadcast, print media, leaflets and posters. In some of the interventions captured by the review, although the communications could be classified as mass communications, these communications may be somewhat restricted in their reach due to the methods of distribution. For example, in the intervention evaluated by Malmvall et al [25] communication targeted the elderly and other patient risk groups. One of the components of the intervention was campaign posters which were placed in health centre waiting rooms and pharmacies. These communications are likely to reach only those in contact with health facilities, but would not have reached those in the target audience who did not have contact with primary care settings e.g. housebound elderly people.

Restricting analysis to only the studies that scored 70% or more in the quality and applicability appraisal, there was only one intervention that took an exclusively mass communications approach [21]. This intervention reported convincing evidence of positive effect. Five interventions combined a mass communications approach with other approaches [13, 19, 25, 20, 24]. Three of these reported convincing evidence of positive effect [13, 19, 25], and two were found to be ineffective [20, 24]. No conclusions can be drawn from these results on the effectiveness of mass communications to promote immunisation. The intervention evaluated by de Juanes et al [21] provides evidence that an exclusively mass communications approach can be effective, but this is only one study and should not be interpreted as firm evidence of the efficacy of mass communications methods. Combining mass communications with other forms of communications is associated with mixed results and therefore suggests that mass communications can contribute to effectiveness, but are not essential.

The interventions captured in the review also include a range of some form of personalised communications (e.g. home visit from HCW, personally addressed letter, counselling sessions, telephone appointing, personal email) i.e. any active attempt to make the communication personally relevant. There was limited use of electronic communication (email), with only one intervention captured by the review using this channel to communicate with HCWs [19]. This evaluation was relatively recent (2010), and it is possible that use of electronic communications may be a trend in future interventions. Face-to-face communications (with the exception of face-to-face training and education) were mostly used for hard-to-reach groups in the interventions captured in the review. For example, in the intervention evaluated by Arthur et al [17] patients aged over 75 received a home visit from a nurse who offered them influenza immunisation, and in the intervention evaluated by Nuttall [23], elderly patients who had not been vaccinated against influenza in the previous influenza season received a letter inviting them to attend their GP surgery for immunisation and a home visit from a health visitor to discuss the influenza immunisation programme. These interventions were relatively small scale, but the intervention evaluated by Thompson and Harutyunyan [24] included face-to-face communications (counselling) on a large scale.

Analysis of the studies that scored more than 70% in the quality and applicability appraisal indicates that an exclusively personalised approach strategy is not associated with positive effect. Half of interventions that took an exclusively personalised approach reported convincing evidence of positive effect [17, 26], and half reported no evidence of effect [14, 23]. Similarly, the review found mixed evidence of effectiveness for the inclusion of personalised approaches with other intervention components: half the interventions that included a personalised approach combined with other strategies, reported convincing evidence of positive effect [13, 17, 19, 26, 27], and half reported no evidence of effectiveness [14, 16, 18, 23, 24]. Interventions that did not include a personalised approach, reported similarly mixed results: two had convincing evidence of positive effect [21, 25], while three had no convincing evidence of effectiveness [15, 20, 22]. There is no clear pattern therefore, to indicate that the inclusion of personalised communications in general are associated with effectiveness.

However, evidence of effectiveness for the most genuinely 'personalised' communications is more promising. All seven of the interventions that reported convincing evidence of positive effect used some form of face-to-face communication with the target audience [13, 17, 19, 21, 25, 26, 27]. Five interventions reporting no effect also included some face-to-face communications, indicating that the inclusion of face-to-face communications *per se* cannot be interpreted as sufficient to achieve effectiveness [15, 16, 22, 23, 24]. The evidence does suggest however that face-to-face communication can be an effective component of promotional communications for immunisations for at least some target audiences. The effective interventions targeted all groups who had demonstrated vaccine-resistant behaviour. It may be that face-to-face communications allowed the audience to ask questions about vaccine efficacy and safety, which meant that misconceptions could be addressed. It may also be that face-to-face contact was interpreted by the audience as an indicator of serious personal risk status, irrespective of any verbal or informational exchange, and this itself could have been sufficient to have a positive effect. However, there is insufficient detail in the reported studies to extrapolate with any certainty the reasons why face-to-face communication is associated with effectiveness.

Although training and education is not strictly a promotional communication, a number of interventions in the review used this approach as a communication adjunct and to supplement other promotional communications activities. Training and education provision was generally for HCWs. The evidence for the effectiveness of training and education is mixed but promising and warrants further research. Training and education of HCWs was a component of 12 of the 33 interventions included [15, 28, 13, 27, 29, 25, 31, 22, 32, 24, 33, 34]. Training and education was associated with: improved HCW vaccine uptake in one high validity score evaluation [27] and two low score validity evaluations; [30, 31]; improved vaccine uptake in at risk patient groups in two high validity studies [13, 25]; high risk patients in two low validity score studies [32 33], and low risk patients in two low validity score evaluations [28, 34].

More than one factor seems to be involved in the effect of education and training provision for HCWs. Perception shifts of HCWs leading to more pro-vaccination attitudes appear to be closely linked to improved knowledge, but there is also evidence that education and training also empowers HCWs to be more proactive in their own promotional efforts. The intervention evaluated by Siriwardena et al [22], for example, was intended to increase influenza and pneumococcal vaccination uptake in the elderly and patient risk groups through an educational outreach visit to HCW in their general practice workplace. Follow up of intervention practices revealed that the educational outreach led to localised implementation of communications initiatives. Some practices used posters and leaflets in waiting rooms, and there was use of media to raise awareness. The drivers behind these localised communications initiatives are not clear, but could be as a result of improved communication skills or improved confidence in communication skills, or could simply reflect motivation to disseminate messages and knowledge gained through the educational outreach intervention.

Overall, there is no clear pattern of association from which any conclusions can be drawn about, which approaches or combinations of approaches (mass, personalised, training/education) are most effective, but further testing of the effectiveness of face-to-face communications, as well as the provision of education and training for HCWs are both indicated as promising areas for future research.

An examination of the various communication channels used across the evaluated interventions did not find any clear pattern in terms of which channels are associated with effectiveness. For example, print materials (including letters, leaflets and posters) were used in many of the evaluated interventions. An equal mix of positive and no effect outcomes were reported for these interventions. Similarly, personally addressed invitations were a widely used strategy but mixed outcomes were reported and there was no overall trend.

Message framing is also known to be a significant influence on audience response to interventions. Message framing is relevant to both mass and personalised communications because the affective impact of key messages is likely to be a significant moderating influence on behavioural intentions and outcomes in both approaches. All the message framing studies included in the review were carried out in an experimental setting. Four studies included in the review examined the effect of how information is presented on intentions to immunise among specific target groups [37, 38, 46, 45].

Two studies examined loss-framed and gain-framed messages [37, 38]; one study examined the effect of normative feedback [45]; and one study examined the complexity of risk information and its effect on audience understanding and motivation [46]. Results of message framing are reported in section 4.3.

Many of the interventions captured by the review attempted to address personal barriers to immunisation, as well as communicating the benefits. The intervention evaluated by Dey et al [15], for example involved a public health nurse visiting HCW groups to provide information about the safety and efficacy of immunisations and to correct any misconceptions, as well as to inform HCWs where they could obtain a free vaccination. This may have helped to overcome several barriers to HCW immunisation uptake, including concerns about immunisation safety, lack of belief in the efficacy of immunisation, and uncertainty about where to obtain immunisation.

Many of the interventions address structural barriers to immunisation through institutional organisational change. For example, in the intervention evaluated by Humair et al [13], patients were charged only for the cost of the vaccine and injection, but not for the cost of the medical consultation. In the intervention evaluated by Tapiainen et al [16], free walk-in immunisation clinics were opened in wards not located in the main hospital, to make access to immunisation easier for HCWs who may previously have had difficulty accessing clinics. The intervention evaluated by Arthur et al [17] took a personalised approach in the form of a home visit from a nurse who was able to offer immunisation to elderly patients in their own home.

A number of interventions promoting influenza immunisation involved some form of improved service delivery such as in-home or workplace vaccination. Six effective high validity score interventions that included improved service delivery reported evidence of effectiveness [13, 17, 19, 21, 25, 26], and two reported no effect [15, 16]. Three high validity score interventions did not include an improved service delivery component, and only one of these was effective [27]. The evidence therefore indicates that improved service delivery is associated with positive intervention effect, but is neither necessary nor sufficient on its own.

The duration and intensity of exposure of the target audience/audiences varied across the interventions captured in this review, depending on the intervention design. Although it is not possible to accurately determine the extent of audience exposure to promotional communications for most of the interventions, the interventions captured in the review can be divided into two groups: interventions where there was a one-off contact with members of the target audience, often through a single approach or communication channel (e.g. invitation letter/telephone call, visit from a HCW); and interventions where there were attempts to reach the target audience(s) using more than one approach or multiple communication channels on more than one occasion.

Restricting analysis to those evaluations of interventions that have validity scores greater than 70%, five of the seven interventions which involved only a one-off contact with the target audience(s) reported no evidence of effectiveness [14, 15, 18, 22, 23]. Five of the eight high validity score interventions which aimed to expose the target audience to promotional communications on multiple occasions through multiple channels were found to be effective [13, 19, 21, 25, 27]. The evidence therefore suggests that interventions that achieve (or attempt to achieve) multiple contacts with the target audience are more likely to be associated with positive effect than interventions that include only one-off contact with the target audience.

Clearly, as well as the impact of an intervention approach, there are several other important aspects of a given intervention to consider, when assessing effectiveness and feasibility. These include ease of implementation, cost, cost effectiveness and acceptability. Few of the evaluations in the review considered any of these aspects, with some exceptions:

- Hull et al [14] estimated the additional cost to a GP practice of achieving a 6% increase in influenza immunisation rates through telephone appointing, and found that without item-of-service payment the intervention would not be financially attractive to practices.
- Jackson et al [39] assessed the acceptability of the MMR decision aid they evaluated. The web-based interactive decision aid was based on a decision aid originally developed in Australia in 2004, adapted to be appropriate for the United Kingdom setting. The aid comprised nine sections with interactive informational content: 'introduction'; 'how to use this site'; 'frequently asked questions'; 'how to compare the risks'; 'what are my options?'; 'making a decision'; 'useful websites'; 'references'; and 'contact us'. Most parents reported that they found the decision aid acceptable and useful in supporting informed decision-making.
- Looijmans et al [27] calculated the average cost of implementing the intervention to be €1421 per intervention nursing home (average number of HCW = 193). This included the costs for all programme materials, specialist staff and coordinators' time.

As previously noted, the interventions captured in the review are heterogeneous in terms of setting, audience, approach and communication methods used. With the exception of experimental studies, most interventions used a combination of different communication methods and in many cases a combination of mass, personalised, training/education approaches, and improved service delivery. This makes it difficult to separate the effect of particular approaches to determine 'what works'.

4.3 Theoretical underpinnings that have been used to inform communication methods and approaches

Few of the evaluated interventions included in the review had explicitly stated theoretical underpinnings [37, 38, 43, 44]. These studies cited the following theories/models:

- Prospect Theory (PT)
- Theory of Planned Behaviour (TPB)
- Health Belief Model (HBM)
- Leventhal's Common Sense Model of Lay Illness Representation

The message framing studies that compared gain-framed and loss-framed messages had the same theoretical basis [37, 38]. Both studies were informed and shaped by Prospect Theory (PT), which states that presenting the same information about risk in different ways affects people's perspectives, preferences and actions. The theory suggests that when making decisions from which they expect to gain, people are risk adverse, but are more risk tolerant when considering decisions which increase the risk of some personal loss.

Vaccination is most usually perceived as a preventive behaviour from which the decision maker gains (better long term health). According to the PT hypothesis, intentions to vaccinate would therefore be strengthened by gain-framed messages more than loss framed messages.

Fahy and Desmond [38] examined the effectiveness of gain versus loss-framed messages in promoting parental HPV vaccination uptake intentions, and hypothesised that gain-framed messages would encourage immunisation intent, in line with Prospect Theory. Fahy and Desmond [38], reported no significant effect of frame on intentions to immunise, although intentions were already highly positive in both conditions, before and after intervention, and therefore any marginal effects may not have been detected because the study was underpowered (sample size too small to detect small change at statistically significant levels).

Abhyankar et al [37] interpreted PT slightly differently in order to explore message framing in relation to MMR. They tested the hypothesis that a loss-framed message would lead to greater intentions to immunise compared to a gain-framed message as recent adverse publicity regarding side-effects of MMR resulted in perceptions that vaccination was risky behaviour, not a health gain behaviour. Abhyankar et al [37] did in fact report significantly stronger intentions among those who read the loss-framed message than those reading gain-framed messages. This finding has interesting ethical implications, as loss-framed messages (fear-appeals) are known to gain immediate attention, but there is evidence that they undermine self-efficacy in the longer term [50]. Thus, intention to immunise associated with exposure to a loss-framed message may not translate into future immunisation uptake and may cause anxiety, and so any future application would need to be carefully, prospectively tested.

Both studies also discussed the Theory of Planned Behaviour (TPB). Fahy and Desmond [38] stated that:

> 'According to the theory of planned behaviour, performance of a particular behaviour is predicted by the intention to perform the behaviour which in turn is a function of attitude, normative beliefs and perceived behavioural control (PBC). Thus, individuals are likely to intend to vaccinate their daughters if they believe that the behaviour will lead to valued outcomes, that significant others think they should carry out the behaviour and that they have the necessary resources or opportunities to perform the behaviour.' [38]

Fahy and Desmond's [38] study aimed to examine the applicability of the TPB in the context of mother's intentions to have their daughters receive the HPV vaccine. Abhyankar et al [37] used TPB as the framework through which to explore the role of intrapersonal variables in the relationship between frame and intentions. Fahy and Desmond [38] found perceptions of vaccine efficacy were positively correlated with stronger intention to immunise. No other associations between TPB variables and intentions to vaccinate were detected.

The intervention evaluated by Gottvall et al [43] was based on the Health Belief Model (HBM) [51]. According to the HBM, people will take action to prevent an ill-health condition if they: consider themselves to be susceptible to that condition; if they believe it would have potentially serious consequences; if they believe that a course of action available to them would be beneficial in reducing either their susceptibility to, or the severity of, the condition; and if they believe that the anticipated barriers to, or cost of, taking the action are outweighed by its benefits. The intervention did improve knowledge levels but did not improve the prevalence of preventive behaviours including vaccine uptake. The evaluation therefore did not provide any evidence in support of the HBM as an appropriate model for the design of vaccination promotional interventions.

The HBM was also implicit in the design of, and referenced in, the analysis of the intervention described by Dey et al [15]. Dey at al [15] also concluded that the HBM is not an appropriate model for large-scale immunisation uptake dependent on health systems delivery, because of its strong focus on individual responsibility that ignores structural barriers and facilitators.

Lloyd et al's [44] intervention used formative research. This research was interpreted using Leventhal's Common Sense Model of Illness Representation, and the interpretation was in turn used to inform the design of the intervention. Leventhal's model assumes that individuals take an active role in assessing and solving health concerns using both emotional and cognitive processes to understand and appraise, to cope and act, and to resolve their concerns [52]. Lloyd et al [44] reported positive results for knowledge improvements and intention to immunise, and on the basis of these results concluded that it was possible to design effective promotional communications for HPV vaccine targeting adolescent girls.

Despite the absence of explicitly stated theoretical underpinnings in most of the interventions included in the review, it is implicit that many are based on the information deficit model i.e. the belief that vaccine hesitancy is caused primarily by a lack of knowledge about the subject, and the belief that providing information to overcome this 'knowledge deficit' will change attitudes and opinions. However, this model has been widely discredited as research has shown that simply providing people with information does not change their views; there are many more complex factors that influence attitudes and beliefs [53]. This review similarly found no evidence that improved knowledge resulted in improved vaccine uptake or even intention to be vaccinated.

Only three of the evaluations had an explicitly stated original hypothesis:

- Arthur [26] stated that: 'by offering the influenza vaccination during home-based health assessments, nurses can dispel the myths surrounding the vaccine, patients have more time to discuss their concerns, and potential barriers, such as the difficulties which older people may face in getting to their local surgery are removed'. The evaluation results were not conclusive, but did appear to fit with this hypothesis.
- Natter and Berry [46] stated that: 'in line with previous studies, it was predicted that, if people are not informed of the baseline, perceived effectiveness of vaccination and likelihood of being vaccinated would be higher in the relative risk format condition than the absolute format condition. It was also predicted that informing people of the baseline would eliminate these differences and would also lead to more accurate estimates of risk'. The results of this experimental study found high levels of cognitive ability amongst respondents and that more transparent sharing of information on risk did not act as a barrier, and was likely to increase vaccination.
- Nuttall's [23] study had a clearly stated hypothesis: 'a visit from a health professional to provide information regarding influenza and immunisation, for those people aged over 65 years who failed to attend for immunisation in the 2000/2001 campaign, is more likely to increase influenza uptake than other interventions'. The sample size for this study was rather small and therefore conclusions are limited, but there was no evidence of effectiveness for this intervention.

This review aimed to identify and analyse promotional communication interventions for immunisations, and it was therefore outside the scope of the review to search for, or include studies investigating the reasons why people are vaccine-hesitant or vaccine-resistant. However, it is clearly important that these reasons are investigated and understood, in order to develop effective communication interventions to promote immunisation. Therefore it may be expected that most, if not all of the interventions identified in the review would be based on the results of formative research. However, this does not appear to be the case. Although many of the studies cited literature to support the choice of intervention approaches and communication channels, only five of the 33 evaluations reported that the interventions were developed on the basis of formative research carried out specifically to identify knowledge, attitudes and perceptions that were influencing vaccination decisions and behaviours:

- In the intervention evaluated by Corrigan [42], the author notes that in designing the strategic framework for European Immunisation Week 'extensive desk research was undertaken', and a questionnaire survey of Expanded Programme on Immunization (EPI) managers in the European Region was conducted to understand barriers to immunisation, and to identify potential strategies and communication channels for European Immunisation Week was distributed. Details of the results of the formative research were not reported.
- Prior to developing their intervention to increase influenza immunisation rates in nursing home HCW, Looijmans van den Akker et al [27] carried out formative research to assess demographic, behavioural and organisational determinants of immunisation uptake among their target group. The study used a questionnaire to survey 1 125 nursing home HCWs. The survey found the following pre-intervention variables were determinants of immunisation uptake: presence of a chronic illness; working in healthcare for more than 15 years; perceived high personal risk; perceived reduction of personal risk as a result of immunisation; perceived reduction of risk to patients; awareness of the existence of a guideline; agreement with the guideline; social influence of those people close to the HCWs; influence of media attention for avian influenza; agreement with statements that all HCWs should get vaccinated and HCWs should get vaccinated because of their duty not to harm; information received through an informational meeting; and information received from a nursing home physician The intervention was 'largely based' on these determinants and developed according to the intervention mapping method.
- The intervention evaluated by Malmvall et al [25] was also based on formative research. Interviews were conducted with 15 elderly people to gain insight into their beliefs and attitudes towards influenza immunisation to inform the design of the mass media component of the intervention. In addition,

questionnaires were completed by nurses involved in vaccination at various health centres in order to gain understanding of health centre routines and logistics. Details of the results of the formative research were not reported.

- The design of the intervention evaluated by Tapiainen et al [16] was based on the results of a survey to determine the reasons that HCWs decide to be immunised, or not to be immunised. The survey revealed that the most common reasons for refusal of influenza immunisation among hospital HCWs were doubts about the necessity of immunisation, fear of side-effects and missed opportunities to be immunised.
- The HPV information leaflets used in the intervention evaluated by Lloyd et al [44] were designed following interviews with young women to assess their informational requirements using thematic analysis based on Leventhal's Common Sense Model of Illness Representation. Details of the results of the formative research were not reported.

Three of the evaluations of interventions that used formative research to inform design had a validity score greater than 70% [27, 25, 16]. Of these, two did report evidence of effect [27, 25]. Although, it is not possible to draw any conclusions on the contribution that formative research can make to effectiveness of an intervention, it is clear that its use to inform the design and development of a given intervention is desirable. Drawing on formative research is an evidence-based and strategic approach to communication intervention as well as contributing to practice-based learning.

4.4 Settings and communication channels that have been used to promote or reinforce national immunisation schedules vaccination uptake

The review captured a small number of large-scale communications interventions intended to change the prevailing culture. For example, the intervention evaluated by Malmvall et al [25] was a large-scale intervention that attempted to increase influenza immunisation rates among the elderly and other patient risk groups across a Swedish county. The intervention had multiple components, including a mass-media campaign designed by professional marketing and public relations experts, educational interventions for HCWs and structural changes to remove barriers to immunisation and improve access (e.g. free immunisation). Activities and structural changes implemented as part of the intervention continued as standard practice after the initial three-year intervention period, reflecting high-level commitment to improving social acceptance of influenza immunisation, and to improving and maintaining uptake rates.

Similarly, the intervention evaluated by Thompson and Harutyunyan [24] was a large-scale intervention. Improving uptake of childhood immunisations was only one of the intervention objectives: the aim of the intervention was to improve several key maternal and child health practices, including breastfeeding, newborn care, hygiene practices and nutrition in one region of Armenia. The intervention reflected commitment by non-government organisations (NGOs) in Armenia (American Red Cross and Armenian Red Cross Society) to tackle the decline in maternal and child health, associated with the deterioration in the health system which occurred after independence.

Both interventions reported positive impacts, although neither reported any measure of statistical significance. Clearly, no conclusions can be drawn on the contribution that cultural change may have made to these promotional interventions but further investigation of this potential positive influence is warranted.

In terms of country setting, twelve countries were represented in the interventions captured by the review. The majority of the studies were from Western and Northern Europe. It is particularly notable that just under half of the interventions in the review were from the United Kingdom. This may reflect some level of bias in the review, as it was restricted to English language studies. However, it is likely that this also reflects the fact that in the past decade there has been a drop in public confidence in immunisations in the United Kingdom, associated with the MMR controversy. Other countries in Western Europe have also experienced a drop in public confidence in immunisations in recent years e.g. drop in public confidence in vaccination in France, associated with controversy surrounding the safety of the hepatitis B vaccination [55, 56].

There were few interventions captured in the review from Eastern Europe [42, 20, 24, 34]. These interventions were all large-scale multi-component interventions. With the exception of Uskun et al [34], the communications included in the interventions were multi-faceted, and made use of mass-media channels. Many countries in Eastern Europe have specific structural and health problems that impact on immunisation coverage and these interventions reflect efforts to address these problems using a multi-objective, high investment strategic approach. Baseline health knowledge can be low in such settings. For example, in the intervention evaluated by Thompson and Harutyunyan [24], mothers' baseline knowledge about childhood illness was assessed, and it was found that only 35% of mothers knew at least two signs to look for (this increased to 65% after the intervention).

The interventions included in the review took place across a variety of settings:

- hospital
- nursing Home
- GP practice
- other healthcare facilities
- community
- school

The choice of intervention setting is clearly dependent on the target audience. In addition, choice of setting is also likely to have a significant bearing on the effectiveness of an intervention.

It is notable that all of the interventions that targeted HCWs to increase their immunisation uptake were based in the workplace. This setting is both the most convenient place to target HCWs, and is often the setting in which HCWs can obtain immunisation. Improved ease of access to vaccination was a common additional component of these interventions, and this appears to be associated with improved uptake. For example, in the intervention evaluated by Tapiainen et al [16], free walk-in immunisation clinics were opened in wards not located in the main hospital, to make access to immunisation easier for HCW who may previously have had difficulty accessing clinics. This was associated with a small but significant increase in immunisation uptake among HCWs. De Juanes et al's [21] study evaluated an intervention which included visits from a doctor or nurse to all hospital departments to offer influenza immunisation to HCWs in the workplace. This active strategy to make immunisation more accessible was associated with a significant increase in immunisation uptake (from 16–21% before the intervention to 40% after the intervention).

For more detailed discussion of the communication channels used to promote or reinforce NIS vaccination uptake see section 4.2.

4.5 The evidence for effectiveness of communication initiatives in changing or reinforcing knowledge, attitudes and behaviours towards national immunisation schedules

Seven studies evaluated knowledge as an outcome measure and all had low validity scores. One evaluation targeted HCWs, but measured knowledge change in the elderly [32]. Six studies measured knowledge change in the intervention's direct target audience [42, 43, 39, 44, 36, 34]. Of these studies, three targeted young people [42, 43, 44], one targeted HCWs [34], one targeted parents [39], and one targeted patient risk groups [36]. The evaluations reveal a positive intervention trend in terms of increasing knowledge (with the exception of the evaluation by Corrigan [42] which revealed mixed positive and negative results), across the targeted audiences.

Three of the seven evaluations that looked at knowledge as an intervention outcome measure also measured intervention effect on attitude/behavioural intentions i.e. intention to be immunised [43, 44], or parental intention to have their child immunised [39]. The interventions evaluated by Gottvall et al [43] and Lloyd et al [44] were school-based educational interventions intended to improve HPV vaccine acceptance. Jackson et al [39] evaluated a web-based decision aid intended to empower parents to make informed decisions about the MMR vaccination. All three evaluations found no effect on intentions to immunise. Clearly, evidence that improving knowledge does not improve intention to vaccinate does not offer much hope that knowledge change will improve vaccine uptake. However, the small number of studies and the low validity scores limit interpretation. Jackson et al [39] reported that although unaffected by the intervention, parental intentions to have their children immunised were consistently 'strong' and as indicated by previous research, improved knowledge is unlikely to be influential amongst the minority group of parents who reject immunisation invitations because of personal beliefs [1].

Two of the seven evaluations measured immunisation uptake [32, 34]. The aim of the intervention evaluated by Uskun et al [34] was to increase childhood immunisation rates through training and educating HCWs. Thus, the effect of intervention on knowledge was measured in HCWs, but immunisation uptake was measured in children. In this case, a positive effect of intervention on HCW knowledge was accompanied by a significant increase in uptake of childhood immunisations (with the exception of one specific immunisation). The intervention evaluated by Stenqvist et al [32] also targeted HCW, to increase immunisation rates amongst the elderly. An increase in knowledge (measured as awareness of the recommendation for yearly influenza immunisation) in the elderly attributed to the intervention, was accompanied by an increase in immunisation rates.

Six interventions did not aim to change knowledge but did target and measure attitude change. Outcome measures were: intentions to immunise; perceived effectiveness of immunisation; subjective norms/normative beliefs; and perceived behavioural control. All of these evaluations received low validity scores in the quality appraisal [37, 45, 38, 43, 39, 46]. Four of the studies examined the effect of message-framing [37, 45, 38, 46]. It is not possible to draw any firm conclusions about the effectiveness of message framing on intentions to immunise on the basis of these studies. However there is some evidence to suggest that loss-framed messages may be more effective than gain–framed messages in terms of increasing intentions to immunise where concerns about vaccine safety are influential [37].

There was weak evidence of no effect of message framing on subjective norms/normative beliefs or perceived behavioural control [37, 38]. Chanel et al's [45] study found no evidence that social-norms feedback changed intentions to immunise. However, Natter and Berry's [46] study did report evidence that provision of risk information made socially and in a personally relevant way, improved intention to immunise, and there is some indication that this may be partially due to the influence of normative perceptions. The evidence, therefore, is somewhat mixed and crucially, none of the evaluations that measured attitudes also measured immunisation uptake. Therefore, there is no evidence here on whether positive changes to intention to immunise are predictive of improved immunisation uptake.

All fifteen of the studies with high validity scores used immunisation uptake as a main outcome measure. Of these studies, seven have reported convincing evidence of positive effect [13, 17, 19, 21, 25, 26, 27], and eight reported no evidence of effect [14, 15, 16, 18, 20, 22, 23, 24].

In summary, there is good evidence that a range of promotional communications can positively change knowledge, attitudes and behaviours. The evidence for increased immunisation uptake is particularly promising for HCWs and patient risk groups (including elderly) and seasonal flu vaccine promotions. However many of the interventions captured by the review combined communication channels and methods, it is not possible to identify which types of communication initiatives are most effective or to estimate their contribution to overall intervention effect. In addition, many interventions included structural change to make immunisations more accessible (e.g. reduced cost, more accessible clinics), further complicating attempts to determine the net contribution of communications.

4.6 Evidence on the impact of national immunisation schedules communication to control relevant communicable disease

None of the included studies provided any data on disease prevalence and therefore no analysis or conclusions can be drawn from this review regarding this question.

4.7 The impact of campaign communications promoting national immunisation schedules on public acceptance and vaccine uptake rates

In the wake of the 2009 influenza pandemic, WHO Director-General Dr Margaret Chan said:

'We did not anticipate that people would decide not to be vaccinated...in today's world, people can draw on a vast range of information sources. People make their own decisions about what information to trust, and base their actions on those decisions' [45]

Public acceptance of immunisation and public confidence in immunisation are clearly key factors determining immunisation uptake. Promotional communications are of course only one of the many information sources influencing public attitudes towards immunisation. Information, and misinformation, about immunisation is increasingly more accessible through the broadcast media and online. A simple online search for information about routine childhood immunisations can return hundreds of websites that claim, for example, that the MMR vaccination is linked to autism in children. The wide availability of such misinformation undoubtedly has a negative effect on public confidence in immunisation. Promotional communications must therefore attempt to overcome the negative influence such information has on public acceptance of immunisation.

None of the studies captured by this review directly assessed the impact of promotional communications on public acceptance. Indirectly, some studies provide some insight into mechanisms for promotional communications to influence public acceptance. Llupia el al [19] describe the use of website and real time updates as a social diffusion tool for acceptance, and as the 'glue' holding multi-component interventions together, providing a shared identity and feedback to multiple stakeholders. Although all staff had free internet access at the ward level and could therefore access the campaign webpage, the authors noted that the greatest increase in immunisation uptake attributed to the intervention was among physicians and administrative staff who had their own email accounts in the hospital, while immunisation uptake was lower among other staff who did not have email accounts. The authors therefore conclude that email was a more effective tool for diffusion of information than a campaign webpage in that setting. This intervention was implemented at worksite level, not general population level, and more research is needed to understand if this could scale-up, yet this strategy to improve acceptance within social networks seems worthy of further exploration.

Chanel et al [45] also provides insight on the challenges of achieving public acceptance. This study found that high levels of public awareness and information seeking measured by tracked internet searches about the 2009 influenza pandemic was not associated with any increased intention to be vaccinated.

Public support is essential to achieve voluntary herd immunity, but as noted by authors of some of the included studies, high immunisation coverage rates are not an incentive for individuals to be immunised. Sartor et al [31] found even HCWs were not motivated to consider their own immunisation as a contribution to the 'herd immunity' effect. Similarly, a parent's concern about the risk of adverse events following routine childhood immunisation may mean that they delay immunisation, or avoid having their child immunised. This parent is unlikely to consider the beneficial contribution that immunising their child would make to herd immunity, rather, they are more likely to concentrate on the perceived personal risks associated with immunisation. Research on whether framing herd immunity messages to emphasise more relevant personal benefits, such as protecting family and friends, could improve public acceptance would be a valuable contribution to the knowledge base.

5. Conclusions

5.1 Overview

A substantial proportion of the evaluations included in this review are for interventions promoting seasonal influenza vaccination, targeting selected patient risk groups. A smaller number of evaluations are for interventions promoting universal childhood vaccines to parents, children and young people.

There are significant contextual differences between the two types of intervention. Childhood vaccine-preventable disease immunisation is a universal intervention, aiming for 100% coverage of the population; influenza vaccination is most commonly offered as a selective intervention for indicated groups. The benefits of immunisations for childhood vaccine-preventable diseases are at individual, family and whole-population level. For influenza immunisation the beneficiaries are individuals, families, health care systems and, to a lesser extent, whole populations. Influenza vaccination is a recurring preventative measure for a dynamic infection with imprecise estimates for risk of onset and severity of consequences, whereas immunisations for childhood vaccine preventable diseases are delivered as a series of one-off preventative measures against less mutable pathogenic agents with more predictable pathology. Decisions about influenza vaccine are made by the primary beneficiary whereas childhood vaccine-preventable disease decisions are, in the main, made by the parents of the primary beneficiary.

Immunisation for influenza and childhood vaccine-preventable diseases also share important common characteristics: both are public health strategies requiring large-scale adoption to achieve intended impact; vaccine uptake is a voluntary behaviour; benefits are delayed (protection against future infection); benefits are hypothetical (not everyone will be exposed to the infectious agent or become infected); the benefits cannot be precisely defined (the severity of illness for those infected will range from mild to severe); risk probability of vaccination side effects are estimated to be very small by experts; and discourse on possible vaccination side effects tend to emphasise serious consequences and has achieved substantial visibility. There is evidence that many who are vaccine-hesitant are not actively vaccine-resistant or vaccine-refusers [2]. Communications therefore can assist in the information appraisal and decision-making process if received as personally relevant and perceived as credible and trustworthy.

The findings drawn from these two areas of communication activity and discussion on this have been presented separately in the earlier sections of the review. This final section brings together the learning and insight from all the included studies, to summarise the strategic implications of the review findings. It highlights the key evidence generated by the review on what constitutes effective promotional communication for national immunisation schedules, as well as the evidence gaps. It concludes with recommendations for future practice, evaluation of practice, and research strategies.

5.2 Barriers to vaccine uptake and promotional communications

Knowledge

The review identified substantial evidence that lack of accurate information and/or misinformation is a barrier to immunisation for seasonal influenza. For example, baseline research of target audiences found that even HCWs underestimated the safety of the influenza vaccine, its efficacy in preventing infection, as well as individual susceptibility to infection [16]. A number of evaluations of interventions targeting the elderly and HCWs demonstrated increased knowledge, and in some interventions improved vaccination uptake, in response to education and training.

The review identified almost no evidence however, that knowledge improvement can increase vaccine uptake amongst parents and children, with the exception of a small study of HPV vaccine promotion that aimed for affective (emotional) change as well as knowledge change goals.

Beliefs

The review identified very little practice or research on the role of belief systems in immunisation hesitancy and how communications can effectively address this barrier. Only two interventions identified in the review were based on belief system theories: Abhyankar et al [37] and Lloyd et al [44]. Both studies were small and experimental but did demonstrate the potential relevance of belief systems to designing, developing and positioning of pro-immunisation messages. There is a substantial body of evidence that could help to inform novel and creative message development and positioning. See for example Loewenstein et al [57] 'Risks as Feelings' framework; Tversky and Kahneman [58] on the impact of framing on decision-making and Leventhal et al's Common Sense Model of Illness and Self-Regulation [52, 59].

The few studies that included a theory of behaviour and aimed to modify belief system drivers for the behaviour are insufficient to draw any firm conclusions on appropriate models or theories of behaviour. Given that anti-immunisation beliefs and world-views have been identified as a factor in immunisation hesitancy [60], the lack of belief system concept testing in intervention design and evaluation is a substantive and significant gap in the evidence base.

Access

Mass and personalised communications combined with organisational responses to perceived barriers to vaccine in personally relevant settings was associated with increased uptake. For example, communication and increased opportunities to be vaccinated in the workplace improved vaccination uptake among HCWs who had previously given personal inconvenience as a reason for their non-vaccinated status. Immediate vaccination delivery combined with face-to-face contact to address misinformation and false beliefs was also associated with increased vaccination uptake amongst the elderly in some instances. The evidence base does not provide any indication of the relative contributions or the inter-dependence of improved access and promotional communications, but there is some evidence that they may act synergistically.

Limited visibility of outreach

The majority of interventions mobilised and disseminated health resources from within the healthcare system and the associated settings responsible for immunisation. There are obvious practical advantages to this, as almost all the included interventions combined communications components with some aspect of service delivery. However, this did limit reach to those already using health care settings and may have inadvertently framed messages as medical advice, with little relevance to current non-medical/perceived low personal risk, priorities or lifestyles.

5.3 Facilitators of vaccine uptake and promotional communications

Advocacy

Strongly visible communications in support of immunisation from workplace managers, clinical personnel with recognised responsibility for a broader health care remit than immunisation, and technical experts able to respond to specific concerns and informational gaps were all found to be effective promotional communication ambassadors for vaccination. The evidence indicates that both symbolic (for example high-level visibility of senior manager's decisions to be vaccinated) support and proactive practical measures (for example improving vaccination access) can be effective promotional strategies.

Social network and social capital

There is substantial evidence from other fields that social diffusion of health behaviours is an important influence on population outcomes [61]. Social diffusion describes how behaviours and related social norms and values are transmitted through social networks of individuals with varying levels of influence (see appendix 6 for a short summary of social diffusion/diffusion of innovation). The evidence found in the review for communications to positively drive the social diffusion of vaccine acceptance was limited, but promising. Further research on this as a promising strategy is recommended. More specifically, with the rapid growth of digital interactive technologies, research and development in their application to support social diffusion is clearly of particular interest.

Personal appeals

The review found good evidence that face-to-face communications but not other forms of personalised communications were engaging and persuasive. A number of researchers recognised that further research was needed to assess the cost-effectiveness and feasibility of such approaches to reach whole populations. The evidence may indicate that directly personal contact may only be justifiable for those who are clearly identified as vaccine-hesitant.

A number of included studies found structural change to information management and internal communications of healthcare systems to be an effective support to personalised promotion of vaccination. For example, improved record keeping and tracing systems enabled healthcare providers to identify and follow up individuals not compliant with national immunisation schedules. However, the evidence for improved tracing systems resulting in improved vaccine uptake was not convincing, and more research is needed to determine if better internal record systems can be used to enhance effectiveness of communication interventions.

The evidence for the effectiveness of fear or positive persuasion message framing was mixed and therefore inconclusive, but did underline the critical importance of developing risk communication that is informed by the risk perceptions of the target audience, *not* the perceptions of risk managers and communicators.

Mass communications

The review identified moderately convincing evidence that promotional communications informed by baseline audience research, and developed by communications professionals can change attitudes and behaviour. Unfortunately, none of the included studies demonstrated positive links between attitudes and behaviour, and therefore the evidence provides only a partial understanding of the pathway from communications inputs to vaccination uptake, and the mediating role of attitudes and beliefs. More comprehensive evaluation planning and practice is needed to more accurately appraise mass media communications on value for money.

5.4 Strategic implications and recommendations

Communication interventions based on clearly stated frameworks in support of desired behaviour

Explicit and conceptually explicit theoretic foundations for intervention design and implementation are needed. Clearly identified inputs, intermediate factors and desired outcomes, enable a potential pathway for change to be tested and examined. The information gained from their evaluation will support evidence-based development of pro-immunisation communications practice. Vaccine-related knowledge, attitudes, perceptions and behaviour are all useful indicators of effectiveness. Evaluation should aim to measure multiple outcomes as well as the strength and nature of any identified association.

Communications that support population-scale behaviour

Theories of change need to incorporate macro-level theories of behaviour change as well as models of individual level behaviour choices. Given that immunisation coverage must occur at population level for public health objectives and benefits to be fully realised, effective communications planning and immunisation service delivery must simultaneously aim to understand individual choice perspectives, and the social dynamics processes that shape norms, values and culture. Evaluation also needs to be designed to test the contribution of inter-personal and structural determinants of health behaviour as well as intrapersonal determinants.

Immunisation advocacy

Credible and trusted champions for immunisation, and visible proof of action can help to build support and trust in vaccination efficacy and safety, as well as raise awareness of the benefits. Informed and motivated health care workers can become important advocates and champions for immunisation in the health care setting. Other opinion formers may also be influential and be able to reach out to different target audiences.

Information provision

Knowledge improvement is associated with higher vaccination uptake amongst some groups. It is less clear if informational approaches can help to shift behaviours in all groups. Nevertheless, accurate and balanced information is clearly a pre-requisite to informed choice, and an important counter-balance to misinformation. There is also strong evidence from research on risk perception and communication, that transparency in risk assessment and sharing of information that informs risk management is helpful in building trust. Informational content and style will also be more effective if based on formative research, message-testing and piloting of communication interventions.

Education and training

Health care workers are responsive to education and information. The effectiveness of communication is enhanced when combined with improved availability of vaccines in workplace settings.

Expertise in communication

Changing and reinforcing voluntary behaviour is challenging, and poorly conceived and executed communications may exacerbate vaccination hesitancy. Professional experience in the design, delivery and evaluation of promotional communications and associated service provision, can achieve positive attitudes towards immunisation and improved vaccination uptake.

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[References 13–46 are the primary studies included in the systematic literature review]

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Appendix 1. Protocol

PROTOCOL

A Systematic Literature Review of the Evidence for Effective National Immunisation Schedule Promotional Communications

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1. Background

'Immunisation hesitancy', along with publicly articulated concerns about public health national immunisation schedules (NIS) policies have negatively impacted population uptake of routine vaccination. This has affected the incidence of vaccine preventable diseases, resulting in some resurgence of infection, and the occurrence of clustered outbreaks [1]. The social and cultural origins of these trends are complex, but some of the factors that appear to contribute to the trend include: declining levels of trust in expert opinion; a tendency towards greater emotional and personal engagement of citizens on the issue; rapid dissemination of information and misinformation; and low awareness of the consequences of immunisation avoidance or delay because this is seldom seen at first-hand [2].

It is clear that a traditional public health response, relying exclusively or largely on the scientific evidence for the safety, efficacy and population-wide benefits rationale for NIS, is an inadequate response to this highly-charged and dynamically evolving communications environment. Ill-conceived or insufficiently tested and developed communications intended to promote NIS may at least be ineffective and at worst exacerbate immunisation hesitancy and resistance [see for example 3–4]. Research into the recent resurgence of public distrust in public health vaccination policy can inform the development of more effective communications favouring NIS. This is a contemporary issue and is deeply rooted in modern communication technologies. The most relevant research evidence therefore is likely to be recently published, globally inter-connected but also culturally/regionally influenced [5,6].

Systematic review has been used to evaluate the evidence for the effect of communications interventions in healthcare. For example, Grilli et al.'s [7] review of mass media interventions' effects on health services utilisation and Gagnon et al.'s [8] review of interventions for promoting information and communication technologies adoption by healthcare professionals. However, a scoping exercise did not identify a systematic review addressing the effectiveness of national immunisation schedule promotional communications. This systematic review therefore aims to address this apparent gap in the evidence.

2. Objectives

The aim of this systematic review is to assess the evidence for the effectiveness of national immunisation schedule promotional communications. The following research questions will be addressed:

- Which audiences (e.g. parents, young people and children, the elderly, the media, health professionals, chronic disease patients whose health is particularly at risk from nationally indicated vaccine-preventable communicable disease) have been targeted by NIS promotional communications?
- Which communication methods and approaches have been used to promote or reinforce NIS vaccination uptake?
- What theoretical underpinnings are used to inform communication methods and approaches?
- Which settings and communication channels have been used to promote or reinforce NIS vaccination uptake?
- What is the evidence for effectiveness of communication initiatives in changing or reinforcing knowledge, attitude and behaviour towards NIS?
- What is the evidence for impact of NIS communication initiatives to control relevant communicable disease?
- What impact have campaign communications promoting NIS had on public acceptance and vaccine uptake rates?

3. Methods

3.1 Criteria for considering studies for this review

Types of literature

Published academic and grey literature (including theses) in printed or electronic formats will be eligible for inclusion. Unpublished literature will also be eligible although the review team will not make a systematic search for this type of literature. Studies published in 2000 or later will be included.

The database searches will not be limited by language. However the search terms will all be in English. As a number of academic databases hold non-English language studies with English-translated titles and abstracts, consideration will be given to translating the full text study into English based on the (English language) information recorded in the bibliographic database. All relevant non-English language studies found during the searches will be documented including those not translated.

Types of studies

The types of studies suitable for inclusion will report on any national immunisation schedules policy for mainstream and selected populations intended to support 'herd immunity' (i.e. excludes non-routine health needs such as overseas travel; temporary and extra-ordinary lifestyle at-risk groups etc.). To be eligible, the study results will provide evaluation, experimental, quasi-experimental, or observational interrupted time-series data. Measured and reported data will include a behavioural or a behavioural precursor outcome.

Types of participants

Human populations of all age groups will be eligible for inclusion provided the study includes or impacts on subjects or populations (the general public and health or medical professionals) from the following European countries and their territories: Albania, Andorra, Armenia, Austria, Azerbaijan, Belarus, Belgium, Bosnia-Herzegovina, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Georgia, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Macedonia, Malta, Moldova, Montenegro, Netherlands, Norway, Poland, Portugal, Romania, Russia, San Marino, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey, Ukraine, United Kingdom, Vatican City, Abkhazian, Abkhazia, Ajaria, Ceuta, Melilla, Channel Islands, Chechnya, Corsica, Crimea, Dagestan, Faroe Islands, Gibraltar, Greenland, Ingushetia, Isle of Man, Kabardino-Balkaria, Kaliningrad, Kalmykia, Karachay-Cherkessia, Kosovo, Nagorno-Karabakh, North Ossetia and South Ossetia.

Types of interventions

Studies which evaluate a health promotional communication to inform and influence an individual's decisions regarding their country of residence's national immunisation schedule. Relevant promotional communication channels can include, but are not limited to: advertising (billboards, television, radio, and print media); direct mail newsletters, leaflets and emails; press conferences, media briefings and press releases; seminars and workshops; online social networking and updates.

Types of outcome measures

The primary outcome of interest for the review is a change in measured immunisation uptake rates. It is likely this data is collected nationally.

Relevant secondary outcomes are measured changes in the target audience's knowledge, attitudes and other behavioural determinants related to the immunisation schedule and the promotional communication used. For example, measures of campaign awareness (spontaneous or prompted) and of which communication channels or settings were used; knowledge or comprehension of key communication messages; acceptance of the communication messages (triggers or barriers to immunisation uptake or recommendations for vaccinations to patients); and behaviours such as information-seeking.

3.2 Search methods for identification of studies

Search terms are included for all the NIS vaccines in European countries as listed in the latest Immunization Summary [9]. Records will be kept of all the search strategies applied for both the academic and grey literature.

Academic literature

We will search the following academic literature databases using the search strategy at the end of this protocol document:

- - BIOSIS Previews (via Web of Knowledge)
- - Business Source Premier (via EBSCOHost)
- - CINAHL (via EBSCOHost)
- - Health Source (via EBSCOHost)
- - Maternity and Infant Care (via OvidSP)
- - Medline (via PubMed)
- - PsycINFO (via EBSCOHost)
- - Social Services Abstracts (via CSA Illumina)

The strategy will be adapted to each databases' search terminology. A simplified version of the search strategy using selected search terms will be used in the following literature databases:

- - Campbell Library of Systematic Reviews
- - Centre for Reviews & Dissemination
- - The Cochrane Library
- - Index to Theses
- - Web of Science Indices
- - ZetocSearch

Handsearching

After analysis of the search results, the journals that contain the largest number or relevant studies will be hand-searched from 2000 onwards to identify further relevant studies that were neither indexed by the databases nor identified by the search strategy. It is anticipated that *Eurosurveillance*, *Health Promotion Practice* and the *Journal of Communication in Healthcare* may be indicated for this process. The bibliographies from included studies will also be checked for further studies.

Grey literature

Using selected terms from the academic literature search strategy, we will search for relevant grey literature publications via (but not restricted to) the following databases and websites:

- Copac National, Academic, and Specialist Library Catalogue
- European Centre for Disease Prevention and Control
- EU Bookshop
- GAVI Alliance (Global Alliance for Vaccination and Immunization)
- HealthComm Key (Emory Center for Public Health Communication database)
- ICA Health Communication (a Johns Hopkins University database)
- Karlsruhe Virtual Catalog KVK
- OpenSIGLE (System for Information on Grey Literature in Europe)
- Social Care Online
- VACSATC (Vaccine Safety - Attitudes, Training and Communication)
- WHO: World Health Organization

Searches of websites for organisations listed as ECDC Competent Bodies will be conducted for relevant reports. Google or Yahoo searches will also be run using selected search terms from the strategy. It should be noted that the grey literature strategy may also identify further academic literature.

Personal contact

Key individuals and organisations, identified through the search process above, may be contacted to identify further publications.

Specific campaigns to follow-up

Immunisation campaigns for events such *European Immunisation Week* and *World Vaccination Week* and the WHO *Prevent. Protect. Immunize.* campaign will be followed up to identify any relevant campaign evaluations.

3.3 Data collection and analysis

Storage

Search results will be imported into the reference management database RefWorks, and duplicates will be removed. A record of the total number of included studies at each stage of the systematic review will be completed throughout the process. The results will be summarised as a flow chart in the final report.

Selection of studies

In the first stage of study selection, two researchers will independently screen the titles and abstracts of the studies stored in the RefWorks database against the inclusion criteria to identify potentially relevant studies. Potentially relevant studies identified at this stage will be obtained in full text. A minimum of two researchers will then independently screen the full text studies for relevance and eliminate any that do not meet the inclusion criteria. It is anticipated that a significant number of studies will be excluded after full text screening, as it is likely that the title/abstract alone will not be sufficient to indicate whether a study includes European subjects/population impacts. Remaining studies after the second screening stage will be included in the review. Any discrepancies in studies selected for inclusion will be resolved by discussion between the review team.

Quality and risk bias assessment

Assessments of the strengths and weaknesses of the studies captured in the systematic review give an indication of the strength of evidence the SLR provides. NICE [10] guidelines will be used as the source of quality appraisal checklists for the various study designs. Criteria will assess whether the results of studies have been unduly influenced by the study design, other risks of bias and the degree to which these have been controlled or adjusted for in the analysis. Quality criteria will also assess study conduct, for example outcome measures used, thoroughness of reporting, fidelity of the implementation of the intervention, applicability of statistical methods and generalisability (external validity) of findings. Exact quality criteria will be confirmed after reviewing the results generated from the full search exercise. If there are few studies providing evidence for effective NIS promotional communication campaigns, we will aim to include as many as possible highlighting where 'lower quality' evidence was used. On the other hand, if there are many studies, we will raise the threshold in order for the review to focus on best quality evidence.

Data extraction and synthesis

Data to be extracted from studies included in the review will include (but are not restricted to): general information (author, publication year, publication type); study characteristics (aims, objectives, design); study participant characteristics; immunisation type; description of the communication methods (source, cultural context) and any theoretical basis; study setting; outcome measures and results; and a quality score.

A standardised data extraction form will be developed after the study selection process in response to the type and quality of studies identified for inclusion. The data extraction form will be piloted on a sample of studies selected. The objective will be to ensure that the tables concisely capture all relevant information. Data extraction will be carried out by one researcher. A second researcher will independently check the data extraction forms for accuracy and completeness. Any disagreements will be resolved by discussion between the researchers. Records of any amendments or corrections to the data extraction forms will be kept for reference.

It is not possible to specify exact details of the data synthesis at this stage. It will be framed by a narrative overview of the findings which will systematically summarise the extracted results, and highlight relevant characteristics of the included data. An assessment will be made by the reviewers whether a meta-analysis of outcome data is appropriate, based on the similarity of the included studies' design, setting, intervention, follow-up and outcome measures. If a meta-analysis is inappropriate, a narrative synthesis of the data will be used to structure the evidence for the specified research questions.

4. References

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Sample search strategy

Database: Maternity and Infant Care; **Interface**: OvidSP

1. "acellular pertussis".mp.
2. (aP adj2 (immuni#$ or vaccin$ or inocul$)).mp.
3. ("Bacill$ Calmette-Guerin" or "Bacill$ Calmette Guerin").mp.
4. BCG vaccine.de.
5. BCG.mp.
6. Chickenpox.de.
7. chickenpox.mp.
8. "childhood immuni#ation schedule$".mp.
9. (dip adj2 (immuni#$ or vaccin$ or inocul$)).mp.
10. dip?theria.mp.
11. Diphtheria.de.
12. Diphtheria-tetanus-pertussis vaccine.de.
13. DPT.mp.
14. (DT adj2 (immuni#$ or vaccin$ or inocul$)).mp.
15. DTaP.mp.
16. DTaPHepIPV.mp.
17. DTaP-Hep-IPV.mp.
18. (DTaPHibHepIPV or DTaP-Hib-Hep-IPV).mp.
19. (DTaPHibIPV or DTaP-Hib-IPV).mp.
20. (DTaPIPV or DTaP-IPV).mp.
21. (DTaPIPVHib or DTaP-IPV-Hib).mp.
22. DTIPV.mp.
23. DT-IPV.mp.
24. DTP.mp.
25. DTwP.mp.
26. (DTwPHep or DTwP-Hep).mp.
27. DTwPHib.mp.
28. DTwP-Hib.mp.
29. flu.mp.
30. h?emophilus.mp.
31. Haemophilus influenzae type b.de.
32. hav.mp.
33. HBV.mp.
34. hepatitis A.mp.
35. Hepatitis B.de.
36. ("hep A" or hepA).mp.
37. ("hep B" or hepB).mp.
38. hepatitis B.mp.
39. Hib.mp.
40. (HibMenC or Hib-MenC).mp.
41. HPV.mp.
42. ("human papillomavirus" or "human papilloma virus").mp.
43. immuni#ation.mp.
44. "immuni#ation schedule$".mp.
45. "inactivated polio$ vaccine".mp.
46. Influenza.de.
47. influenza.mp.
48. inject$.mp.
49. inoculat$.mp.
50. (IPV not "intimate partner violence").mp. [mp=abstract, heading word, title]
51. jab?.mp.
52. Measles.de.
53. measles.mp.
54. "Measles/mumps/rubella (MMR) vaccine".de.
55. (MenAC or Men AC).mp.
56. (MenC or MenCconj).mp.
57. ("mening$ C" or meningitisC).mp.
58. meningitis C.mp.
59. Meningitis.de.
60. (MM adj2 (immuni#$ or vaccin$ or inocul$)).mp.

61. MMR.mp.
62. Mumps.de.
63. mumps.mp.
64. OPV.mp.
65. "oral polio$ vaccine".mp.
66. Papillomavirus - human.de.
67. Pertussis vaccine.de.
68. pertussis.mp.
69. Pneumococcal infection.de.
70. pneumococcal.mp.
71. "pneumococcal conjugate".mp.
72. "pneumococcal pol#saccharide".mp.
73. (Pneumoconj or Pneumo-conj).mp.
74. pneumops.mp.
75. polio$.mp.
76. Poliomyelitis.de.
77. Poliovirus vaccine.de.
78. Poliovirus.de.
79. Rotavirus infections.de.
80. rotavirus.mp.
81. "routine immuni#ation$".mp.
82. Rubella.de.
83. rubella.mp.
84. rubeola.mp.
85. TBE.mp.
86. (Td adj2 (immuni#$ or vaccin$ or inocul$)).mp.
87. Tdap.mp.
88. (TdIPV or Td-IPV).mp.
89. Tetanus.de.
90. tetanus.mp.
91. "tetanus toxoid".mp.
92. ("tick-borne encephalitis" or "tickborne encephalitis").mp.
93. "triple jab".mp.
94. (TT adj2 (immuni#$ or vaccin$ or inocul$)).mp.
95. (tuberculosis adj2 (immuni#$ or vaccin$ or inocul$)).mp.
96. typhoid.mp.
97. vaccin$.mp.
98. Vaccination.de.
99. ("vaccine preventable" or "vaccine-preventable").mp.
100. varicella.mp.
101. ("vitamin A" adj5 (immuni#$ or vaccin$ or inocul$)).mp.
102. Whooping cough.de.
103. whooping cough.mp.
104. "yellow fever".mp.
105. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11 or 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19 or 20 or 21 or 22 or 23 or 24 or 25 or 26 or 27 or 28 or 29 or 30 or 31 or 32 or 33 or 34 or 35 or 36 or 37 or 38 or 39 or 40 or 41 or 42 or 43 or 44 or 45 or 46 or 47 or 48 or 49 or 50 or 51 or 52 or 53 or 54 or 55 or 56 or 57 or 58 or 59 or 60 or 61 or 62 or 63 or 64 or 65 or 66 or 67 or 68 or 69 or 70 or 71 or 72 or 73 or 74 or 75 or 76 or 77 or 78 or 79 or 80 or 81 or 82 or 83 or 84 or 85 or 86 or 87 or 88 or 89 or 90 or 91 or 92 or 93 or 94 or 95 or 96 or 97 or 98 or 99 or 100 or 101 or 102 or 103 or 104
106. advert$.mp.
107. Advertising.de.
108. (audience$ adj2 research$).mp.
109. billboard$.mp.
110. brand$.mp.
111. broadcast$.mp.
112. campaign$.mp.
113. chatroom$.mp.
114. communicat$.mp.
115. Communication.de.
116. Communications media.de.
117. (communit$ adj1 coalition$).mp.
118. (communit$ adj1 leader$).mp.

119. ("digital media" or "digital medium").mp.
120. educat$.mp.
121. ((electronic adj1 mail$) or email$ or e-mail$).mp.
122. (electronic adj1 communication$).mp.
123. entertainment-education.mp.
124. (flier$ or flyer$ or handbill$ or handout$ or leaflet$).mp.
125. Health promotion.de.
126. information$.mp.
127. initiative$.mp.
128. interpersonal.mp.
129. journal$.mp.
130. magazine$.mp.
131. Marketing.de.
132. marketing.mp.
133. Mass media.de.
134. media.mp.
135. message$.mp.
136. network$.mp.
137. newsletter$.mp.
138. newspaper$.mp.
139. online.mp.
140. (policy or policies).mp.
141. (poster or posters).mp.
142. "press conference$".mp.
143. "press release$".mp.
144. print$.mp.
145. (program or programs or programme or programmes).mp.
146. promot$.mp.
147. (PSA or "public service announcement$").mp.
148. (public adj2 information).mp.
149. ("public relations" or PR).mp.
150. publici$.mp.
151. publicity.mp.
152. publish$.mp.
153. (radio or radios).mp.
154. (SMS or "text message$").mp.
155. "social media".mp.
156. "social network$".mp.
157. telecommunication$.mp.
158. telemedicine.mp.
159. (televis$ or TV).mp.
160. website$.mp.
161. workshop$.mp.
162. 106 or 107 or 108 or 109 or 110 or 111 or 112 or 113 or 114 or 115 or 116 or 117 or 118 or 119 or 120 or 121 or 122 or 123 or 124 or 125 or 126 or 127 or 128 or 129 or 130 or 131 or 132 or 133 or 134 or 135 or 136 or 137 or 138 or 139 or 140 or 141 or 142 or 143 or 144 or 145 or 146 or 147 or 148 or 149 or 150 or 151 or 152 or 153 or 154 or 155 or 156 or 157 or 158 or 159 or 160 or 161
163. 105 and 162
164. accept$.mp.
165. attitud$.mp.
166. "Attitudes (women)".de.
167. aware$.mp.
168. behavio?r$.mp.
169. (belief$ or belive$).mp.
170. comprehen$.mp.
171. confidence.mp.
172. credib$.mp.
173. distrust$.mp.
174. knowledge$.mp.
175. (immunis$ adj2 coverage).mp.
176. (immunis$ adj2 rate).mp.
177. (immunis$ adj2 uptake).mp.
178. (immuniz$ adj2 coverage).mp.

179. (immuniz$ adj2 rate).mp.
180. (immuniz$ adj2 uptake).mp.
181. (inoculat$ adj2 coverage).mp.
182. (inoculat$ adj2 rate).mp.
183. (inoculat$ adj2 uptake).mp.
184. (intent$ or intend$).mp.
185. mistrust$.mp.
186. "media analys?s".mp.
187. ("market research" or "marketing research").mp.
188. opinion$.mp.
189. (perceive$ or perception$).mp.
190. poll.mp.
191. react$.mp.
192. refus$.mp.
193. resist$.mp.
194. respon$.mp.
195. ("tracking study" or "tracking studies").mp.
196. trust$.mp.
197. understand$.mp.
198. uptake.mp.
199. (vaccin$ adj2 coverage).mp.
200. (vaccin$ adj2 rate).mp.
201. (vaccin$ adj2 uptake).mp.
202. 164 or 165 or 166 or 167 or 168 or 169 or 170 or 171 or 172 or 173 or 174 or 175 or 176 or 177 or 178 or 179or 180 or 181 or 182 or 183 or 184 or 185 or 186 or 187 or 188 or 189 or 190 or 191 or 192 or 193 or 194 or 195 or 196 or 197 or 198 or 199 or 200 or 201
203. 162 and 202
204. limit 203 to yr="2000 –Current”

Appendix 2. Sample search strategy

Database: Medline

Interface: PubMed

1. "acellular pertussis"[TIAB] OR (aP[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB]))

2. "Bacille Calmette-Guerin"[TIAB] OR "Bacillus Calmette-Guerin"[TIAB] OR BCG[TIAB]

3. "chickenpox"[TIAB]

4. (Dip[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB])) OR Diphtheria[TIAB] OR Diptheria[TIAB]

5. (DPT[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB])) OR (DT[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB]))

6. DTaP[TIAB] OR DTaPHepIPV[TIAB] OR "DTaP-Hep-IPV"[TIAB] OR DTaPHibHepIPV[TIAB] OR "DTaP-Hib-Hep-IPV"[TIAB] OR DTaPHibIPV[TIAB] OR "DTaP-Hib-IPV"[TIAB] OR DTaPIPV[TIAB] OR "DTaP-IPV"[TIAB] OR DTaPIPVHib[TIAB] OR "DTaP-IPV-Hib"[TIAB] OR DTIPV[TIAB] OR "DT-IPV"[TIAB]

7. (DTP[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB])) OR DTwP[TIAB] OR DTwPHep[TIAB] OR DTwP-Hep[TIAB] OR DTwPHib[TIAB] OR DTwP-Hib[TIAB]

8. Flu[TIAB]

9. hemophilus[TIAB] OR haemophilus[TIAB] OR HAV[TIAB] OR (HBV[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB])) OR "hep A"[TIAB] OR hepA[TIAB] OR "hep B"[TIAB] OR hepB[TIAB] OR "hepatitis A"[TIAB] OR "hepatitis B"[TIAB] OR Hib[TIAB] OR HibMenC[TIAB] OR Hib-MenC[TIAB]OR HPV[TIAB]OR "human papillomavirus"[TIAB] OR "human papilloma virus"[TIAB]

10. influenza[TIAB] OR immunisation*[TIAB] OR immunization[TIAB] OR "immunisation schedule*"[TIAB] OR "immunization schedule*"[TIAB] OR "inactivated polio* vaccine"[TIAB] OR inoculat*[TIAB] OR (IPV[TIAB] NOT "intimate partner violence"[TIAB])

11. jab[TIAB] OR jabs[TIAB]

12. measles[TIAB] OR "meningitis C"[TIAB] OR meningitisC[TIAB] OR MenAC[TIAB] OR "Men AC"[TIAB] OR MenC[TIAB] OR MenCconj[TIAB] OR (MM[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB])) OR MMR[TIAB] OR mumps[TIAB]

13. OPV[TIAB] OR "oral polio* vaccine"[TIAB]

14. pertussis[TIAB] OR pneumococcal[TIAB] OR "pneumococcal conjugate"[TIAB] OR "pneumococcal polysaccharide"[TIAB] OR Pneumoconj[TIAB] OR Pneumo-conj[TIAB] OR pneumops[TIAB] OR polio*[TIAB]

15. rotavirus[TIAB] OR "routine immunisation*"[TIAB] OR "routine immunization*"[TIAB] OR rubella[TIAB] OR rubeola[TIAB]

16. TBE[TIAB] OR (TD[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB])) OR TdIPV[TIAB] OR Td-IPV[TIAB] OR Tdap[TIAB] OR tetanus[TIAB] OR "tetanus toxoid"[TIAB] OR "tick-borne encephalitis"[TIAB] OR "tickborne encephalitis"[TIAB] OR "triple jab"[TIAB] OR (TT[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB])) OR (tuberculosis[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB]) OR typhoid[TIAB]

17. vaccin*[TIAB] OR "vaccine preventable"[TIAB] OR varicella[TIAB] OR ("vitamin A"[TIAB] AND (vaccine[TIAB] OR immunisation[TIAB] OR immunization[TIAB] OR inoculation[TIAB]))

18. "whooping cough"[TIAB] OR "yellow fever"[TIAB]

19. "BCG Vaccine"[MESH] OR "Chickenpox"[MESH] OR "Diphtheria"[MESH] OR "Diphtheria-Tetanus Vaccine"[MESH] OR "Diphtheria-Tetanus-acellular Pertussis Vaccines"[MESH] OR "Diphtheria-Tetanus-Pertussis Vaccine"[MESH] OR "Haemophilus influenzae type b"[MESH] OR "hepatitis A vaccines"[MESH] OR "Hepatitis A"[MESH] OR "hepatitis B vaccines"[MESH] OR "Hepatitis B"[MESH] OR "influenza vaccines"[MESH] OR "Influenza, Human"[MESH] OR "mass vaccination"[MESH]

20. "Measles Vaccine"[MESH] OR "measles"[MESH] OR "Measles-Mumps-Rubella Vaccine"[MESH] OR "meningitis"[MESH] OR "Mumps Vaccine"[MESH] OR "Mumps"[MESH] OR "Papillomavirus Infections"[MESH] OR "Papillomavirus Vaccines"[MESH] OR "pertussis vaccine"[MESH] OR "Pneumococcal Vaccines"[MESH] OR "Poliomyelitis"[MESH] OR "poliovirus vaccines"[MESH] OR "Rotavirus Infections"[MESH] OR "Rubella Vaccine"[MESH] OR "rubella"[MESH] OR "tetanus"[MESH] OR "Vaccination"[MESH] OR "whooping cough"[MESH]

21. #1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8 OR #9 OR #10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20

22. advert*[TIAB] OR (audience*[TIAB] AND research[TIAB]) OR billboard*[TIAB] OR brand*[TIAB] OR broadcast*[TIAB] OR campaign*[TIAB] OR chatroom*[TIAB] OR "communit* coalition*"[TIAB] OR "communit* leader*"[TIAB] OR "digital media"[TIAB] OR "digital medium"[TIAB]

23. educat*[TIAB] OR "electronic communication*"[TIAB] OR "electronic mail*"[TIAB] OR email*[TIAB] OR e-mail*[TIAB] OR entertainment-education[TIAB] OR flier*[TIAB] OR flyer*[TIAB] OR handbill*[TIAB] OR handout*[TIAB] OR leaflet*[TIAB] OR initiative*[TIAB] OR media[TIAB] OR message*[TIAB] OR communicat*[TIAB] OR promot*[TIAB]

24. program[TIAB] OR programs[TIAB] OR programme[TIAB] OR programmes[TIAB] OR publicity[TIAB] OR information*[TIAB] OR interpersonal[TIAB] OR journal*[TIAB] OR magazine*[TIAB] OR marketing[TIAB] OR network*[TIAB] OR newsletter*[TIAB] OR newspaper*[TIAB]

25. online[TIAB] OR policy[TIAB] OR policies[TIAB] OR poster[TIAB] OR posters[TIAB] OR "press conference*"[TIAB] OR "press release*"[TIAB] OR print*[TIAB] OR PSA[TIAB] OR "public service announcement*"[TIAB] OR "public information"[TIAB] OR "public relations"[TIAB] OR publici*[TIAB]

26. publish*[TIAB] OR radio[TIAB]OR radios[TIAB] OR "social media"[TIAB] OR "social network*"[TIAB] OR SMS[TIAB] OR "text message*"[TIAB] OR telecommunication*[TIAB] OR telemedicine[TIAB] OR televis*[TIAB] OR TV[TIAB] OR website*[TIAB] OR workshop*[TIAB]

27. "Advertising as Topic"[MESH] OR "Communication"[MESH] OR "Diffusion of Innovation"[MESH] OR "Health Promotion"[MESH] OR "Hotlines"[MESH] OR "Information dissemination"[MESH] OR "Information seeking behavior"[MESH] OR "Marketing of health services"[MESH] OR "Marketing"[MESH] OR "Mass media"[MESH] OR "Program development"[MESH] OR "Program evaluation"[MESH]

28. #22 OR #23 OR #24 OR #25 OR #26 OR #27

29. accept*[TIAB] OR belief*[TIAB] OR believ*[TIAB] OR confidence[TIAB] OR credib*[TIAB] OR distrust*[TIAB] OR trust*[TIAB] OR mistrust*[TIAB] OR resist*[TIAB] OR refus*[TIAB] OR uptake[TIAB]

30. (vaccin*[TIAB] AND (rate[TIAB] OR uptake[TIAB] OR coverage[TIAB])) OR (immunis*[TIAB] AND (rate[TIAB] OR uptake[TIAB] OR coverage[TIAB])) OR (immuniz*[TIAB] AND (rate[TIAB] OR uptake[TIAB] OR coverage[TIAB])) OR (inoculate*[TIAB] AND (rate[TIAB] OR uptake[TIAB] OR coverage[TIAB]))

31. "tracking study"[TIAB] OR "tracking studies"[TIAB] OR attitud*[TIAB] OR aware*[TIAB] OR intent*[TIAB] OR intend*[TIAB] OR knowledge*[TIAB] OR opinion*[TIAB] OR perceive*[TIAB] OR perception*[TIAB] OR react*[TIAB] OR respon*[TIAB] OR understand*[TIAB] OR comprehen*[TIAB] OR "market research"[TIAB] OR "marketing research"[TIAB] OR "media analysis"[TIAB] OR "media analyses"[TIAB] OR poll[TIAB]

32. "tracking study"[TIAB] OR "tracking studies"[TIAB] OR attitud*[TIAB] OR aware*[TIAB] OR intent*[TIAB] OR intend*[TIAB] OR knowledge*[TIAB] OR opinion*[TIAB] OR perceive*[TIAB] OR perception*[TIAB] OR understand*[TIAB] OR comprehen*[TIAB] OR "market research"[TIAB] OR "marketing research"[TIAB] OR "media analysis"[TIAB] OR "media analyses"[TIAB] OR poll[TIAB]

33. "Trust"[MESH]

34. #29 OR #30 OR #32 OR #33

35. #21 AND #28 AND #34

36. #35 AND 2000:2011[dp]

37. #35 AND 2000:2011[dp]

Appendix 3. Studies not obtained in full text

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Appendix 4. Relevant foreign language studies

1. Baudier F, Tarrapey F, Leboube G. Pilot campaign to promote vaccination: description preliminary results of a regional French program. *Medecine et Maladies Infectieuses*. 2007 (6): 331–336.
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4. Neto MC; da Gama MVL, Laprega MR. The insertion of a family health program group into a flu vaccination campaign for the elderly: restructuring medical practice to achieve efficiency and humanization. *Revista de Atenção Primária à Saúde*. 2005 (1): 68–73.

Appendix 5. Results of weight of evidence assessment

Study	Quality, Validity and Applicability Appraisal Score	Weight of Evidence Assessment
13	95%	Convincing evidence of effectiveness
14	95%	No convincing evidence of effectiveness
15	90%	No convincing evidence of effectiveness
16	89%	No convincing evidence of effectiveness
17	86%	Convincing evidence of effectiveness
18	85%	No convincing evidence of effectiveness
19	84%	Convincing evidence of effectiveness
20	83%	No convincing evidence of effectiveness
21	83%	Convincing evidence of effectiveness
22	78%	No convincing evidence of effectiveness
23	76%	No convincing evidence of effectiveness
24	76%	No convincing evidence of effectiveness
25	74%	Convincing evidence of effectiveness
26	72%	Convincing evidence of effectiveness
27	71%	Convincing evidence of effectiveness

Appendix 6. Theories glossary

Extracted from Glanz et al [51] with additional information.

Health Belief Model:

'The Health Belief Model contains several primary concepts that predict why people will take action to prevent, to screen for, or to control illness conditions; these include susceptibility, seriousness, benefits and barriers to a behaviour, cues to action, and most recently, self-efficacy… if individuals regard themselves as susceptible to a condition, believe that condition would have potentially serious consequences, believe that a course of action available to them would be beneficial in reducing either their susceptibility to or severity of the condition, and believe that the anticipated benefits of taking action outweigh the barriers to (or costs of) action, they are likely to take action that they believe will reduce their risks'.

Information Deficit Model:

The Information Deficit Model is 'the belief that uncertainty and lack of trust in vaccination is caused primarily by a lack of knowledge about the subject, and the belief that providing information to overcome this 'knowledge deficit' will change attitudes and opinions'.

The basic assumption of the information deficit model is that increasing knowledge will translate into a change in behaviour. There are three suppositions behind this assumption: knowledge is correlated with behaviour; provision of information will increase knowledge; and increase in knowledge will result in behaviour change [53].

Leventhal's Common Sense Model of Lay Illness Representation:

Leventhal's Common Sense Model of Lay Illness Representation is known variously as the Illness Perceptions Model, the Parallel Process Model, and the Common Sense Model of Self-Regulation of Health and Illness. The model recognises that cognitive factors influence illness coping behaviours but psychosocial factors moderate their interpretation and relevance. It assumes that individuals take an active role in assessing and solving health concerns using both emotional and cognitive processes to understand and appraise, and to cope and act, to resolve their concerns. It identifies the factors involved in the processing of information by a patient regarding their disease or illness, how this information is integrated to provide a 'lay' view of the illness, and how this lay view guides coping behaviours and outcomes [62, 52, 59].

Prospect Theory:

Presenting the same information about risk in different ways affects people's perspectives, preferences and actions. Prospect Theory predicts that when making decisions from which they expect to gain, people are risk adverse, but are more risk tolerant when considering decisions which increase the risk of some personal loss. Health information can be constructed in terms of either benefits or costs i.e. gain-framed (e.g. 'having the influenza vaccination will reduce your risk of serious illness this winter') or loss-framed (e.g. 'you are at risk of serious illness this winter if you don't have the influenza vaccination'). Vaccination is most usually perceived as a preventive behaviour therefore, according to the PT hypothesis, intentions to vaccinate would be strengthened by gain-framed messages more than by loss-framed messages [63, 58]

Social diffusion/diffusion of innovation:

Diffusion of innovation is the process by which an innovation is communicated through certain channels over time among members of a social system. The stages of diffusion of innovation are: innovation development; dissemination; adoption; implementation; maintenance; sustainability; and institutionalisation. Dissemination can be the result of active dissemination efforts (planned systematic efforts to maximise reach and adoption, likely to occur through vertical hierarchies) – or passive diffusion (in which the spread is unplanned, informal and largely mediated horizontally by peers and social networks). Some innovations diffuse quickly and widely, whereas others are weakly or never adopted, and others are adopted but subsequently abandoned.

Theory of Planned Behaviour:

The Theory of Planned Behaviour focuses on 'theoretical constructs concerned with individual motivational factors as determinants of the likelihood of performing a specific behaviour'. The theory assumes that 'the best predictor of behaviour is behavioural intention, which in turn is determined by attitude toward the behaviour, social normative perceptions and perceived behavioural control.' 'Attitude is determined by the individual's beliefs about outcomes or attributes of performing the behaviour (behavioural beliefs), weighted by evaluations of those outcomes or attributes. Similarly, a person's subjective norm is determined by his or her normative beliefs, that is, whether important referent individuals approve or disapprove of performing the behaviour, weighted by his or her motivation to comply with those referents. Perceived behavioural control is determined by control beliefs concerning the presence or absence of facilitators and barriers to behavioural performance, weighted by their perceived power or the impact of each control factor to facilitate or inhibit the behaviour.'

Appendix 7. Data extraction tables

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Abhyankar et al (2008)	Setting Leeds, England, UK Aim To test the effect of message framing on MMR immunisation intentions Target group/population General public Intervention Participants were asked to imagine that they were a parent considering vaccinating their child with the MMR vaccine. The message framing intervention was presented in a questionnaire, and participants read either a gain-framed or a loss-framed message about MMR vaccination. Theoretical underpinnings Theory of Planned Behaviour/Prospect Theory	Randomised trial (no control group) **Participants** Participants 142 females recruited from public places and women's groups. Mean age 35.23 years (SD 10.03; range 17-66 years). 72 randomised to gain framed condition; 70 randomised to loss-framed condition. **Main outcome measures** Intention to immunise Assessed using two bipolar items ranging from not at all (-3) to very much (+3) (range -6 to +6). "I intend to vaccinate my child against MMR", and "I wish to participate in the MMR programme". Attitude Assessed using five bipolar (-3 to +3) items (range -15 to +15). Statement: "Vaccinating my children against MMR would be..." followed by endpoints: "Bad-Good"; "Harmful-Beneficial"; "Foolish-Wise"; "Threatening-Assuring"; and "Risky-Safe". Other Subjective norm (perceptions of whether significant others think a person should or should not engage in a behaviour). Assessed using two unipolar (+1 to +7) items (range 2 to 14). "People who are important to me would..." and "My GP would..." "Approve - Disapprove" "...of my vaccinating my child against measles, mumps and rubella". Perceived Behavioural Control (PCB). Assessed using three unipolar (+1 to +7) items (range 3 to 21). For example, "I think making an appointment for MMR vaccination would be..." "Easy-Difficult". Perceived outcome efficacy (perceived benefits and costs of performing the recommended health behaviour). Assessed using three unipolar (+1 to +7) items (range 2 to 14). "MMR vaccination leads to..." a) certainty about my child's health status b) relief and c) reassurance. **Analysis** Analysis ANOVA	Intention to Immunise: Significant effect ($p<0.05$) of frame on intention to immunise. Stronger behavioural intentions were found among those who read the loss-framed message (mean 4.43; SD 2.4) compared with those who read the gain-framed message (mean 2.99; SD 3.4). Those that who had previously vaccinated their children for MMR had greater intentions (mean 4.8) than those who had decided not to vaccinate (mean 0.05) ($p<0.05$). There was a significant interaction between frame and past MMR decision suggesting that the advantage of the loss frame over the gain frame was more pronounced in those who had vaccinated their children previously. Attitude: No significant effect of message frame on attitude. Gain-framed message (mean 8.86; SD 6.5), Loss framed (mean 10.35; SD 5.0). Subjective Norms: No significant effect of message frame on subjective norms. Gain-framed (mean 11.51; SD 2.7), Loss framed (mean 12.16; SD 2.6) Perceived behavioural control: No significant effect of message frame on PBC. Gain-framed (mean 17.49; SD 3.5), Loss framed (mean 18.04; SD 3.2) Perceived outcome efficacy: Significant effect ($p<0.05$) of frame on perceived outcome efficacy. Greater perceptions of outcome efficacy were reported in women who received the loss-framed message (mean 16.16; SD 4.4.) compared with those who received the gain-framed message (mean 14.42; SD 4.6).		Section A: Population 14% Section B: Data Collection 60% Section C: Study Design 100% Section D: Results 67% Overall Validity 57%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Arthur (2001)	Setting Rural general practice, Leicestershire, UK Aim To increase influenza vaccination uptake in patients aged over 75. Target group/population All patients aged 75 years and over registered at the practice Intervention A nurse home visit to carry out a general health assessment, and (if they wished) vaccination against flu. The health assessment lasted approximately 30 min, during which patients were offered influenza vaccination if they had not already received it in the previous year. If patients changed their mind they were free to report to the surgery for vaccination at a later date. In the previous year, over-75 health assessments did not coincide with the vaccination season. Theoretical underpinnings N/A	Quasi-experimental study Before and after study. **Participants** Participants n=389 patients. **Main outcome measures** Immunisation uptake	In the year previous to the intervention, influenza immunisation uptake among over 75s was 38.3% (n=149). During the intervention year, uptake was 57.5% (n=224). The authors did not report the level of significance.	The study also compared uptake in those patients who received a nurse visit with those who did not. Patients who received the nurse visit were four times more likely to be vaccinated against influenza (subsequent to the health assessment offer) than those who did not (OR 4.1, 95% CI 1.7-9.9, p<0.001), after controlling for age and vaccination status for the previous winter.	Section A: Population 100% Section B: Data Collection 75% Section C: Study Design 40% Section D: Results 80% Overall Validity 72%
Arthur et al (2002)	Setting One large rural general practice, Leicestershire, England, UK Aim To compare different forms of approach in improving uptake of influenza vaccination among patients aged 75 years and over in primary care. Target group/population Patients aged 75 years and over, registered with the practice and not living in nursing/residential homes or sheltered accommodation Intervention One-third of patients were randomised to receive an offer of influenza vaccination as part of an over-75 health check administered by a practice nurse in the patient's home, and two-thirds of patients were randomised to receive a personal letter of invitation to attend an influenza vaccination clinic held at the surgery. Theoretical underpinnings N/A	RCT **Participants** Participants n=880 regular health check, n=1372 personal letter **Main outcome measures** Immunisation uptake **Analysis** Analysis Intention-to-treat. Chi-Squared.	67.9% (n = 932) of those who were sent a personal letter were vaccinated, compared with 74.3% (n = 505) of those offered a combined health check and influenza vaccination (6.4% difference; 95% CI 2.2% to 10.4%; p = 0.003). When the analysis was restricted to those who had not been vaccinated in the previous year, rates of influenza vaccination uptake were lower in both the nurse health check group (56.2% [196/349]) and the personal letter group (44.0% [322/731]), but the difference between the groups was greater (12.1%; 95% CI = 5.8% to 18.4%; p< .001).	Authors suggest that as the difference in uptake is greater among those who do not routinely come forward for vaccination a more viable option may be to target these patients.	Section A: Population 100% Section B: Data Collection 50% Section C: Study Design 100% Section D: Results 80% Overall Validity 86%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Chanel et al (2011)	Setting Provence-Alpes-Côte-d'Azur Region, France. Aim To examine how different types of information - related to others' intentions about vaccination, public opinion about a swine flu vaccination campaign, others' beliefs about a swine flu pandemic, or quantitative scientific information provided through experts - can influence vaccination decisions. Target group/population General public. Intervention At each successive stage in the study, participants used an electronic voting system to vote individually on their intention to immunise in response to a question/prompt or other information. The collective results of the vote were disclosed, and participants were given the opportunity to change their vote, or to stick to their original choice before moving on to the next stage. Stage 1: Question to assess initial intention regarding influenza vaccination. Stage 2: Question to assess intentions after being presented with results of initial vote. Stage 3: Four successive attitudinal questions regarding the vaccination campaign (two with a positive slant and two with a negative slant). Stage 4: Two quantitative subjective belief questions. Stage 5: A 25-minute round table session including a brief presentation and a question/answer session, with an epidemiologist and a professor of health economics (both pro-vaccination). Theoretical underpinnings N/A	Quasi-experimental study Before and after study (series) **Participants** Participants 175 attendees at a scientific non-academic conference. **Main outcome measures** Intention to immunise	There was no significant change in the proportion of those who did intend to be immunised, and those who did not intend to be immunised across the first four stages. At the last stage there was a significant decrease in the proportion of those who did not intend to be immunised (from an average of 75% in the first four stages, to 55% in the last stage), and a significant increase in the proportion of those who did intend to be immunised (from an average of 19% to 32%). Over the first four stages, there was no significant change in the proportion of participants who did not change their mind about their intention to immunise (average 81%). In the last stage, the proportion of people whose intention remained constant (i.e. did not change their mind) decreased to 57% ($p<0.0001$). The proportion of positive changes (i.e. changed from intention not to immunise to intention to immunise) increased to from less than 10% to 38% ($p<0.001$) and the proportion of negative changes decreased to from more than 10% to 6% ($p=0.0039$).	The experiment took place at the peak of the swine-flu epidemic in France (December 2009).	Section A: Population 0% Section B: Data Collection 80% Section C: Study Design 80% Section D: Results 67% Overall Validity 55%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Corrigan 2006	Setting Belarus Aim The goal of European Immunization Week (EIW) was to increase vaccination coverage by drawing attention to and increasing awareness of the importance of every child's need and right to be protected from vaccine preventable diseases. Target group/population EIW targeted the general public. A special focus was placed on activities targeting vulnerable groups. Intervention A number of activities to promote immunisation were carried out in Belarus as part of EIW 2005. The promotional communications consisted of: 63 TV speeches; 58 cinema advertisements; 454 radio information slots; and 250 press articles. Theoretical underpinnings N/A	Quasi-experimental study Before and after study. **Participants** Participants 6,000 participants aged 17-19. (Young people aged 17-19 were a core target group for EIW due to the Rubella campaign.) **Main outcome measures** Knowledge or comprehension of key communication messages	Awareness of immunisation as a means of preventing infectious disease increased from 43.2% before EIW to 57.5% after EIW in evaluation participants. It is reported that before EIW, 75.4% of participants understood the need for immunisation, however after EIW only 73.0% understood the need for immunisation. The proportion of participants that did not know why they needed to be immunised increased from 12.5% before EIW to 18.8% after EIW. 89.9% of participants were aware that rubella immunisation protects from rubella after EIW compared to 82.5% before EIW. 37.6% of participants were aware that rubella vaccination protects their future children from congenital rubella syndrome after EIW compared to 32.9% before EIW. Promotional campaign awareness: Asked "have you heard of EIW? 54.6% (yes), 44.6% (no).	The campaigns for EIW were evaluated for several European countries (Belarus, FYR Macedonia, Ireland, Italy [Tyrol province], Serbia and Tajikistan). However, Belarus is the only country for which data were reported/collected before and after campaign activities. For all the other countries, data was only collected/reported after the campaign. Thus, only data from Belarus is included for the purposes of the systematic review.	Section A: Population 17% Section B: Data Collection 14% Section C: Study Design 60% Section D: Results 40% Overall Validity 26%
de Juanes et al (2007)	Setting "12 de Octubre" University Hospital, Madrid, Spain. Aim To increase HCWs influenza immunisation rate. Target group/population Hospital workforce Intervention 2001-2002 and 2002-2003: A passive communication strategy, consisting of distribution of informative posters throughout the hospital, provision of information about disease, vaccines, recommendations, and timing and sites of vaccination sessions. Information sheets were sent to the heads of all departments and nursing supervisors for distribution to all personnel. In the 2003–2004 season, the recommendation for vaccination was also published in the internal bulletin and the hospital web site. All hospital departments were actively visited by a doctor or nurse and staff were offered the influenza vaccination in the workplace. Theoretical underpinnings N/A	Quasi-experimental study Interrupted time series: 2001-2002 and 2002-2003 pre-intervention, and 2003-2004 post intervention. **Participants** Participants 5654 hospital staff: 1398 nursing assistants, 1758 nurses, 709 staff physicians, 468 resident physicians, and 1321 ancillary staff. The number and population did not change during the study period. **Main outcome measures** Immunisation uptake **Analysis** Analysis Chi-square test for proportions. The association of previous vaccination with vaccination in successive years was assessed by OR	A significant increase in immunisation uptake was observed among all professional groups over the three seasons: 15.9% (899) vaccinated in 2001-2002; 21.4% (1215) vaccinated in 2002-2003; 40.4%(2287) vaccinated in 2003-2004 ($p < 0.01$) Persons vaccinated in a previous campaign were more likely to be vaccinated in future campaigns: OR 9.1 (95%CI: 7.8–10.7) and OR 3.9 (95%CI: 3.4–4.4) for 2002–2003 and 2003–2004, respectively.	Other factors may have contributed to increased uptake, e.g. heightened concerns over SARS or avian flu. Immunisation uptake varied by profession.	Section A: Population 100% Section B: Data Collection 75% Section C: Study Design 80% Section D: Results 100% Overall Validity 83%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Dey et al (2001)	Setting Nursing homes and primary care settings, England, UK Aim To evaluate the effectiveness of an intervention designed to promote uptake of influenza vaccination in HCW in nursing homes and in primary care. Target group/population Healthcare workers in NHS nursing homes and in primary care. Intervention Intervention groups: Visited by a public health nurse, who raised awareness of the campaign, emphasised efficacy and safety of vaccination, outlined possible side effects and contraindications, discussed impact of influenza on absenteeism, and attempted to allay anxiety and correct misconceptions. Nurses also disseminated promotional materials and informed staff where they could get their free vaccination. Control groups did not receive a visit. Theoretical underpinnings Health belief model	Cluster RCT **Participants** Participants Primary health care teams: n=457 HCW for intervention group, n=395 HCW control group. Nursing home staff: n=768 HCW for intervention group, n=1364 HCW control group **Main outcome measures** Immunisation uptake **Analysis** Analysis Chi-square, adjusted for clustered randomisation	No significant differences in immunisation uptake between intervention and control groups 2 months after intervention for primary care mental health teams: 21.9% (100) intervention 21% (83) control. (p = 0.091) for nursing home staff: 10.2% (78) intervention 5.6% (77) control (p = 0.34)		Section A: Population 100% Section B: Data Collection 75% Section C: Study Design 100% Section D: Results 80% Overall Validity 90%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Fahy and Desmond (2010)	Setting School/university town, North County Kildare, Ireland Aim To investigate the effect of gain-framed and loss-framed messages on parental HPV vaccination uptake. Target group/population Mothers of daughters in the 8–16 year old age group. Intervention Parents read a one-page summary describing HPV infection and then either a gain- or loss-framed message about HPV vaccination. The gain frame message stated: "by choosing to have your child vaccinated with the HPV vaccine she may be less likely to develop cervical cancer". The corresponding statement in the loss-framed message stated: "by choosing not to have your child vaccinated with the HPV vaccine she may be more likely to develop cervical cancer". Theoretical underpinnings Prospect Theory (PT)/Theory of planned behaviour (TPB)	Randomised trial (no control group) **Participants** A convenience non-random sample. Total n=72 36 randomised to gain framed message; 36 randomised to loss framed message. **Main outcome measures** Intention to immunise Assessed using three items rated on seven-point scales. "I will consent to having my daughter(s) vaccinated with the HPV vaccine if offered by a health care provider within the next two years" (disagree strongly/agree strongly); "I expect to get my daughter vaccinated with the HPV vaccine" (disagree strongly/agree strongly); Likelihood that participants would "consider getting the HPV vaccine" for their daughter (very likely/very unlikely). Attitude Assessed using three bipolar semantic differential scales (responsible/irresponsible; harmful/beneficial; worthless/useful). Other Normative Beliefs: Assessed using two items. "Most people important to me would want me to get my daughter(s) vaccinated" ; and "My decision to have my daughter(s) vaccinated would be influenced by recommendations made by healthcare professionals" (disagree strongly = 1/agree strongly = 7). Perceived Behavioural Control (PCB): Assessed using a single item. "I am confident that I could have my daughter(s) vaccinated with the HPV vaccine if I want to" (disagree strongly = 1/agree strongly = 7). **Analysis** Analysis Differences in pre-intervention measures between the gain and loss-framed message groups were assessed using independent t tests (continuous variables) and Chi-squared analyses (categorical variables). Average vaccination uptake intention scores were compared using an independent t test. The effects of frame on perceived HPV vaccine risk, the single item measures of normative beliefs and perceived behavioural control (PBC) were tested using multivariate analysis of variance (MANOVA).	No significant differences between framing condition: Mothers' intentions to have their daughters vaccinated were high and did not vary by framing condition (gain: mean 5.9; SD 1.3; loss: mean 5.62; SD 1.4. p=0.397). No significant main effect of frame on attitudes, PCB and normative beliefs (p = 0.69).		Section A: Population 50% Section B: Data Collection 60% Section C: Study Design 80% Section D: Results 60% Overall Validity 64%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Gottvall et al (2010)	Setting One high school, Sweden Aim To evaluate the effect of an educational intervention concerning human papillomavirus (HPV) in Swedish first year high school students. Target group/population Swedish first year high school students. Intervention An educational intervention including a one-hour class room lesson about HPV and preventive methods, with special focus on vaccination and condom use, through presentation, practical, and discussion. Each student was given an information folder about HPV and its prevention, and invited to visit the project's website about HPV and other STIs. On the website students could take part in a quiz about HPV, with the chance to win a prize. Theoretical underpinnings Health Belief Model	RCT **Participants** Participants At baseline total n= 235 high school students, mean age 16 years. Intervention group n=114 (56 girls; 58 boys), Control group (CG) 1 n=121 (78 girls; 43 boys). At follow up: n = 276. Intervention group n=92 (48 girls; 44 boys), CG1 n=110 (75 girls; 35 boys), CG2 n=74 (37 girls; 37 boys). **Main outcome measures** Intention to immunise Knowledge or comprehension of key communication messages **Analysis** Analysis Mixed-effects models with a random intercept term for each cluster (classes) and group as a fixed effect - linear mixed models and logistic mixed models.	Knowledge: At baseline only one student at baseline mentioned HPV in an open ended question about STIs At follow-up, 70% (n=61) in the intervention group and 7% (n=7) in CG1 included HPV in the answer (p< 0.001). Knowledge of HPV in the intervention group increased significantly after the intervention: The median score for HPV knowledge was 1 out of 10 in both groups at baseline (p = 0.620). At follow-up, the median knowledge score was higher in intervention group than in CG1 (p< 0.001). In intervention group the median knowledge score had increased to 6, and over 80% of the students had five or more correct answers. In CG1 the median was still 1 and 13% had five or more correct answers. Intention to immunise: No significant differences in intention to vaccinate between intervention and controls. At baseline, 19 students (15%) in intervention and 9 students (7%) in CG1 intended to be vaccinated (p = 0.163). This included 2 boys in the intervention group and 1 boy in CG1. At follow-up, 16% (15) of girls in the intervention group and 14% (15) girls in CG1 had received the vaccination (p =0.667). 8% (7: 4 girls/3 boys) students in the intervention group and 11% (11: 8 girls/3 boys) students in CG1 intended to be immunised (p = 0.344).	The second CG was included to check for any bias induced by filling in the baseline questionnaire. The students in CG2 did not participate in the study until they completed the follow-up questionnaire. Significant differences between the two comparison groups were found at follow-up for awareness of HPV and HPV vaccines, with CG1 more aware than CG2. About 15% of the girls, both in intervention group and in CG1 were vaccinated between baseline and follow-up, possibly explaining that fewer students at follow-up than at baseline intended to get vaccinated. The study was underpowered, so conclusions based on statistically significant differences between groups are unaffected while non-significant differences have to be cautiously interpreted due to lack of power.	Section A: Population 25% Section B: Data Collection 80% Section C: Study Design 100% Section D: Results 80% Overall Validity 60%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Hak et al (2000)	Setting General practices, The Netherlands Aim To improve general practitioner (GP) influenza immunisation practices, and to increase overall influenza immunisation uptake in patients. Target group/population General practitioners. Intervention A nation-wide collaborative prevention programme (1995-1997). At national level: The use of GP influenza guidelines was advocated; a team of experts was employed within GP organisations to integrate primary health care procedures; materials such as reminder cards, patient education brochures and organisational information for GPs were developed; further financial arrangements concerning reimbursement were made. At GP district level: Continuing Medical Education (CME) and Small-Group (SG) consensus meetings were organised for both GPs and practice assistants; a district coordinator was appointed to facilitate the management of preventative activities. At GP practice level: District facilitators supported individual GPs in adopting the immunisation guidelines, by helping to improve practice organisation and coordination, and assisting with using computerised registration and supportive software. Theoretical underpinnings N/A	Quasi-experimental study Before and after study **Participants** Participants One GP from each of 988 GP practices (62% response rate; original study sample n=1586). **Main outcome measures** Immunisation uptake Other influenza immunisation practice	Overall influenza immunisation uptake in patients increased from 9.1% before the programme to 16.3% ($p<0.001$) after the programme. The study authors reported significant increases in the proportion of GP practices who reported incorporating immunisation guideline procedures into practice.		Section A: Population 40% Section B: Data Collection 43% Section C: Study Design 80% Section D: Results 60% Overall Validity 55%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Hull et al (2002)	Setting Three research general practices in East London, England. Aim To determine whether telephone appointments offered by general practice receptionists increase the uptake of influenza immunisation among the registered population aged over 65 years in east London GP practices. Target group/population Low-risk patients aged 65-74 who had not previously been in a recall system for influenza immunisation at their general practice. Intervention Telephone call from the practice receptionist to intervention group households, offering an appointment for influenza immunisation at a nurse-run clinic. The intervention period was timed to coincide with the East London and the City Health Authority mailshot, which sent a letter and leaflet to every GP-registered patient aged 65 years and above, urging them to contact their GP for immunisation. In addition, there was a national television campaign during the intervention period to promote influenza immunisation uptake. Those in the control groups did not receive a telephone call. Theoretical underpinnings N/A	RCT Also involves some cluster RCT **Participants** Participants overall: individual n=1261, household n = 1206 intervention: individual n = 660, household n = 605 control: individual n = 658, household n = 601 **Main outcome measures** Immunisation uptake **Analysis** Analysis Intent to treat. Logistic regression for simple RCT, and generalised linear models for clustered data. Chi squared.	The immunisation rate in the control group was 44%, compared with 50% in the intervention group (OR = 1.29, 95% CI = 1.03 to 1.63). The unadjusted difference between control and intervention groups in the proportion of individuals immunised was statistically significant at 5.9% (95% CI = 0.5% to 11%; p = 0.031). The adjusted difference was 6.3% (p = 0.026). Of the patients who made a telephone appointment, 88% were immunised, while 22% of those who did not accept an appointment went on to be immunised.	Patients with chronic disease (asthma, diabetes, chronic obstructive pulmonary disease, ischaemic heart disease, renal disease) who had been recalled in previous years were excluded from the study population.	Section A: Population 100% Section B: Data Collection 75% Section C: Study Design 100% Section D: Results 100% Overall Validity 95%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Humair et al (2002)	Setting Primary care clinic of the Department of Community Medicine in Geneva University Hospital, Switzerland. Aim To increase influenza immunisation rates in patients aged 65 and over who consulted the primary care clinic. Target group/population Patients aged 65 and over who consulted the primary care clinic, hospital physicians and practice organisations. Intervention Leaflets and posters, designed and provided by the local health department, to inform patients about influenza immunisation placed at the clinic reception desk and in waiting areas. A walk-in immunisation clinic to provide an easy, quick and cheap service to patients. Immunisation was 'low cost' i.e. covering the cost of the vaccine and the injection, but no charge for the medical consultation. A 1.5 hour training workshop for physicians to teach them about key aspects of influenza vaccination, particularly national recommendations and practical counselling strategies. Twice-monthly peer comparison feedback to physicians on their individual and collective performance in the vaccination of patients in the target group. Reminder stickers for application on medical records of patients for whom immunisation was recommended available in all consultation rooms. Intervention period: 1 October to 31 December 1996. Prior to this period, the clinic had no policies of activities to promote influenza vaccination. Theoretical underpinnings N/A	Quasi-experimental study Before and after study **Participants** Participants 174 patients aged 65 or over who attended the clinic before the intervention, and 202 patients aged 65 or over who attended the clinic during the intervention period. In addition, 144 patients aged 65 or over who attended the clinic both before the intervention and during the intervention period were included in the study. **Main outcome measures** Immunisation uptake **Analysis** Analysis Effects of the intervention were calculated as Relative Benefits (RB) (equivalent to relative risks for beneficial events) comparing vaccination rates before and after the intervention. For patients who attended in a single period (i.e. before the intervention, or during the intervention) RBs were adjusted using Cox proportional hazard models.	Influenza immunisation uptake of patients aged 65 or over increased from 21.7% before the intervention to 51.7% after the intervention overall. In patients who only attended the clinic before the intervention, immunisation uptake was 15.5%, compared to uptake of 39.1% among patients who only attended the clinic during the intervention (adjusted RB = 2.8; 95% CI 1.8-4.4). In patients who attended the clinic both before and during the intervention period, immunisation uptake increased from 29.2% to 69.4% (RB = 2.4; 95% CI 1.9-3.0). The most significant increases in immunisation rates occurred among patients with lower initial coverage: "younger" elderly aged 65-75 (adjusted RB = 5.7: 95% CI 2.7-12.4), new patients (adjusted RB = 8.6; 95% CI 2.6-28.3) and men (adjusted RB = 3.9: 95% CI 1.9-7.9).	Humair et al noted that every autumn there is a community-wide media campaign to promote vaccination in Geneva targeting mainly high risk groups such as the elderly and people with chronic diseases. The authors consider it unlikely that the 1996 campaign had a significant impact on their results, and note that a previous campaign led to only a 10% increase in the immunisation rate of community-living elderly. In addition the authors consider it unlikely that vaccine reimbursement, which started in Switzerland during the intervention period, had a major influence on their results as reimbursement is paid only when yearly medical expenses reach an excess of SFr 150 (~$100).	Section A: Population 100% Section B: Data Collection 100% Section C: Study Design 80% Section D: Results 100% Overall Validity 95%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Jackson et al (2010)	Setting Moderately deprived community, England UK Aim To aid and help inform parental decision-making about MMR vaccine. Target group/population Parents of children eligible for first or second dose MMR vaccination (i.e. aged 6 months to 5 years). Intervention Web-based MMR decision aid. The original decision aid was developed in Australia, and adapted to be UK relevant. The decision aid comprised nine sections: introduction; how to use the site; frequently asked questions; how to compare the risks; what are my options?; making a decision; useful websites; references; and contact us. Theoretical underpinnings N/A	Quasi-experimental study Before and after study. **Participants** Participants 30 parents of children in 2 childcare organisations in a moderately deprived community in the North of England. Most participants were white British married mothers (mean age 36 years). **Main outcome measures** Intention to immunise Measured on a scale of 1 (definitely do not intend) to 7 (definitely do intend). Knowledge or comprehension of key communication messages Measured on a scale of 0 (no knowledge) to 11 (good knowledge). Other Decisional conflict, measured on a scale of 1 (no decisional conflict) to 5 (extremely high decisional conflict). Scores lower than 2 are associated with 'implementing decisions'. **Analysis** Analysis Repeated measures ANOVAs	Intentions: Parents reported consistently strong intentions to give their child the MMR vaccine at the recommended ages. Baseline mean 5.96 (SD 1.43), 1 week post intervention mean 5.64 (SD 1.65), 3 weeks post intervention mean 5.75 (SD 1.78). The marginal reduction in intentions over time was not statistically significant ($p = 0.59$). Knowledge: At baseline, parents had low to moderate knowledge about the MMR vaccine and the measles, mumps and rubella diseases (mean 6.65; SD 1.70). Mean knowledge scores increased significantly at one week post-intervention (mean 8.61; SD 1.70), and at three months post-intervention (mean = 8.78; SD 1.04). Decisional conflict: At baseline, the mean level of decisional conflict was above 2 (mean 2.34; SD 0.94), indicating that parents were unable to make the decision effectively. At one week and three months post-intervention, mean decisional conflict was below 2 ((mean 1.82; SD 0.74) and (mean 1.74; SD 0.79) respectively), consistent with implementing the decision. This reduction in decisional conflict was statistically significant ($p = 0.001$).	Feasibility study in preparation for a main trial, so it was not the author's intention to ensure that it was statistically powered to make any firm conclusions about effectiveness. The study also evaluated the acceptability of the decision aid. The majority of majority of the parents expressed positive views about the format and content of the decision aid. The majority of parents (88.2%) reported vaccinating their child with MMR (first or second dose) at three months post-intervention.	Section A: Population 33% Section B: Data Collection 33% Section C: Study Design 100% Section D: Results 75% Overall Validity 55%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Lloyd et al (2009)	Setting Two high schools in London, UK. Aim To investigate the emotional and motivational impact on adolescent girls of information about human papillomavirus (HPV). Target group/population Girls aged 13-16 years i.e. within the age range of the UK's HPV vaccination "catch-up" campaign. Intervention Students were randomised to receive a leaflet about either HPV, chlamydia or the environment, in a supervised classroom setting. The health based leaflets (HPV and chlamydia) covered prevalence, detection, prevention, treatment and symptoms. The environment leaflet covered "equivalent" topics including the prevalence and effects of pollution and recycling as preventative against climate change. Students were given 5 minutes to read the leaflet, then they completed a questionnaire. Theoretical underpinnings The HPV leaflet was designed following interviews assessing the information requirements of women using thematic analysis based on Leventhal's Common Sense Model of lay illness representations.	RCT **Participants** Participants 174 students participated in the study. HPV leaflet n=56, chlamydia leaflet n=59, environment leaflet n=59. All participants were girls aged 13-16, mean age 14.3 years. **Main outcome measures** Intention to immunise Knowledge or comprehension of key communication messages Knowledge about HPV was assessed using TRUE-FALSE statements about HPV. Measurement scale range 1-14. Attitude Students evaluated the information on three dimensions: "reassuring", "scary" and "interesting". Other Anxiety was assessed using the six-item State-Trait Anxiety Inventory (STAI). **Analysis** Analysis ANOVA	Students who received HPV leaflets demonstrated significantly more HPV knowledge (mean score = 10.18) than those who received the chlamydia (6.13) or environment leaflets (5.66) ($p<0.001$). Intention to accept HPV vaccination did not differ by information group ($p=0.05$). The HPV leaflet was rated as more interesting ($p=0.03$), more scary ($p=0.007$), and more reassuring ($p<0.001$) than the environmental leaflet, but not the chlamydia leaflet (respectively $p=0.55$, $p=0.85$, and $p=0.41$). Anxiety scores as measured using STAI did not differ by information group ($p=0.59$).		Section A: Population 28% Section B: Data Collection 60% Section C: Study Design 80% Section D: Results 75% Overall Validity 59%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Llupia et al (2010)	Setting University Hospital, Barcelona, Spain Aim To increase influenza immunisation rates among HCW, and to achieve higher coverage in a rapid timescale. Target group/population HCWs (permanent and temporary staff). Intervention Annual seasonal influenza vaccination campaign since 2004 included educational advertising material based on posters placed in strategic sites and visible institutional support by means of an e-mail to all HCWs, and free influenza vaccination. In the 2008-2009 campaign strategies were introduced to promote peer-to-peer communication among HCWs, involving: increased institutional support; raising interest in vaccination via discussions - awareness was spread through weekly educational and advertising messages sent by e-mail, prize draws for vaccinated HCWs, and a webpage titled "I've already been vaccinated" with staff photos; as well as enhancing accessibility by increasing numbers of vaccination mobile unit staff. Theoretical underpinnings N/A	Quasi-experimental study Before and after study. 2007-2008 pre-intervention; 2008-2009 post-intervention. **Participants** Participants >4500 HCWs **Main outcome measures** Immunisation uptake **Analysis** Analysis proportional analysis. Fisher's exact test, and the Mann-Whitney U test	Overall, the coverage achieved was 37% (95% CI, 34.7%-37.4%) in 2008-09, compared with 23.7% (95% CI, 22.5%-24.9%) in 2007-08. Physicians were the professional category with the highest vaccination rate in both seasons studied (2007-2008, 32.5%; 2008-2009, 51.1%), while nurses had the lowest (2007-2008, 23.7%; 2008-2009, 30.7%).		Section A: Population 100% Section B: Data Collection 50% Section C: Study Design 100% Section D: Results 83% Overall Validity 84%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Looijmans-van den Akker et al (2010)	Setting 33 nursing homes, The Netherlands Aim To assess the effects of a systematically developed multi-faceted intervention program on influenza vaccine uptake among HCWs in nursing homes. Target group/population HCW in nursing homes. Intervention A multi-faceted intervention program consisting of three main components: an outreach visit by the primary researcher during which the homes received a script of the program, all required materials (personal invitation letters for the meetings, information leaflets, posters, reference to the website www.gepriktvooru.nl)and background information; a plenary 1 hour information meeting (organized twice in each home) by a specialised nurse of the local municipal health centre (including discussion in small groups and video with role models); and appointment of a local programme coordinator (preferably a physician). Control groups = usual programme Theoretical underpinnings N/A	Cluster RCT **Participants** Participants Intervention n =16 nursing homes; control n =17; total of 6636 HCWs **Main outcome measures** Immunisation uptake **Analysis** Analysis Generalised Estimation Equation analysis with nursing homes as the clustering variable to analyse data on influenza vaccine uptake. Adjusted relative risk (RR).	25% of all HCWs in the intervention group were vaccinated against influenza compared to 16% in the control group, a difference of 9% (RR 1.59, 95% CI: 1.08–2.34, p = 0.02).	There was a large variation in immunisation uptake rates between individual nursing homes. Rates in intervention homes ranged from 6% to 81%, and in control homes from 0.4% to 36%. Part of this variation in effect may be explained by the nursing home compliance with the different elements of the program. It was calculated that the average cost of implementing the programme was €1421 per intervention home.	Section A: Population 57% Section B: Data Collection 75% Section C: Study Design 80% Section D: Results 80% Overall Validity 71%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Luthi et al (2002)	Setting Vaud Canton (federal state), Switzerland. Aim To improve knowledge, awareness, and uptake of influenza immunisation in people aged over 65 living in Vaud Canton. Target group/population People over 65 living in Vaud Canton, and staff of socio-medical institutions and services. Intervention The Health Department of the Canton of Vaud implemented a population based influenza prevention program among people older than 65 - "Un plus pour les SENIORS: la vaccination contre la grippe". The main activities of the project were information meetings about influenza vaccination, among associations for the elderly, and for the staff of socio-medical institutions and services. Information tools were developed, such as a video, information leaflets, brochures, articles in the lay press, a website and a press conference. In addition, information was transmitted by the local TV-network. Theoretical underpinnings N/A	Quasi-experimental study Before and after study. **Participants** Participants Total n=4007 surveys to a stratified random samples of people aged 65 and over in Vaud Canton. Pre-intervention n =2933 (participation rate: 75.8%). Post-intervention n = 3098 (participation rate: 81%). **Main outcome measures** Immunisation uptake Promotional campaign awareness	Vaccination coverage: pre intervention 58.0% (95% CI: 56.2%– 59.8%), post-intervention 58.4% (95% CI: 56.6%– 60.2%), not significant (p = 0.757). There was a statistically significant increase (6.5%) in vaccination coverage was observed in people aged 65 to 69 (p = 0.008). The immunisation coverage was 74.7% among those who had had a home visit from a social worker (nurse or other family-help), and 55.4% among those who had not (p = 0.001). In 2000, these figures were respectively 76.0% and 56.0% (p = 0.001). 52.7% of all the respondents in the post-intervention survey knew about the program. Out of the different tools the program used to increase vaccination coverage the brochure "La grippe se sert de vous" was the tool which had the most impact (28.7%).		Section A: Population 33% Section B: Data Collection 40% Section C: Study Design 80% Section D: Results 83% Overall Validity 59%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Malmvall et al (2007)	Setting Jonkoping County, Sweden. Aim To increase influenza immunisation coverage in people aged 65 and over, and in medical risk groups. Target group/population People aged 65 and over, people in medical risk groups for influenza, HCW (general practitioners, nurses). Intervention The multifaceted campaign started in 2002 and lasted for 3 years (2002-2004) and included: free vaccination for people aged 65 and over; a multi-professional campaign team; annual education meetings in each of the county's 3 districts focusing on nurses in the primary healthcare organisation; a media campaign designed by professional marketing and public relations experts using TV and newspaper advertisements; posters in waiting rooms and pharmacies; leaflets in health centres; a web-based registry that allowed health centres to monitor their results and compare them with other health centres; performance feedback to primary health nurses. From 2005, the same activities continued, but they were now standard rather than part of a special campaign project. Theoretical underpinnings N/A	Quasi-experimental study Interrupted time series. **Participants** Participants People aged 65 and over. **Main outcome measures** Immunisation uptake **Analysis** Analysis	The immunisation rate in over 65s increased from 45% in 2001 to 70% in 2005 (No p value reported). Immunisation rates in people aged 65 and over in Jonkoping County for the years 1999-2005: 1999: 39% 2000: 45% 2001: 52% 2002: 59% 2003: 66% 2004: 68% 2005: 70%.	The authors do not present data on immunisation uptake in medical risk groups. Immunisation rate in those aged 65 and over was calculated (from 2002 onwards) using the number of vaccinations registered and the population in the county. In 2001, the immunisation rate was calculated from the number of doses delivered to the county. The authors assumed from their experience in 2002 and 2003 that 10% of delivered vaccine doses are used by people under 65.	Section A: Population 100% Section B: Data Collection 50% Section C: Study Design 80% Section D: Results 80% Overall Validity 74%
Maltezou et al (2007)	Setting Public hospitals, Greece. Aim To increase influenza immunisation rates in hospital HCW. Target group/population Hospital HCW. Intervention A nationwide campaign by the Hellenic Centre for Disease Control and Prevention (HCDCP). In September 2005 HCDCP sent leaflets on influenza immunisation, educational materials and information on vaccination strategies to all Greek hospitals. Theoretical underpinnings N/A	Quasi-experimental study Before and after study. **Participants** Participants 86, 765 HCW from 132 Greek public hospitals (136 hospitals contacted - response rate 97%). **Main outcome measures** Immunisation uptake	The influenza vaccination rate in HCW was 16.36% during the 2005-2006 influenza season, compared to a self reported influenza vaccination rate of 1.72% among HCW during the 2004-2005 influenza season. The study authors did not report the level of significance. Immunisation uptake in the 2005-2006 influenza season varied by HCW profession, type of hospital, size of hospital and by region of Greece.		Section A: Population 100% Section B: Data Collection 29% Section C: Study Design 80% Section D: Results 67% Overall Validity 65%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Mason and Donnelly (2000)	Setting Iechyd Morgannwg Health Authority, Wales, UK. Aim To investigate the effect on MMR immunisation uptake of sending an MMR information leaflet to parents of children who had not received MMR vaccination by 21 months of age. Target group/population Parents of infants age 21-24 months (born between 1 November 1996 and 31 April 1997) resident in one health authority. Intervention Leaflet "MMR – the facts" and personal reminder letter posted to parents of children who had not received MMR vaccination by 21 months of age in intervention group. A copy of the letter was also sent to the child's general practitioner and health visitor. Parents of children in the control group were not contacted. Theoretical underpinnings N/A	RCT **Participants** Participants n=244 intervention and n= 249 control **Main outcome measures** Immunisation uptake **Analysis** Analysis Intent to treat	No significant difference in the proportion of children immunised between 21 and 24 months between intervention and control groups. Control 6.1% (15/244); Intervention 7.2% (18/249), a difference of 1.1 % (95% CI -3.3%-5.5%).		Section A: Population 83% Section B: Data Collection 100% Section C: Study Design 100% Section D: Results 60% Overall Validity 85%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Natter and Berry (2005)	Setting Reading, UK. Aim To evaluate the effect of the provision of information about the baseline level of risk on people's interpretation of relative and absolute risk reductions. Target group/population General public. Intervention Four different booklets outlining the fictitious scenario of a severe influenza epidemic that was expected to hit Britain in the coming months. In all booklets, people were advised that they should be vaccinated. The booklets contained different combinations of information about baseline risk, relative risk reduction and absolute risk reduction. Booklet 1: Information about baseline risk ("It is predicted that 10% of the adult population (i.e. 10 out of every 100 adults) will be affected by the flu") and absolute risk reduction information ("With vaccination, the risk of being affected by the flu is 5% lower"). Booklet 2: Absolute risk reduction information, but no information about baseline risk. Booklet 3:Information about baseline risk and relative risk reduction information ("With vaccination, the risk of being affected by the flu is reduced by 50%"). Booklet 4: Relative risk reduction information, but no information about baseline risk. Theoretical underpinnings N/A	Randomised trial (no control group) **Participants** Participants 220 members of the public aged between 18 and 72 (mean 28.2) recruited from Reading town centre. 57% of participants were female. 55 participants were randomised to receive booklet 1. 55 participants were randomised to receive booklet 2. 55 participants were randomised to receive booklet 3. 55 participants were randomised to receive booklet 4. **Main outcome measures** Intention to immunise Measured on a scale with a maximum of 6. Other Perceived effectiveness of influenza immunisation measured on a scale with a maximum of 6. **Analysis** Analysis ANOVA.	Intention to immunise: The mean (and SD) for each condition: Booklet 1 - 3.61 (1.2); Booklet 2 - 2.29 (1.0); Booklet 3 - 3.41 (1.3); Booklet 4 - 3.73 (1.2). Significant effect of baseline ($p<0.01$). Significant effect of risk ($p<0.01$). Significant interaction ($p<0.001$). Analysis of the interaction showed that ratings were significantly higher in the relative format condition, but only when participants were not informed about the baseline. Perceived effect of immunisation: The mean (and SD) for each condition: Booklet 1 - 3.71 (1.1); Booklet 2 - 2.41 (1.2); Booklet 3 - 3.56 (1.2); Booklet 4 - 3.59 (1.1). Significant effect of baseline ($p<0.001$). Significant effect of risk ($p <0.05$). Significant interaction ($p<0.001$). Analysis of the interaction showed that ratings were significantly higher in the relative format condition, but only when participants were not given information about the baseline.	The study also explores the effect of provision of absolute risk, relative risk and baseline information on the accuracy of risk estimates.	Section A: Population 50% Section B: Data Collection 40% Section C: Study Design 80% Section D: Results 75% Overall Validity 60%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Nuttall (2003)	Setting A GP practice in East Lancashire, England. Aim To investigate the effect of a visit from a health professional on influenza immunisation uptake in GP practice patients aged 65 and over who were not immunised during a previous immunisation campaign. Target group/population GP practice patients aged 65 and over who were not immunised in the 2000/2001 influenza immunisation campaign. Intervention Three intervention conditions: Patients in group 1 received a letter from East Lancashire Health Authority inviting them to attend their GP surgery for influenza immunisation (this is usual practice). Patients in group 2 received the invitation letter plus a copy of the Department of Health leaflet "Flu Jab - Beat Flu, Use a Jab". Patients in group 3 received the invitation letter and also received a home visit from a health visitor to discuss the influenza immunisation programme. The health visitor ensured the information was consistent by providing facts taken from the leaflet, given in the same order at every visit. Patients were invited to ask questions and the health visitor's responses were based on information from Department of Health literature. Theoretical underpinnings N/A	RCT **Participants** Participants 90 patients took part in the study. The GP practice had 383 patients aged 65-90. After patients were excluded for contraindications, all remaining patients were invited to take part. 30 patients randomised to intervention group 1 (15 aged 65-72 and 15 aged over 72). 30 patients randomised to intervention group 2 (15 aged 65-72 and 15 aged over 72). 30 patients randomised to intervention group 3 (15 aged 65-72 and 15 aged over 72). **Main outcome measures** Immunisation uptake **Analysis** Analysis Chi-squared test for unrelated designs.	Immunisation rates: 27% of patients in group 1; 23% of patients in group 2; 40% of patients in group 3; the difference in immunisation rates between the three groups was not significant (p=0.329). Subdivision of each intervention group into those participants aged under 72 years showed little difference in uptake and no significant difference between the three intervention groups (p=0.914). Immunisation uptake among patients aged 72 and over was greater in group 3 (33%) than in group 1 (7%) or group 2 (7%). The difference was not significant (p=0.067).	The study author noted that although the difference in immunisation uptake between groups for those aged 72 and over was not significant, the findings suggest that this age group may be more responsive to a 'more personal approach' than the younger age group.	Section A: Population 71% Section B: Data Collection 75% Section C: Study Design 100% Section D: Results 60% Overall Validity 76%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Porter et al (2000)	Setting Novgorod City, Russia. Aim To increase uptake of diphtheria vaccine, particularly uptake of second and third doses. Target group/population Adults, in particular those aged 40-59 years, the group most at risk for diphtheria mortality, and mothers. Intervention The intervention took place in 1996, and was a collaborative Russian-American programme involving BASICS (Basic Support for Institutionalizing Child Survival, a project funded through the US Agency for International Development), the Russian Ministry of Health, and the former State Committee for Sanitary and Epidemiologic Surveillance. Communication activities were implemented by city/regional public health agencies. Key messages were developed based on formative research: Diphtheria is dangerous, but it is preventable through vaccination;The vaccine is safe and effective; Individuals are responsible for being sufficiently vaccinated (second and third doses offer complete protection) and should consult their doctor about their vaccination status. Messages were incorporated into a variety of media products: Four TV and radio public service advertisements (PSAs); print advertisements; posters; leaflets; and transit cards. Three of the four PSAs (produced by Moscow Medicine for You, the semi-privatised public information arm of the Ministry of Health) focused on adult immunisation, and emphasised the key messages, while the fourth PSA targeted mothers and focused on the timely completion of the full childhood immunisation schedule. All other media products were created and used locally, and regional teams worked with local media to generate news coverage (TV, radio and print), and to get free placement for TV and radio PSAs. Theoretical underpinnings N/A	Quasi-experimental study Before and after study. **Participants** Participants A random sample of medical records of 40-59 year olds in Novgorod City. The number of medical records is not specified. **Main outcome measures** Immunisation uptake **Analysis** Analysis Descriptive.	Coverage rates for first dose diphtheria immunisation in adults aged 40-59 years increased from 74.1% immediately before the intervention, to 76.2% immediately after the intervention (2.1% increase). Coverage rates for second dose increased from 21.3% to 22.7% (1.4% increase) in the same period, and coverage rates for third dose increased from 9.2% to 10.2% (1.0% increase). The authors did not report levels of significance.	Evaluation of the campaign also included a case-control study which showed that people who had second or third doses of the vaccination during the intervention period were significantly more likely to have been exposed to the campaign (TV news reports and radio news reports) than those who did not have second or third doses of the vaccination during the intervention period. However, those who were immunised were also significantly more likely to have been told by a doctor or nurse about the need to be immunised, and significantly more likely to be required by their workplace to be immunised.	Section A: Population 75% Section B: Data Collection 100% Section C: Study Design 80% Section D: Results 80% Overall Validity 83%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Porter-Jones et al (2009)	Setting Flintshire, Wales, UK. Aim To explore the impact of a novel way to communicate information about MMR on uptake of MMR immunisation. Target group/population Parents of children eligible for their first dose of MMR vaccine (MMR1), being seen by their health visitor (HV) for the routine 8-month assessment. Intervention Following the routine 8-month assessment by a HV, children in the intervention group were given a teddy bear wearing a T-shirt that displayed: the statement 'Get the Bear Facts', and its Welsh translation; a website address that redirected to the UK National Health Service portal for MMR information; and a telephone number that provided information about MMR. Children in the control group did not receive a teddy bear. Parents of children in both groups received standard MMR information. Theoretical underpinnings N/A	RCT **Participants** Participants Children eligible for their first dose of MMR in Flintshire, being seen by their HV for the routine 8-month assessment. Intervention n = 542, control n = 432. **Main outcome measures** Immunisation uptake Other Number of website hits. Number of calls to the telephone helpline. **Analysis** Analysis Pearson's Chi-squared test	There was no significant difference in MMR uptake between children who received a teddy bear (87.3%, 95% CI 84.5–90.1%, n =473) and children who did not (88%, 95% CI 84.8–91%, n =380; p = 0.744). The total number of hits to the website was 62. If every hit is regarded as representing one parent from the study, the number of parents using the site represents only 11% of those whose child received a teddy bear. No calls were made to the telephone helpline (during office hours).	At the time of planning the study, Flintshire had the lowest uptake rate of all childhood immunisations in Wales and the lowest uptake of MMR1 (69%) in North Wales.	Section A: Population 71% Section B: Data Collection 25% Section C: Study Design 80% Section D: Results 80% Overall Validity 59%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Sartor et al (2004)	Setting University hospital, France Aim To increase uptake of influenza vaccination in HCWs Target group/population HCWs at one university hospital. Intervention A mobile cart influenza vaccination programme providing vaccine directly to hospital units. Firstly, to increase awareness of the information campaign: articles were published in the monthly infection control newspaper delivered to each physician and unit of the hospital; announcements were published in a letter personally addressed to each physician and each head nurse; posters were located throughout the hospital; and there were additional education sessions for units with low vaccination uptake. Unvaccinated staff were educated by the vaccination team about the benefits of the vaccine, adverse reactions, as well as about the epidemiology of nosocomial influenza in the setting during the past, and the impact of immunisation of HCW on the protection of patients. The employee health service annual vaccination campaign continued as normal. Theoretical underpinnings N/A	Quasi-experimental study Interrupted time series **Participants** Participants All hospital workers (except administrative staff) n ~ 2300, but varies over years. **Main outcome measures** Immunisation uptake **Analysis** Analysis Mantel–Haenszel test	A significant increase in the overall influenza vaccination rate for HCW from 6% (134/2,298) in 1998 and 7% (158/2,349) in 1999 before the mobile cart to 32% (753/2,381) in 2000, 35% (837/2,420) in 2001, and 32% (771/2,418) in 2002 ($p < 0.001$) after the mobile cart programme was introduced.	The employee health service annual vaccination campaign continued to run during the intervention.	Section A: Population 100% Section B: Data Collection 14% Section C: Study Design 60% Section D: Results 83% Overall Validity 59%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Scottish Executive (2005)	Setting Scotland, UK. Aim To increase uptake of influenza and pneumococcal immunisation in people aged over 65 and in people considered to be "at risk". Target group/population People aged over 65, and risk groups (defined as people who have diabetes, asthma, chronic heart or chest complaints, chronic kidney disease, lowered immunity due to disease or treatment such as steroid medication or cancer treatment, or any other serious medical condition). Intervention The Scottish Executive runs a yearly campaign to promote uptake of seasonal influenza vaccination. In 2003, the campaign was extended to include the promotion of pneumococcal vaccination. The 2003/2004 campaign used the following media: terrestrial TV; national and regional press; local commercial radio. Theoretical underpinnings N/A	Quasi-experimental study Interrupted time series. Pre-campaign baseline data August 2003. Post-campaign surveys in November/December 2003 and in January 2005. **Participants** Participants For all three data points, data were collected from the TNS System Three CAPI (Computer Assisted Personal Interviewing) omnibus, Scottish Opinion Survey (SOS). For the 2005 survey, data were collected from 1047 adults aged 16 across 44 Scottish constituencies. The sample was weighted to match population estimates, in terms of age, sex and socio-economic group, from the National Readership Survey (2002). Information is not provided about participants in the 2003 surveys. **Main outcome measures** Knowledge or comprehension of key communication messages	At baseline, 21% of respondents said they were aware of the term "pneumococcal". 50% of respondents to the first post-campaign survey were aware of the term "pneumococcal", and 33% of respondents to the second campaign survey were aware of the term. Among those aware of the term "pneumococcal", at baseline 10% of respondents correctly described it (unprompted) as being a cause of pneumonia. At the first and second post-campaign evaluation, the figures were 31% and 20% respectively.	Although the Scottish Executive runs a yearly campaign, the 2004/2004 campaign is not mentioned in the report. The 2005 survey may have taken place during/after this campaign. Although the campaign targeted over 65s and risk groups, the evaluation sample included adults of all ages (19% aged over 65). The report includes a number of other measures, such as promotional campaign awareness and immunisation uptake, but as only post-campaign figures are reported, these have not been included.	Section A: Population 33% Section B: Data Collection 43% Section C: Study Design 80% Section D: Results 33% Overall Validity 46%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Scottish Executive (2007)	**Intervention** Setting Scotland, UK. Aim To promote the importance of, and increase uptake of influenza immunisation. Specific objectives: to achieve uptake of 70% in those aged 65 and over; and to achieve uptake of 60% in people "at risk". Target group/population People aged 65 and over and the "at risk" (includes those with medical conditions such as asthma, diabetes, heart, liver, renal, immunosuppressant and other diseases, as well as care workers and poultry workers). Intervention The Scottish Executive runs an annual advertising campaign to increase influenza immunisation uptake in specified target groups. In 2006/2007, for the first time, the campaign ran in two phases targeting different audiences. The first phase in October 2006 targeted over 65s and used television advertising. The second phase in November/December 2006 targeted the "at risk", and used radio, outdoor posters, panels on public transport, leaflets in doctors' surgeries and pharmacy bags. This phase did not use television advertising. The main campaign message was about the consequences of contracting influenza virus. Specifically, the advertising communicates the message "At 100mph, flu can hit you hard, make sure you get your free flu jab". Theoretical underpinnings N/A	**Study design** Quasi-experimental study Interrupted time series. Data points 2003, 2005 and December 2006. **Participants** Participants December 2006 sample: 317 adults (over 16 years) defined as "at risk" from 30 in-street sampling points across Scotland. A sample profile was designed based on previous estimates, and quotas were imposed to ensure that the sample was representative of the "at risk" population in terms of age, sex and socio-economic group. The 2003 sample consisted of 256 "at risk" adults, and the 2005 sample consisted of 200 "at risk" adults. **Main outcome measures** Promotional campaign awareness Spontaneous awareness and prompted awareness	**Evaluation Results** Results Spontaneous campaign awareness in "at risk" adults was 69% in 2003, 79% in 2005 and 65% in 2006. Prompted campaign awareness (all respondents were played the radio advert in full and shown a picture of the poster advert from the current campaign) in "at risk" adults was 72% in 2003, 90% in 2005 and 68% in 2006.	**Notes** Notes The 2006/2007 campaign differed from previous campaigns in that it was the first to have a specific phase targeting the "at risk" only. In addition, television advertising was not used in the 2006/2007 campaign, while previous campaigns did use TV advertising.	**Quality Appraisal** Section A: Population 17% Section B: Data Collection 71% Section C: Study Design 80% Section D: Results 33% Overall Validity 52%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Siriwardena et al (2002)	Setting General practices in the Trent region, England, UK Aim To investigate the effect of an educational outreach visit to primary healthcare teams on influenza and pneumococcal vaccination uptake in high-risk patients. Target group/population Primary healthcare teams in general practices. Intervention An educational outreach visit to intervention practices by a research GP that took no longer than 1 hour. The visit involved: provision of evidence-based information; presentation of both sides of controversial issues; encouragement of active learning; use of simple overheads and graphs; and emphasis of essential messages. The educational element was a dialogue around perceived barriers to vaccination within the organisation. There was also discussion about techniques to improve adult vaccination rates, with a summary of the evidence of effective interventions. Control practices received audit and feedback alone. Both intervention and control practices undertook a follow-up data collection six months after the educational intervention (eight months after baseline data collection), which took place at the start of the annual influenza vaccination campaign. Theoretical underpinnings N/A	Cluster RCT **Participants** Participants Intervention group n=15 general practices, control group n=15 general practices. **Main outcome measures** Immunisation uptake **Analysis** Analysis Poisson regression. Expressed as mean vaccination rates, OR and CI	Improvements in pneumococcal vaccination rates in the intervention practices were significantly greater compared with controls in patients with coronary heart disease, 14.8% increase versus 6.5% increase (OR = 1.23, 95% CI = 1.13 - 1.34); and diabetes, 15.5% increase versus 6.8% increase (OR = 1.18, 95% CI = 1.08 - 1.29); but not splenectomy, 6.5% increase versus 4.7% increase (OR = 0.96, 95% CI = 0.65 - 1.42). Improvements for influenza vaccination were also greater in intervention practices than in control practices but did not reach statistical significance for coronary heart disease, 18.1% increase verus 13.1% increase (OR 1.06, 95% CI 0.99 - 1.12; p = 0.08); for diabetes, 15.5% increase versus 12.0% increase (OR 1.07, 95% CI 0.99 - 1.16 p = 0.09); and for splenectomy, 16.1% increase versus 2.9% increase (OR 1.22, 95% CI 0.78 - 1.93; p = 0.38). Although not significant, influenza vaccination for patients aged 65 and over showed a greater increase in controls practices than intervention practices, 25.4% increase versus 20.7% increase (OR 0.99, 95% CI 0.96 - 1.02; p = 0.42). There are no statistics reported for high risk groups overall.	A semi-structured questionnaire after the visit showed the range of approaches by which practices augmented their existing organisational strategies. These included awareness raising through poster campaigns and information leaflets in the waiting room, as well as patient reminders and media campaigns (both local and national) for influenza. The education and training to practice teams also encouraged practitioner reminders, such as templates and vaccine prompts, to trigger health professionals into advising high risk patients to be immunised.	Section A: Population 86% Section B: Data Collection 67% Section C: Study Design 100% Section D: Results 60% Overall Validity 78%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Stenqvist et al (2006)	Setting The Vastra Gotland Region in Sweden which includes the city of Gothenburg. Aim To increase influenza immunisation rates in people aged 65 and over to 45% by 2002 and to 65% in 2005. Target group/population HCW in primary health care facilities. Intervention The Department of Communicable Disease Control implemented a programme in the Gothenburg area in 1999 which was expanded to the whole Region in 2001. Every September, repeated 3 hour information sessions were held in various locations in the region. HCW from primary care facilities were invited to attend. Information sessions covered many aspects of influenza and vaccination, both theoretical and practical. Theoretical underpinnings N/A	Quasi-experimental study Interrupted time series. **Participants** Participants Random samples of 600 individuals aged 64-74, 75-84 and over 84 years surveyed every March-April. **Main outcome measures** Immunisation uptake Estimated from population surveys. Knowledge or comprehension of key communication messages	The estimated immunisation rate in over 65s increased from 33.6% to 54.6% in the Gothenburg area between 1999 and 2004, and from 44.1% to 51.9% in the whole region between 2001 and 2004. There are no reported measures of significance. In 1999, 80.2% of respondents in the Gothenburg area were aware of the recommendation for yearly influenza immunisation, while 89.4% of respondents in the Gothenburg area were aware of the recommendation in 2004.	There were a number of promotional activities outside the scope of the project that targeted over 65s during the time the project ran. There were national mass media campaigns targeting people over 65. Some primary healthcare centres used posters and sent personal reminders to people in this age group. The cost of vaccination for people aged over 65 was reduced from 150 SEK to 100 SEK (i.e. from approx. €15 to €10). Although the study authors stated that the project had no budget to target over 65s, they note that in 2003 the project "flu nurse" started to hold influenza information meetings for people aged over 65.	Section A: Population 60% Section B: Data Collection 40% Section C: Study Design 80% Section D: Results 60% Overall Validity 57%
Tapiainen et al (2005)	Setting The University Children's Hospital, Basel, Switzerland. Aim To increase the influenza immunisation rate among paediatric HCW. Target group/population Hospital paediatric HCW. Intervention The intervention was designed based on the results of an attitude survey of paediatric HCW in the hospital, and took place between the 2003-2004 and 2004-2005 influenza season. Firstly, all paediatric HCW were sent an "informal" letter with the following information: what is influenza?; efficacy of influenza immunisation; side effects; patient protection; real contraindications. There were also educational conversations with the head nurses of each ward. Free walk in immunisation clinics were then opened, which were extended to wards not located in the main hospital. After walk in clinics were closed, the opportunity for voluntary immunisation was directly offered on wards. Theoretical underpinnings N/A	Quasi-experimental study Before and after study. **Participants** Participants All hospital paediatric HCW: 538 in the 2003-2004 influenza season and 554 in the 2004-2005 influenza season. **Main outcome measures** Immunisation uptake **Analysis** Analysis Chi-squared tests.	The immunisation rate among all HCW increased from 19% (95% CI 15% - 22%) before the intervention to 24% (95% CI 20% - 28%) after the intervention (p=0.03). Among physicians, the immunisation rate increased from 43% (95% CI 33% -54%) before the intervention to 64% (95% CI 55% - 75%) after the intervention (p=0.004). The immunisation rate among nurses (13% before to 14% after; p=0.52) and other HCW (16% before to 16% after; p=1.0) did not change significantly after the intervention.		Section A: Population 100% Section B: Data Collection 75% Section C: Study Design 100% Section D: Results 83% Overall Validity 89%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Thompson and Harutyunyan (2009)	Setting Gegharkunik, Armenia Aim To improve maternal and child health practices, including immunisation uptake, breastfeeding and newborn care, appropriate hygienic practices and proper nutrition. Target group/population Armenian Red Cross Society (ARCS) volunteers, general public, caretakers of children under 5 (especially mothers), teachers. Intervention The intervention took place April - November 2003. 387 ARCS volunteers were recruited from villages across the region and trained to be peer health educators. The 16 hour training programme supported and reinforced the WHO/UNICEF Integrated Management of Childhood Illnesses (IMCI) clinical guidelines related to 16 key maternal and child health practices. The community-based peer health educators counselled and educated approximately 500 caretakers of children under 5 in the community about key nutrition and health practices and proper referral practices. They also provided in-home counselling sessions (2 hours over the course of a week) for pregnant and lactating women, and group health education classes for new parents (typically 2 hour sessions). Peer health educators also served as community resources for further follow up and advice, with the master trainers (primary care physicians from the region trained in both community and clinical IMCI) providing second level and referral support. 800 teachers were trained on IMCI topics and STI/AIDS prevention for inclusion in classroom curriculum and school practices. A media awareness campaign using posters, brochures and 8 regional television spots and radio spots that addressed key knowledge and promoted awareness of home-based visits and group health education activities. Promotional materials such as puzzles, bibs and notepads with key messages and images were distributed at health centres, schools and kindergartens. Theoretical underpinnings N/A	Quasi-experimental study Before and after study **Participants** Participants Pre-intervention: random sample of 300 households with a child under 24 months in the 16 target villages. Post-intervention: independent random sample of 300 households containing a child under 24 months in the 16 target villages. **Main outcome measures** Immunisation uptake	The proportion of children aged 12-23 months vaccinated with DTP/Polio vaccination before by first birthday increased significantly from 30.8% before the intervention, to 64.3% after the intervention (33.5% increase; $p<0.05$). The proportion of children aged 12-23 months vaccinated with measles vaccination before by first birthday increased from 76.7% to 79.3% (2.6% increase; not significant). The proportion of children aged 12-23 months who were up to date with all vaccinations in the Armenian regimen (HBV3; BCG, OPV3; DPT3) before first birthday increased from 7.7% to 28.6% (20.9% increase; not significant).		Section A: Population 57% Section B: Data Collection 100% Section C: Study Design 100% Section D: Results 60% Overall Validity 76%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Toscani et al (2003)	Setting Geneva canton (federal state), Switzerland. Aim To increase influenza immunisation rates in risk groups. Specific objective to achieve an influenza immunisation rate of 60% in over 65s in Geneva canton in 2000. Target group/population Risk groups (over 65s and people with chronic conditions or immunosuppression) and health professionals. Intervention The "United against Flu" campaign started in Geneva canton in 1993, supported by the Health State Department in collaboration with a number of health institutions and professional institutions. Information activities as part of the campaign; letters to health professionals and health institutions; press conferences; participation in TV and radio programmes and cultural events; on-job training activities for health professionals; teaching to students of different health professions; information and education for patient risk groups through clubs and other organisations. Supporting materials produced as part of the campaign: TV spots; leaflets and posters for the general public and health institutions; promotional materials such as handkerchief packages and stickers; a campaign website (http://www.grippe.ch). Theoretical underpinnings N/A	Quasi-experimental study Interrupted time series. **Participants** Participants Random samples of residents of the Geneva canton aged 65 and over completed questionnaires: 1994 - 1200 participants; 1996 - 2300 participants; 2000 - 1500 participants. **Main outcome measures** Immunisation uptake **Analysis** Analysis Chi-squared test for trend.	Reported influenza immunisation coverage of the Geneva population aged over 65 for years 1991-2000 increased significantly from 28.7% (95% CI 25.6-31.8%) to 58.5% (95% CI 55.5-61.5%) ($p<0.01$). Exact figures are not available for the years 1992-1999.	From 1996, the cost of influenza immunisation for over 65s and patient risk groups was covered by health insurance. Data collection methods for vaccination coverage are unclear.	Section A: Population 100% Section B: Data Collection 20% Section C: Study Design 20% Section D: Results 20% Overall Validity 40%

Title	Intervention	Evaluation Design	Evaluation Results	Notes	Quality Appraisal
Uskun et al (2008)	Setting Isparta city, Turkey Aim To increase coverage of routine childhood vaccinations. Target group/population Individuals who were primarily responsible for immunisation in healthcare services (representing 18% of primary HCWs in the region). These were healthcare workers from primary health centres: nurses, midwives and health officers who were responsible for vaccines and immunisation, and GPs who had not received any immunisation training since graduation). Intervention An intensive 3 full-day workshop comprising instructive lectures interspersed with activities designed to elicit discussion of participants' knowledge about immunisation. The intervention was conducted on 18 consecutive occasions in the same location, for different participants, and the total duration of the intervention was 54 week days (3 months). Theoretical underpinnings N/A	Quasi-experimental study Before and after study. **Participants** Participants 229 HCW **Main outcome measures** Immunisation uptake Knowledge or comprehension of key communication messages **Analysis** Analysis paired t-tests for pre- and post-test scores. McNemar's Chi-squared test.	The intervention increased primary HCW knowledge about immunisation significantly ($p < 0.01$). The mean pre-intervention knowledge test score was 21.5 [95% CI 20.7-22.3]. The mean post-intervention knowledge test score was 36.7 [95% CI 36.3-37.2]. After the intervention, there was a significant increase ($p < 0.001$) in vaccination coverage rates in children aged <12 months: Hepatitis B (1st dose): 11.8% before; 33.5% after Hepatitis B (2nd dose): 12.5% before; 20.4% after Hepatitis B (3rd dose): 14.5% before; 27.3% after Diphtheria, tetanus, pertussis/oral polio vaccine (DTP/OPV) (2nd dose): 23.6% before; 24.6% after DTP/OPV (3rd dose): 22.2% before; 31.4% after BCG: 25.4% before: 25.8% after Measles: 26.8% before; 27.4% after	The authors reported that there was a significant increase in vaccination rates, however, DTP/OPV (first dose) uptake actually significantly decreased from 25.2% before the intervention to 24.9% after the intervention.	Section A: Population 33% Section B: Data Collection 43% Section C: Study Design 100% Section D: Results 67% Overall Validity 58%