TECHNICAL REPORT

Systematic literature review to examine the evidence for the effectiveness of interventions that use theories and models of behaviour change: towards the prevention and control of communicable diseases

Insights into health communication

ECDC TECHNICAL REPORT

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Contents

Abbreviations

ECDC	European Centre for Disease Prevention and Control
EEA/EFTA	European Economic Area/ European Free Trade Association
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HIV	Human immunodeficiency virus
HPV	Human papillomavirus
MRSA	Methicillin-resistant *Staphylococcus aureus*
NICE	National Institute for Health and Clinical Excellence
PDF	Portable document format (file type)
PRECEDE	Predisposing, reinforcing, and enabling constructs in educational/environmental diagnosis and evaluation
PROCEED	Policy, regulatory, and organisational constructs in educational and environmental development
STI	Sexually transmitted infection

Executive summary

A systematic literature review assessed the effectiveness of interventions using theories and models of behaviour change to prevent or control communicable diseases relevant to Europe. The review was commissioned by the European Centre for Disease Prevention and Control (ECDC) and conducted by the Institute for Social Marketing of the University of Stirling and the Open University.

Purpose of the review

Behavioural or social theories and models are considered an important tool in effective behaviour change interventions and programmes. They can identify the changes that take place, explain and support change dynamics, identify key influences on outcomes and select those participants most likely to benefit. Their use in health intervention planning and management also improves the prospects for replication, modification and the scaling up of effective interventions and the learning that can be derived from practice whether the intervention is successful or unsuccessful.

There is a substantial body of published work evaluating interventions using behaviour change theories and models to prevent or control communicable diseases relevant to Europe. This systematic review of the evidence aimed to collate the targets of interventions – diseases and disease groups, populations, types of behaviour for change – and map the behaviour change theories and models used. A further objective was to look at what techniques and activities were used by interventions, via which health communication channels and in which settings. The review also sought to examine the effectiveness of the interventions and report on any evidence of effectiveness for relevant interventions and programmes based on theories and models of behaviour change. The analysis and findings are intended to provide a current status report on the evidence and shortcomings in relation to good practice, policy, learning and strategies.

Review methods

Systematic reviews are designed to be comprehensive, transparent and replicable and to minimise selection bias. These methods are intended to capture and synthesise research evidence to meet pre-specified research objectives. Systematic reviews therefore follow a detailed protocol, specified in advance, and fully document all stages of the process.

To be included in this review, studies were required to evaluate an intervention, programme, strategy, action plan, national policy or campaign that aimed to change an individual's or a community's health behaviour; prevent and/or control a Europe-relevant communicable disease(s) and used a theory or model of behaviour change cited in Glanz, Rimer and Viswaneth's 2008 handbook 'Health Behavior and Health Education: Theory, Research, and Practice' [1].

A search strategy was devised to identify relevant studies published in peer-reviewed journals or published as reports by governments or health agencies in English since January 2001. Searches were run in electronic databases of academic literature in the fields of public health, medicine, psychology and social sciences and on the websites of relevant organisations. Relevant study designs were outcome evaluations using experimental or quasi-experimental designs. The measured and reported data had to include a behavioural precursor, or a behavioural outcome. Behaviour change interventions only aimed at preventing or controlling HIV/AIDS, and those only targeting risky sexual behaviour were excluded from the review.

A team of researchers assessed studies against the inclusion criteria, scored them for internal and external validity and summarised their data in tables. All of the 61 included studies were used in a narrative synthesis to answer the pre-specified research objectives. A narrative synthesis of best evidence, using only the 21 studies rated as high quality (in terms of validity) was used to address the evidence of effectiveness research objectives.

Review results

After the completion of criteria screening 61 studies were included in the review. Three-fifths of the studies were conducted in North America (n=38), nine studies came from Europe, four studies from Australia and four from Africa. Two studies came from the Middle East, two from southern Asia, and two from Puerto Rico. Just over half of the studies included were randomised controlled trials (n=31) and a third were before-and-after studies (n=21). Twenty-one of the studies scored ≥75% for overall validity in the assessment of study quality. The lowest overall validity score was 33% and the highest 100%, with a mean overall validity score of 68%.

The studies were categorised into six groups according to the disease or infection targeted. The behaviour change intervention in 34 studies targeted more than one disease group and four of the six groups were targeted by at least ten interventions: 'Respiratory tract infections', 'Vaccine-preventable diseases and invasive bacterial infections',

'Blood-borne diseases and sexually transmitted infections (STIs)' and 'Food- and waterborne diseases and zoonoses'.

Behaviour change theories and models were used in the studies either to inform the behaviour change intervention or programme, or to design or evaluate the intervention. The models and theories used most often were those that model individuals' health-related behaviour. Models of interpersonal health behaviour were the next most frequently used, with community and group models and theoretical planning frameworks for health promotion used less often for disease prevention or control. Nearly one third of the studies (n=18) used multiple theories or models and two studies mentioned new models synthesised from multiple theories.

All the studies shared the general aim of prevention and/or control of communicable diseases, however they differed in their specific aims (e.g. target population, settings, outcome measures and quality). We synthesised the narrative data of the studies to meet the pre-specified research objectives. These objectives are used as the framework for reporting the results below. Headings (a) to (g) below map the current use of interventions applying theories and models of behaviour change to prevent or control communicable diseases. Headings (h) to (j) assess the evidence of effectiveness where the theories and models are used. The review identifies some promising areas of practice that are recommended for further development and testing for effectiveness. The review also highlights gaps in the evidence base.

a) Communicable diseases and disease groups targeted by theory-based interventions

The 61 studies included were categorised into six groups according to the disease or infection targeted by the intervention. In 34 studies the intervention targeted more than one disease group. The 'Respiratory tract infections' group was the target in 28 studies, focussing on influenza, tuberculosis, upper- and lower-respiratory tract infections and acute respiratory infection. The 'Vaccine preventable diseases and invasive bacterial infections' group was targeted in 19 studies (mostly frequently influenza but also measles and pneumococcal disease), as was the 'Blood-borne diseases and STIs' group (including human papillomavirus infection, hepatitis B, hepatitis C and HIV). Ten studies targeted diseases from the 'Food- and waterborne diseases and zoonoses' group (including hepatitis A, *E.coli* and non-specific gastrointestinal infections and diarrhoea). The 'Antimicrobial resistance and healthcare-associated infections' group was the intervention target in four studies (for methicillin-resistant *Staphylococcus aureus*, rotavirus infection and general nosocomial infections). Finally, diseases from the 'Emerging and vector-borne diseases' group were the target of three studies (including tick-borne Lyme disease, ehrlichiosis and babesiosis, and schistosomiasis).

b) Theory or model used to inform the intervention or programme

Thirty studies used behaviour change theories or models to inform the intervention. The models and theories used most often to inform the intervention or programme were those that model individuals' health-related behaviour. Studies did not provide much detail beyond stating that a theory or model informed the intervention or evaluation. Nineteen studies were informed by the Health Belief Model, taking into account perceived beliefs of the target audiences for each intervention. Nine studies were informed by individual motivational factors – four using the Theory of Reasoned Action and five using the Theory of Planned Behavior.

Models of interpersonal health behaviour examine the influence of social relations. Thirteen studies were informed by Social Cognitive Theory, or its earlier form of Social Learning Theory.

Three studies used community and group models of health behaviour. Two of these used the Diffusion of Innovations model to spread an intervention amongst a social group. One study used a community organisation model, the Locality Development Model.

Finally, theoretical frameworks for planning health promotion were used in two studies to inform the intervention. The PRECEDE–PROCEED model was mentioned by one study, and the Behavioral Ecological Model by another.

The majority of studies mentioned a single theory or model only. Ten studies used more than one theory to inform the intervention. Most of the studies that used the Theory of Reasoned Action and/or the Theory of Planned Behavior used a second theory or model. One of the studies combined three theories to create a new theory.

c) Theory or model used in the intervention design

Thirty-one studies used behaviour change theories or models in the intervention design or evaluation. The models and theories used most often in the intervention design or its evaluation were those that targeted individuals' health-related behaviour. Interventions in seven studies were informed by the Health Belief Model, using or measuring perceived beliefs. Nine studies were informed by individual motivational factors – two by the Theory of Reasoned Action, six by the Theory of Planned Behavior and one using constructs from both theories in an Integrated Behavioral Model. The Common Sense Model, which emphasises the role of an individual's emotions in decision-making, was used in one study. Use of the Transtheoretical Model, also referred to as the Stages of Change Model, was mentioned in eight studies, and one study applied it for both the intervention design and its evaluation. One study used another model based on stages, the Precaution Adoption Process Model.

Models of interpersonal health behaviour examine the influence of social interactions. The intervention design of one study was informed by Social Cognitive Theory, another by the Transactional Model of Stress and Coping and a third by the Extended Parallel Process Model. Three studies used the community and group model of health behaviour, Diffusion of Innovations, to design an intervention which could be spread among a social group.

Finally, theoretical frameworks for planning health promotion were used by four studies. The PRECEDE–PROCEED model was applied in three studies to design and evaluate an intervention, and one study used the Social Ecological Model.

The majority of studies made reference to a single theory or model. Eight studies used more than one theory to develop or evaluate the intervention: seven combined constructs from two theories and one combined three theories. Two of these studies combined constructs to create a new theory. Many of the studies did not provide much detail beyond stating that a theory or model informed the intervention design or evaluation.

d) Populations targeted/segmentation into sub-populations

The interventions in the 61 studies targeted a wide range of populations. Over one-quarter of the interventions targeted more than one population. End-users were the population targeted by most of the interventions. Population types ranged from parents and children (infants to adolescents), college students and soldiers and new immigrants, to at-risk groups of infected individuals, injecting drug users and pregnant women. Intermediary populations, targeted for the prevention or control of communicable diseases, were predominantly defined as healthcare workers or general practitioners/family doctors (in 17 studies) and food industry workers and school staff (in one study each).

Only four studies segmented their target populations into sub-populations and delivered separate interventions to each. These studies obtained mixed results: two were successful in terms of changing all their sub-populations' behaviour and two were unsuccessful. Another four studies used stage of change models (e.g. the Transtheoretical Model and the Precaution Adoption Process Model) in the design of their intervention to categorise which stages the study subjects were at before the intervention started, and to tailor the intervention to that stage for that study subject. Thus different respondents received suitably tailored and segmented interventions in these four studies, however outcome data were not reported at this level of detail.

e) Types of behaviour targeted

Immunisation or vaccination uptake was the most frequently targeted behaviour for change in the 61 included studies reviewed. Attempts to alter behaviour favouring immunisation were the focus of 27 studies. Thirteen of these studies specifically targeted the adoption of disease prevention behaviour and increasing awareness and knowledge surrounding the disease as a means of increasing vaccination uptake. Five of these studies targeted parents' attitudes towards vaccinating their child as a means of increasing vaccination rates among children.

Improved hand hygiene was the second most commonly targeted behaviour featuring in 13 of the studies. Six of these studies featured interventions which included promoting the use of waterless hand sanitiser, while four studies aimed to improve hand hygiene by implementing a new programme of hygienic practices or food-safety training. One of these hand hygiene studies was among six which aimed to improve food preparation practices.

Five or fewer studies examined interventions aimed at one of the following behaviour types: addressing the sharing or re-use of injecting drugs equipment; interventions encouraging medicine regimen adherence; reducing antibiotic use and prescription; improving respiratory hygiene behaviour; reducing unsafe sexual behaviour; the uptake of health screening; modification of injecting drug preparation practices and avoiding tick bites, safe tick removal and learning to recognise the symptoms of Lyme disease.

Just under a quarter of the studies reviewed targeted more than one behaviour for change with a view to preventing or controlling communicable diseases (n=14). For example, some interventions aimed at controlling influenza targeted hand hygiene improvement alongside vaccination uptake. Other interventions addressing the re-use of injecting drug equipment also targeted the curbing of unsafe sexual behaviour.

f) Health communication channels, activities and settings used

Health communication was not an inclusion criterion for studies, however all but two described some health communication channel or activity. Many studies used multiple communication channels or activities in their intervention (148 channels in 61 studies; an average of 2.4 channels per intervention). The most common activity was classes or lectures occurring in just over a third of studies (n=21). One-to-one conversation (or instruction), posters and leaflets were each used by just over a quarter of the interventions. Between and eight and twelve interventions used one of the following channels: educational hand-outs, letters, promotional items (e.g. pens, fridge magnets) or films/DVDs/videotapes.

Seventy-six different settings were coded across the 61 studies, reflecting a tendency for interventions to target only one setting for the behaviour change intervention. The most common settings for interventions were healthcare settings (n=24). Eleven interventions were set in hospitals (four of these in a specific ward), 11 interventions in health centres or doctors' practices (including one intervention that used hospital and health centre settings) and three interventions were set in drug treatment services. Educational settings were the second most frequent setting, used for 15 interventions, from pre-school to tertiary education. Other settings included study participants' own homes (n=10) and other types of accommodation (e.g. residential, nursing or care homes/sheltered housing, military barracks or homeless shelters) (n=5). Examples of less common settings in the review included: drug treatment services, 'the streets', cinemas and ferryboats.

Only twelve studies were conducted in more than one setting. These studies tended to have interventions targeting hard-to-reach populations such as homeless people or injecting drugs users, or studies where the intervention was targeted at segmented populations (e.g. family doctors in their surgery and parents of young children in their own homes).

Digital communications were used as channels to communicate behaviour change in nine studies: eight studies (all published between 2008 and 2010) described interventions that used websites as a communication channel and one intervention, from a 2006 study, used email. Of the eight interventions using websites, four could be described as an online setting: three provided online training and in a fourth study, the evaluated intervention was an educational website.

g) Applicability of the theory/model in the evaluation

None of the evaluations in the studies assessed the applicability of the theory or model.

Some studies made statements about the applicability of a theory or their intervention, but did not evaluate it. For example, authors were explicit about how theoretical constructs were applied to their intervention, or described similar studies that used the same theory, or simply stated that a certain theory was the most applicable. Other studies discussed applying their intervention to different settings or populations. Those that used behaviour change theory constructs in the evaluation tool sometimes gave an indication of a survey's predictive validity and test-retest reliability.

h) Extent to which the health behaviour change objective of the intervention/programme was met

Of the 21 studies graded as high quality (≥75% overall validity), over half reported that the intervention had been successful in significantly changing the behaviour of its participants. Interventions in seven studies aimed at changing behaviour to improve a target population's engagement with healthcare services reported significant behaviour changes. Changed behaviour included increased immunisation or vaccination uptake, increased health screenings attendance and reduced use and prescription of antibiotics. Parents were targeted in their own home setting in six of the studies: five studies reported a significant change in behaviour and only one study reported no significant change in behaviour. The evidence indicated that individual-level behaviour theories – Health Belief Model, Theory of Reasoned Action and the Theory of Planned Behavior – and interpersonal behaviour theories – Social Cognitive Theory and the Transactional Stress and Coping Model – were associated with positive outcomes. Both the studies that proposed their own new theoretical model achieved their health behaviour goals.

Eight of the 21 studies graded as high quality reported no evidence of effect and did not exhibit any pattern in the intervention targets to explain the lack of success. A broader range of theories and models was associated with the studies reporting a lack of significant results. Four of the studies used individual-level behaviour change theories – the Health Belief Model, the Theory of Reasoned Action and the Transtheoretical (Stages of Change) Model – to evaluate the intervention. The other studies mentioned that the same individual-level behaviour change theories informed the interventions. One study was based on a planning model (Social Ecological model) and another used the Diffusion of Innovations community model in its intervention design.

i) Evidence for effective interventions and programmes using theories/models of behaviour change to prevent communicable diseases

Of the 21 high quality studies (≥75% overall validity), the prevention (or prevention and control) of communicable disease was an aim of the intervention in 15 of them. Nine of these studies were considered successful in achieving their aim to change a particular behaviour type with a view to improving the prevention of communicable diseases. Six were considered unsuccessful, in that they identified little or no change in the target behaviour. Among the 15 prevention studies, there was no comparative evidence available to determine whether using the theory made the intervention effective or not. However, by mapping the studies to their theoretical bases we compared those with an effective intervention (i.e. a successful outcome) to those without.

There were more similarities than differences in terms of the range of health behaviour change theories used between the successful and unsuccessful prevention interventions. The main differences were that two successful studies used two theories of interpersonal health behaviour which take account of how an individual's environment interacts with their health behaviour, and one study with an unsuccessful intervention used a community change model. However, an examination of how the theories were used revealed that the five interventions claiming to apply a theory or model in the intervention design were either significantly effective in changing preventive behaviour (four studies) or changed the behaviour insignificantly but in a positive direction (one study). Those studies which stated they used a theory or model to evaluate the intervention accounted for two successful preventive behaviour change interventions and four unsuccessful behaviour change interventions. In these cases the theory or model was not unsuccessful and acted as a useful tool, providing insight via the measured theoretical constructs.

j) Evidence for effective interventions and programmes using theories/models of behaviour change to control communicable diseases

Among the 21 high quality studies (≥75% overall validity), the control (or prevention and control) of communicable disease was an aim of the intervention in eight studies. Six of these were considered successful in achieving their aim, to change a particular behaviour with a view to improving the control of communicable diseases. Two were considered unsuccessful, in that they found little or no change in the target behaviour. Within the eight studies, there was no comparative evidence available to determine whether using the theory made the intervention effective or not. However, by mapping the studies to their theoretical bases we were able to compare those with an effective intervention (i.e. a successful outcome) to those without.

There were no substantive differences between the health behaviour change theories or models selected and the successful or unsuccessful control of communicable disease interventions. However, examining how theories were used, one of the main differences is that the two interventions stating that they used a theory/model in the intervention design were both significantly effective in changing infection control and preventive behaviour. The rest of the studies with interventions aimed at controlling communicable disease, both the successful and unsuccessful, only mention a theory or model in relation to their intervention, without specific details on its application.

Strategic implications and recommendations

Current practice and evidence of effectiveness

The majority of studies included in this review were informed by theories or models of individual-level behaviour change. There was a lack of evaluative evidence on interpersonal and community-level theories and how these can be used to inform behaviour change interventions. There was also little evidence on interventions which built and tested new theories.

Only one study was identified that evaluated the cost-effectiveness of theory-based interventions. Individual-level research of health behaviour and outcomes is likely to be more costly to conduct than ecological studies, yet as outlined above these theories intended to modify individual-level behaviour remain the most commonly applied.

The majority of interventions were communications-based and were tentative in their use of new media, using it in a more traditional manner.

There was a clear focus on the end-user as the target for the intervention (adults, parents and children, or adolescents). A smaller volume of identified evidence targeted health professionals (healthcare workers and general practitioners) or other intermediaries.

Recommendations for future research

As outlined above, theories intended to modify individual-level behaviour remain the most commonly applied. Policy could correct the current skewing of the evidence by recommending more ecological-level change research. This could mean more community level theory and/or a policy of a pre-condition that research planning positions individual level theory into wider social scale planning frameworks.

There is a need for an approach to encourage and support research reporting to go beyond simply describing the theoretical model and to measure and test the key variables and how these influence and are influenced by health behaviour.

A number of more recent intervention studies used new media for online training and health promotion. Technology-driven change and opportunities should trigger reflection on appropriate theories to inform and shape future intervention design, monitoring and evaluation.

Shared learning is perhaps more relevant and achievable than finding out which theory works best. The evidence supports the fact that more than one theory can be effective in achieving the desired impact. An initiative to collect good-practice case studies, could provide a focus for shared learning, practice-led information exchange and practice-informed policy development. This would complement the research evidence and may be more achievable than building a research-led knowledge base.

1. Introduction

Behavioural or social theories and models are considered an important tool in effective behaviour change interventions and programmes [1–3]. These theories can be divided into two types. An explanatory theory helps to describe a problem and identify why such a problem exists. Such theories can predict behaviour and inform action targeting the modifiable factors. Change theories guide an intervention's inception and progress, and form a basis for its evaluation. Models draw on more than one theory and are usually informed by empirical findings [4].

Thus behavioural and social theories have the potential to help identify what changes can take place, explain and support change dynamics, identify key influences on outcomes and select participants who are the most likely to benefit. The use of behavioural and social theories in intervention planning and management also improves the prospects for replication, modification and scaling up of effective interventions, and improves the learning that can be derived from practice whether the intervention is successful or unsuccessful. Examples of health behaviour change and social theories include: the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior, the Integrated Behavioral Model, the Stages of Change (Transtheoretical) Model, the Precaution Adoption Process Model, the Social Cognitive Learning Theory, Theories of Organisational Change, and the PRECEDE-PROCEED planning model.

This systematic literature review assesses the effectiveness of interventions that use theories and models of behaviour change to prevent or control communicable diseases relevant to Europe. [1] The review is believed to be the first of its kind on this topic. It systematically identifies, collates and analyses peer-reviewed English language data published in the last ten years. It is limited to studies in which the intervention or programme was based on a theory or model of behaviour change, and the theory must have been identified by the study's authors.

1.1 Objectives

The aim of the review was to assess the effectiveness of interventions that use theories and models of behaviour change to prevent or control communicable diseases relevant to Europe. The following research objectives are addressed to answer the pre-specified research questions 1–11 from the review's protocol (see Appendix 1):

1. communicable diseases and disease groups (e.g. antimicrobial resistance and healthcare-associated infections; emerging and vector-borne diseases; food- and waterborne diseases and zoonoses; blood-borne diseases (excluding HIV); respiratory tract infections; vaccine preventable diseases and invasive bacterial infections) targeted by theory-based interventions

2. theory or model used to inform the intervention or programme

3. theory or model used in the intervention design

4. populations targeted/segmentation into sub-populations

5. types of behaviour targeted

6. techniques and activities used

7. health communication channels, activities and settings used

8. applicability of the theory/model in the evaluation

9. extent to which the health behaviour change objective of the intervention/programme was met

10. evidence for effective interventions and programmes using theories/models of behaviour change to prevent communicable diseases

11. evidence for effective interventions and programmes using theories/models of behaviour change to control communicable diseases

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[1] Excluding those described on ECDC's website as prevalent only outside Europe (see Section 2.2 'Types of interventions').

1.2 Review structure

This review adheres to a standard systematic review structure. Section 2 describes the research methods and outlines the research parameters and search strategy (see Appendix 1 for the review's protocol). It also includes a description of the inclusion/exclusion criteria used in the review, along with details of the data collection process and data analysis stage. The methodological limitations of the review are also included. The main findings are presented and discussed in Section 3, beginning with a summary of the evidence base (including countries, disease groups, models, study designs, quality). The results of the 61 included studies are also presented in a matrix which displays details of the studies according to research objectives. Some studies are reported in more than one paper and therefore studies are named according to lead author and publication date. The findings are then presented and analysed according to research objectives 1—8 detailed above. As the results for the research objectives 6 and 7 overlapped, these objectives were combined. Section 4 focuses on the 21 higher-quality studies used to analyse research objectives 9, 10 and 11 (a synthesis of best evidence). Finally, the section concludes by discussing the strengths and limitations of the evidence base. Section 5 summarises the strategic implications and recommendations from the evidence, examining current practice and evidence of effectiveness and looking at promising potential practice and suggestions for future research.

2. Methods

2.1 Background

Systematic reviews are designed to be comprehensive, transparent, and replicable, and to minimise selection bias. These methods are intended to capture and synthesise the research evidence to meet the pre-specified research objectives. Systematic reviews therefore follow a detailed protocol, specified in advance (see Appendix 1 for this review's protocol) and fully document all steps and decisions involved in the process [5–6]. This section outlines how academic studies evaluating interventions using behaviour change theories or models towards the prevention or control of communicable diseases were identified, analysed and appraised, then combined into a narrative synthesis to address the objectives.

2.2 Criteria for considering studies for the review

Types of literature

Studies published in a peer-reviewed journal in English were eligible for inclusion. Conference abstracts published in a peer-reviewed journal are likely to contain too little information to be included. However the conference abstracts found via the search strategy were assessed using the same inclusion criteria. Studies published as reports by governments or health agencies were also eligible. Theses, web pages and journal articles that had not been accepted for publication by a journal were excluded. In terms of the date of studies, those published in the last 10 years were eligible for inclusion (January 2001 to October 2011). Based on investigations by Glanz et al. [4] into theory use in published health research, a range of theoretical formulations relating to health behaviour were used during this period.

Types of studies

The types of studies suitable for inclusion were outcome evaluations using experimental or quasi-experimental designs. Cross-sectional studies that evaluated an intervention were excluded from the review as the study design cannot demonstrate whether the exposure to the intervention preceded the outcome measured by the study. Measured and reported data were required to include a behavioural precursor, or a behavioural outcome.

Types of participants

Human populations of all age groups were eligible for inclusion.

Types of interventions

The evaluated intervention, programme, strategy, action plan, national policy or campaign must have:

*   aimed to change an individual's or a community's health behaviour
*   aimed to prevent and/or control a Europe-relevant communicable disease, or group of diseases, and
*   used a theory or model of behaviour change.

The list of communicable diseases was generated from the 'Health Topics' list on ECDC's website[2] by examining the information given in the hyperlink for each term, and excluding those described on the website as prevalent outside Europe only. These health topics, diseases, viruses and vectors are listed at the beginning of the search strategy in Appendix 2. Interventions using theories and models of behaviour change only aimed at preventing or controlling HIV/AIDS, and those only targeting unsafe sexual behaviour were excluded from the review. At the time of the review's protocol development, eight rigorous English-language reviews were identified that examined HIV and STI prevention and risk reduction, including contraceptive use (published between 2005 and 2010; see Appendix 1 for further details). Also, from the initial literature scoping exercises, a high volume of interventions targeting HIV and unsafe sexual behaviour from academic and grey literature sources appeared not to be culturally relevant to Europe. Screening these would have used much of the project's resources and may have skewed the report findings. Other blood-borne infections (hepatitis B and hepatitis C) are included in the scope of this review however, as infection can occur through other types of unsafe behaviour. Interventions to prevent or control human-to-human and animal-to-human disease transmission were eligible for inclusion, however animal-to-animal disease transmission was excluded.

To be included in the review, the intervention must have been based, according to the article's authors, on a behaviour change theory or model. A comprehensive handbook entitled 'Health Behavior and Health Education: Theory, Research, and Practice' by Glanz, Rimer and Viswanath [1] was used as the definitive source of eligible

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[2]The Health Topics list is available at: http://www.ecdc.europa.eu/en/healthtopics/Pages/health_topics_disease_group.aspx

theories and models.[3] If the theory or model was described in this book, the study was eligible for inclusion. In the study, theory-based interventions could have been compared with another intervention based on the same theory; an intervention based on a different theory; an intervention not based on a theory/model, or standard practice. These studies are reported even if there was no difference in effect sizes or if effect sizes could not be explained by any differences in the intervention's theoretical basis.

It was not necessary for the intervention to include a health communication component to be considered eligible for the review.

Types of outcome measures

As the main focus of the review was a change in behaviour rather than what behaviour was being changed, many proxy outcome measures of risk and protective behaviour were relevant. We expected to include measures of information-seeking rates; screening rates; vaccination/immunisation uptake; prescription rates; medication adherence or other programme adherence rates (e.g. food safety practices, hand washing); injection risk behaviour; purchase or use of protective equipment (e.g. insect repellents, face-masks, antibacterial soaps, mesh screens, disinfectant); plus other behavioural outcomes as defined in individual studies. In addition, measures of beliefs and attitudes towards behaviour and subjective norms associated with behaviour were also relevant.

Biomedical indicators of the prevalence of a communicable disease and mortality rates due to a communicable disease, as the ultimate target of the interventions, were recorded where these were reported as a study outcome.

2.3 Search methods for identification of studies

To identify relevant studies published in peer-reviewed journals, searches were run in electronic academic literature databases from the fields of public health, medicine, psychology and social sciences and on the websites of relevant organisations. Groups of search terms were developed into a search strategy which combined communicable disease terms (e.g. the names of infections, vectors and disease groups) with behavioural terms, intervention terms and study design terms. See Appendix 2 for an example search strategy. The bibliographic data held in each database about an article (generally its title, abstract, keywords) were searched for instances of the search term combinations.

The strategy was adapted to run in the search terminology and indexing structure of 12 electronic databases containing academic literature. Searches were run from 5—11 July 2011. Selected terms from the strategy were used to search 14 relevant open-access websites containing published research between 29 August and 10 September 2011. Finally, a series of general internet searches were made using selected terms in the Google search engine. (See Appendix 3 for a list of the databases, websites and a sample Google search).

One aspect of the search strategy that deviated from the original protocol was that journals containing the largest number of relevant studies were not searched manually to identify further relevant studies. The manual searching of full text journals is regarded as a safety-net to catch any studies which may have been missed. Most of the journals that contained relevant studies in our final set were indexed in more than one academic database, so it was unlikely that indexing would be incorrect for a study in multiple databases. Our website and Google searches acted as a sufficient safety-net. The bibliographies of recent reviews identified at the scoping and protocol development stage were also checked for further studies.

Storage

Search results were imported from the databases and websites into the EPPI-Reviewer 4 reference management database [7] and duplicates were removed. The database recorded the bibliographic details of each study considered by the review, where and how studies were found and reasons for their inclusion or exclusion. Electronic copies of journal articles were uploaded to the database for screening and storage. The software was also used for the subsequent data extraction and quality appraisal of the included studies. A record of the total number of studies included at each stage of the review is summarised as a flow chart in Appendix 4. Thirteen citations that passed the title and abstract screening stage were unobtainable in full text versions for further screening by 31 October 2011 (listed at the end of the References section).

Free-text search strategy

During the developmental stages of this review, it was expected that search terms related to behavioural change theories and models (e.g. model$, theor$, framework$, construct$ and specific theory names) would be used as search terms. To test this method, the included studies from a selection of systematic reviews of theory-based intervention studies were looked up in the Medline database to examine how they were indexed.

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[3] Currently in its fourth edition (2008), this book has been translated into numerous languages and is used around the world. According to the authors: 'No single book can be truly comprehensive … We acknowledge that there is substantial variability in the extent to which various theories and models have been codified, tested, and supported by empirical evidence. Of necessity, some promising emerging theories were not included' (p. xxiii).

If the theory terms had been a prerequisite of the search fewer than half would have been identified, as the theory or model was only mentioned in the full text of the article, rather than in its title, abstract or keywords. For this reason, behavioural change theory and model terms were not used in the initial search strategy. Consequently, the reviewers anticipated that a significant number of studies could only be included or excluded after full text screening, as it was unlikely that the title and abstract alone would be sufficient to indicate whether a study was based on a behaviour change theoretical construct. After the title and abstract screening, a large number of articles (n=1 273) required full text screening to establish a theoretical basis. The EPPI-Reviewer 4 software facilitates a free-text search of uploaded electronic journal articles (PDFs) allowing the entire text of a journal article and any other data in the record to be searched [8] (EPPI-Centre, 2011). Thus a second search strategy was devised of behaviour change theory and model terms and relevant authors' surnames (see Appendix 5). A number of articles were only available in paper format (n=79); the full text and reference lists of these articles were read by one reviewer and assessed for inclusion (see 'Selection of studies' below).

Selection of studies

During the first stage of study selection, four reviewers independently screened the titles and abstracts of the studies stored in the database against the inclusion criteria to identify potentially relevant studies. A random sample of 100 records was used to test inter-rater consistency. There was 89% agreement, and after discussions between the four reviewers, the disagreements and any misunderstandings about the inclusion criteria were resolved. Potentially relevant studies identified at this stage were obtained in full text. This was followed by the free-text searches described above to identify papers that included a behaviour change theory or model. Two reviewers independently screened these full text studies for relevance and eliminated any that did not meet the inclusion criteria. Any disagreements in studies selected for inclusion were resolved by discussion among the review team. Those studies remaining after the full text screening were included in the review (see flowchart in Appendix 4).

2.4 Data collection and analysis

Quality and risk bias assessment

Assessment of the strengths and weaknesses of studies included in a systematic review give an indication of the strength of evidence provided by the review. The quality appraisal stage assesses whether the results of studies have been unduly influenced by the study design, other risks of bias and the degree to which this has been controlled or adjusted for in the analysis. This stage also assesses a study's conduct and its generalisability (external validity). In a change from the protocol, the proposed NICE [86] quality appraisal checklists were replaced. An alternative quality appraisal tool was identified and successfully applied to a related review [9]. Glynn's 'Critical Appraisal tool' [10] was developed for library and information sciences and is one of the few tools in a peer-reviewed publication designed to apply to all research designs [11]. A recent review of critical appraisal tools found that few tools have undergone reliability testing, including Glynn [10]. However, Glynn has undergone content validation and its creator provides an explanation for its development and a comprehensive guide for its use [11]. For each included study, Glynn's Critical Appraisal tool was applied to provide a validity score for its population/sample, data collection, design, results and overall validity[4]. Three reviewers independently completed an inter-rater consistency test for the critical appraisal on 15% of the included articles. Sufficient agreement and understanding of the tool enabled two reviewers to complete half each of the remaining studies. As publication in a peer-reviewed journal was an inclusion criterion, no studies were excluded on their quality rating. An overall validity threshold score of ≥75% was used to denote high-quality studies.

Publication bias must also be considered in the analysis and interpretation of results in the evidence base and in this review. Publication bias refers to the over-reporting of studies which produced statistically significant results and the under-reporting of studies which found no or negative effects, resulting in a non-random sample of available studies.

Data extraction and synthesis

Data extraction tables captured the relevant information for the review in a concise format for each included study (see Appendix 6). Using a sample of three studies, three reviewers piloted the data extraction tool, resolved discrepancies and refined the tool. Data extraction for the rest of the studies included was divided between four reviewers. A second reviewer independently checked the data extraction tables for accuracy and completeness.

After examining the completed data extraction tables, it was concluded that, although the studies shared general aims of prevention and/or control of communicable diseases, they were heterogeneous in their specific aims, target population, settings, outcome measures and quality. For this reason, a meta-analysis was not appropriate, and a narrative data synthesis was created to structure the evidence for the research objectives outlined in Section

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4 Glynn's Critical Appraisal tool uses a checklist format with 28 questions requiring either Yes/No/Unclear/Not Applicable as an answer. The final validity score for a study is based on the percentage of 'Yes' answers. Comprehensive guidance for applying the tool is provided in Glynn 2006 [10].

1.1. The full sample of 61 studies was used to address research objectives 1 to 8. A narrative synthesis of best evidence, using only the studies rated as high quality (i.e. high overall validity) at the critical appraisal stage was applied to examine research objectives 9 to 11. For a description of each health behaviour change model and theory identified and included in the review see Appendix 7.

Methodological limitations

As detailed above, a pragmatic decision was made to deal with the high number of full text articles that required assessment to determine whether they had a relevant theoretical basis. Some of the PDFs of studies uploaded to the EPPI-Reviewer database may have contained image-only data (e.g. a scanned copy of an article) rather than a text-searchable PDF. It is possible that relevant studies containing their theoretical basis in the full text and not the title, abstract or keywords could have been missed by the free-text search and inadvertently excluded. Moreover, papers were not systematically examined for links with other papers at any stage, although some of the studies included were picked up this way. It is a limitation of our search strategy that theory-based studies excluded for containing only cross-sectional data could have been formative research for studies with comparator data published in a second paper. However, they were excluded as they did not mention theory.

The review relies only on what was presented in the journal article, which is relevant to assessment against inclusion criteria (i.e. stated, not implied, use of theory) and the quality appraisal (i.e. the study's validity is based on information in the journal article only). This method was clearly stated in the protocol of the systematic review.

3. Results

3.1 Summary of studies included

Sixty-one studies were included in the review after all the rounds of criteria screening had been completed. Twenty-one of the included studies scored ≥75% for overall validity in the assessment of study quality (using Glynn's critical appraisal tool) [10]. The lowest overall validity score was 33% and the highest 100%, with a mean overall validity score of 68%. The matrix in Figure 2 below summarises the 61 studies included and identifies those rated as high quality. The 61 studies are used to meet research objectives 1 to 8 (Sections 3.2 to 3.8).

The majority of the studies included, just over half, were randomised controlled trials (n=32), including one cluster randomised controlled trial. Before-and-after studies (using the same sample after the intervention) represented the second largest group with 19 studies. There were five non-randomised controlled trials and three before-and-after studies (using different samples after the intervention). One randomised trial with no control group and one interrupted time series study design were also included. There were no cohort/longitudinal studies included in the review.

Countries covered

There was no geographical limit for studies included. Diseases only prevalent outside Europe were excluded, however the full text had to be available in English for pragmatic reasons. The resultant output reflected this criterion: there were studies from around the world, but predominantly from countries where English is the main language. The majority of studies (three-fifths) were conducted in North America (n=38,), with 34 from the United States and four from Canada (see Figure 1). Nine studies came from Europe (four from the United Kingdom, two from the Netherlands and one each from Sweden, Ireland and Moldova). Four studies were from Australia and four were from Africa (one each from Egypt, Nigeria, South Africa and Zambia). Two studies came from the Middle East (Israel and Iran), two came from southern Asia (India and Bangladesh) and two were from Central America (Puerto Rico).

Figure 1. Geographic origin of studies

Legend: North America, Europe, Australia, Africa, Middle East, Southern Asia, Central America
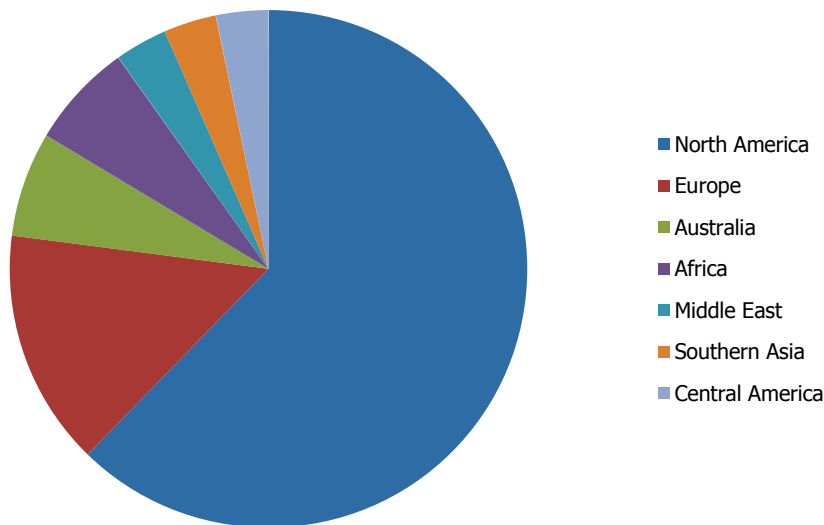
Disease groups targeted

The 61 studies included were categorised into six disease groups according to the disease targeted. Thirty-four studies targeted more than one disease group, including one which targeted three groups. Four of the six groups were targeted by at least 10 interventions. The respiratory tract infections group was the most frequent, occurring in 28 of the 61 studies. The 'Vaccine preventable diseases and invasive bacterial infections' group was targeted in 19 studies, as was the 'Blood-borne diseases and STI' group. Ten studies targeted the 'Food- and waterborne diseases and zoonoses' group. Less commonly targeted were diseases in the 'Antimicrobial resistance and healthcare-associated infections' group (n=4) and the 'Emerging and vector-borne diseases' group (n=3).

Behavioural change theories and models used

All the included studies explicitly used interventions based on or informed by a behaviour change theory or model, and in a quarter of studies (n=18) multiple theories or models were used (with a range of two to five other theories or models). Studies that simply mentioned a theory or model in relation to the intervention, with no further detail on its application, were used to address research objective 2 (Section 3.3). Studies that described using a theory or model in the design or evaluation of an intervention were used to address research objective 3 (Section 3.4).

The Health Belief Model was the most commonly occurring behaviour change model in the review. It featured in 26 of the 61 studies: it was mentioned in only 19 studies and described as specifically informing the intervention design or evaluation in seven studies. Social Cognitive Theory (Social Learning Theory) was the next most frequent, appearing in 14 studies (only mentioned in 13 studies and informing the design or evaluation of one study). The Theory of Planned Behavior was involved in eleven studies (only mentioned in five studies and informing the design or evaluation of six studies) and Stages of Change (Transtheoretical) Model informed the design or evaluation of eight studies. The Theory of Reasoned Action was mentioned in six studies (only mentioned in four studies and informing the design or evaluation of two studies). Diffusion of Innovations featured in five studies (only mentioned in two studies and informing the design or evaluation of three studies); and the PRECEDE-PROCEED planning framework featured in four studies (only mentioned in one study and informing the design or evaluation of three studies). Five multi-theory studies included theories which were not indexed in the review's reference handbook [1] (Glanz et al. 2008) and two studies mentioned new models synthesised from multiple theories. Eight theories and models only featured in one study each. Three were only mentioned once: the Community Organization Locality Development Model, the Precaution Adoption Process Model and the Behavioral Ecological Model; and five informed the intervention design or evaluation: the Integrated Behavioral Model, the Precaution Adoption Process Model, the Common Sense Model, the Transactional Stress and Coping Model and a social ecological model.

Figure 2. Matrix summarising the 61 studies included and identifying those rated 'high-quality'

STUDY	Abou-Saleh 2008	Adeneye 2007	Boom 2008	Britto 2006	Campbell 2009	Cebotarenco 2008	Colon 2009	Conner 2011	Cox 2010	Creedon 2005	Crosby 2008	Daltroy 2007	Dempsey 2006	Ferguson 2010	Francis 2009	Garrard 2006	Gerend 2009	Grigis 2011	Gik 2004	Gonzales 2006	Gottvall 2010	Hoffman 2005	Hovell 2003	Janmeja 2005	Jenks 2005	Jurasckova 2011	Knittel 2010	Larson 2009	Latka 2008	LaVela 2008	Lewin 2005	Lloyd 2009	Looijmans. 2010	Luby 2010	Maunder 2010	Mayor 2010	McCaul 2002	Mertz 2010	Mullan 2010	Nevo 2010	Nyamathi 2007	Nyamathi 2010	Painter 2010	Pooya 2006	Quick 2002	Quinley 2004	Reynolds 2008	Rosen 2009	Samore 2005	Schensul 2009	Slaunwhite 2009	Taylor 2011	Trepka 2008	Turnbull 2001	Updegraff 2011	Vet 2011	White 2001	White 2005	York 2009	Zerr 2005	Zimmerman 2003	TOTALS
QUALITY SCORE (high ≥ 75%)	63%	46%	74%	63%	76%	61%	57%	75%	74%	71%	44%	71%	78%	57%	88%	50%	75%	48%	64%	54%	68%	65%	75%	61%	65%	64%	54%	70%	77%	65%	100%	54%	71%	79%	76%	68%	64%	57%	75%	71%	76%	72%	44%	33%	79%	73%	62%	79%	80%	73%	50%	78%	79%	89%	83%	76%	64%	79%	61%	70%	67%	
DISEASE GROUP																																																														
Antimicrobial resistance & Healthcare-associated infections												Y																										Y		Y																					Y		4
Blood-borne diseases (incl. HIV & STI)	Y			Y		Y		Y		Y			Y		Y	Y		Y	Y	Y							Y	Y		Y						Y					Y												Y				Y					19
Emerging and Vector-borne diseases		Y												Y												Y																																				3
Foodborne & Waterborne diseases & Zoonoses																		Y				Y								Y					Y			Y				Y					Y							Y		Y	Y				10
Respiratory tract infections			Y	Y		Y		Y							Y	Y		Y					Y	Y				Y			Y	Y		Y	Y	Y		Y				Y			Y	Y	Y	Y				Y			Y	Y			Y		Y	28
Vaccine preventable diseases and Invasive bacterial infections			Y	Y		Y		Y										Y	Y					Y			Y			Y			Y		Y						Y				Y	Y						Y	Y			Y	Y			Y	19
THEORY/MODEL																																																													
Health Belief Model	Y					Y		Y	Y	Y						Y	Y	Y	Y	Y	Y			Y	Y				Y				Y		Y	Y		Y			Y	Y	Y									Y	Y			Y	Y	Y	Y	Y		26
Theory of Reasoned Action	Y							Y	Y																							Y																					Y								Y	6
Theory of Planned Behavior					Y							Y			Y												Y		Y						Y	Y																Y			Y			Y	11
Integrated Behavioral Model																																				Y																								1
Stages of Change (Transtheoretical) Model		Y		Y																				Y			Y						Y			Y			Y																				7
Precaution Adoption Process Model										Y																																																			1
Common Sense Model																												Y																																	1
Social Cognitive Theory (Social Learning Theory)	Y					Y							Y			Y			Y				Y						Y	Y				Y	Y					Y	Y	Y													Y				Y		15
Transactional Model/Coping model																																										Y																			1
Extended Parallel Process Model																												Y																																	1
Diffusion of Innovations			Y			Y															Y																														Y									Y	5
Community Organization (LDM)		Y																																																											1
PRECEDE-PROCEED									Y							Y												Y																								Y									4
Social Ecological Model																													Y																					Y										1
Behavioural Ecological Model																							Y																																						1
Other (not in Glanz et al. 2008)																		Y												Y		Y									Y							Y												5
Multiple synthesised to new model																																									Y																				2
MULTIPLE	Y							Y	Y		Y							Y					Y						Y	Y	Y		Y		Y						Y		Y					Y	Y	Y		Y			Y				Y		18
TARGET BEHAVIOUR																																																												
Immunization/Vaccination			Y	Y				Y	Y		Y		Y	Y			Y	Y	Y	Y							Y		Y		Y		Y	Y		Y				Y	Y		Y	Y		Y	Y			Y	Y		Y	Y			Y		Y		Y	27
Hand hygiene										Y								Y											Y					Y			Y		Y		Y							Y				Y			Y	Y	Y	Y	Y		13
Food preparation																		Y				Y														Y		Y													Y									6
Sharing/reusing injecting drugs equipment	Y				Y																								Y		Y																												5
Medicine regimen adherence																							Y	Y							Y															Y		Y											5
Reducing antibiotic use/prescribing						Y									Y														Y																	Y													4
Respiratory hygiene																														Y															Y										Y				4
Risky sexual behaviour					Y																Y								Y																														4
Health screening								Y				Y																																											Y				3
Modifying drug preparation IDU practices						Y																																																				2
Avoiding insect bites																	Y									Y																																	2
Safe tick removal																	Y									Y																																	2
Recognizing symptoms																	Y									Y																																	2
Water treatment																																																		Y								1
Cleaning/disinfection																		Y																																									1
Water storage																																																		Y								1
Organizational changes																Y																																										1
Drug treatment uptake		Y																																																								1
Stress resilience training																																																		Y								1
Tattoing/Body Piercings (unhygienic conditions)																																											Y															1
TARGET POPULATION																																																												
Health Care Workers			Y	Y		Y		Y					Y																		Y		Y		Y			Y		Y									Y			Y							Y		13
Parents				Y		Y						Y	Y	Y	Y															Y											Y							Y						Y						10
Adolescents					Y								Y				Y	Y	Y		Y									Y													Y							Y										8
GPs/Family Doctors		Y														Y																																			Y	Y		Y					Y	6
Injecting Drug Users	Y				Y		Y																				Y		Y																														6
Children												Y			Y														Y																									Y			Y		Y	5
Adults															Y																						Y							Y												Y		Y	5
College students																	Y									Y														Y																		Y			4
Infected individuals																						Y		Y																		Y																		3

Columns (studies): Abou-Saleh 2008, Adeneye2007, Boom 2008, Britto 2006, Campbell 2009, Cebotarenco 2008, Colon 2009, Conner 2011, Cox 2010, Creedon 2005, Crosby 2008, Daltroy 2007, Dempsey 2006, Ferguson 2010, Francis 2009, Garrard 2006, Gerend 2009, Girgis 2011, Glik 2004, Gonzales 2006, Gottvall 2010, Hoffman 2005, Hovell 2003, Janmeja 2005, Jenks 2005, Jurasckova 2011, Knittel 2010, Larson 2009, Latka 2008, LaVela 2008, Lewin 2005, Lloyd 2009, Loojimans. 2010, Luby 2010, Maunder 2010, Mayor 2010, McCaul 2002, Mertz 2010, Mullan 2010, Nevo 2010, Nyamathi 2007, Nyamathi 2010, Painter 2010, Pooya 2006, Quick 2002, Quinley 2004, Reynolds 2008, Rosen 2009, Samore 2005, Schensul 2009, Slauwwhite 2009, Taylor 2011, Trepka 2008, Turnbull 2001, Updegraff 2011, Vet 2011, White 2001, White 2005, York 2009, Zerr 2005, Zimmerman 2003, TOTALS

Category	TOTALS
TARGET POPULATION cont'd	
Young women	2
Immigrants to N. America	2
Young adults	2
Individuals on methadone treatment	1
Soldiers	1
Local population/community	1
Mothers of teenage girls	1
Veterans with Spinal Cord Injuries/Disorders	1
Homeless adults	1
MSM (men who have sex with men)	1
Restaurant workers (food production)	1
Bone Marrow Transplant Patients	1
Pregnant women	1
Infants	1
Older low income & minority ethnic adults	1
Pre-school teaching staff	1
Adolescent girls	1
Mothers of pre-school-age children	1
Young men	1
SETTING	
Health Centre/GPs practice	11
Private home	10
Hospital	7
School	8
University/College	6
Community	6
Specific Hospital Ward/Unit	4
Residential, Nursing or Care Home/Sheltered Housing	3
Drug treatment services	3
Training centre	2
Streets/Outdoors	2
Online	5
Needle exchange site	2
'Shooting galleries	1
Ferryboats	1
Military garrison/barracks	1
Homeless shelters	1
Restaurants	1
Cinema	1
Nursery school	1
COMMUNICATION CHANNEL(S)	
Classes/lectures	21
One-to-one conversation	17
Posters	17
Leaflets	16
Educational handout	12
Letters	10
Promotional items	9
Video/DVD/Film	8
Telephone	5
Website	8
Performances/Entertainment	3
Online training	3
Newsletter/Article	3
Demonstration	3
Workshop/Conference	2
Reminder in medical records	2
Mass media advertising	2
In-clinic reminders	2
Results postings	2
Questionnaires/Staff surveys	1
Email	1
'Champion' work colleague	1
Not specified	1
None	1

3.2 Communicable diseases and disease groups targeted by theory-based interventions

Respiratory tract infections group

The most common group of communicable diseases targeted by behaviour change theory-based interventions was respiratory tract infections. These types of infections were targeted in 28 of the 61studies [12–39].

Influenza was the most frequently mentioned respiratory tract infection, as well as the most frequently targeted disease overall, being the specific focus of 16 studies [12–15,18,21,22,24,26,27,29,31,34–36,39]. Tuberculosis was the specific intervention target in four included studies [19,20,23,28]. Other types of respiratory tract infections mentioned in the studies were respiratory virus [16,22,25] or upper respiratory tract infection [17,21,30,37], lower respiratory tract infection [32], acute respiratory infection [33] and upper respiratory illnesses [38].

Vaccine-preventable diseases and invasive bacterial infections group

Nineteen studies evaluated interventions targeting vaccine-preventable diseases and invasive bacterial infections [12-15,18,21,22,24,26,27,29,31,34,35,36,39,40,41,42]. Influenza is also classified as a vaccine-preventable disease and was targeted by 16 of the 19 studies [12-15,18,21,22,24,26,27,29,31]. One study [40] targeted 10 vaccine-preventable diseases, although it did not specify which diseases. One study [41] targeted invasive pneumococcal disease and one study [42] targeted measles.

Blood-borne diseases and STI group (including HIV)

The joint-second most common group of communicable diseases targeted by theory-based interventions was blood-borne diseases and STIs. These were featured in 19 studies which accounted for just under one-third of the total studies [43–60].

The most frequently targeted blood-borne diseases and STIs were human papillomavirus (HPV), which featured in seven studies [46-48,50,52,53,56] and hepatitis C virus (HCV) which was also the intervention target of seven [43-45,49,54,55,57]. The hepatitis B virus (HBV) was targeted in five studies [40,51,58,59,60]. HIV was targeted in four studies [44,45,54,55] and was targeted in combination with hepatitis C because studies which reported HIV as a sole intervention target were deemed ineligible for this review (see Section 2.2)

Food- and waterborne diseases and zoonoses group

Communicable diseases categorised as food- and waterborne diseases and zoonoses were the specific target of theory-based behaviour change interventions in ten of the studies [18,25,32,37,58,61–65].

General foodborne illness and foodborne pathogenic infection was the intervention target in four studies [61,62,64,65] whilst diarrhoea was targeted in three studies [25,32,63], one of which targeted both diarrhoea and *E. coli* [63]. Hepatitis A was the target in two studies [18,58] whilst gastrointestinal infection was cited as the intervention target in one study [37].

Antimicrobial resistance and healthcare-associated infections group

Only four of the interventions in the studies targeted antimicrobial resistance and/or healthcare-associated infections [66-69]. The interventions in two studies targeted general nosocomial (hospital-acquired) infections [66,68], one study intervention targeted methicillin-resistant *Staphylococcus aureus* (MRSA) [67] and one study intervention targeted rotavirus infection [69].

Emerging and vector-borne diseases group

The least frequently targeted group of communicable diseases among the studies was emerging and vector-borne diseases, targeted by interventions in three instances [70-72]. Two of the studies targeted Lyme disease, ehrlichiosis, and babesiosis [71-72], while one study targeted schistosomiasis [70].

3.3 Theory or model used to inform the intervention or programme

The models and theories used most often to inform the intervention or programme were those that model the health-related behaviour of individuals. Nineteen studies were informed by the Health Belief Model, taking into account perceived beliefs of the target audiences for the interventions. Nine studies were informed by individual motivational factors – four using the Theory of Reasoned Action and five using the Theory of Planned Behavior.

Models of interpersonal health behaviour examine the influence of the 'web of interactions people have with others within their social circles' [1, p.167]. Thirteen studies were informed by Social Cognitive Theory, or its earlier form of Social Learning Theory.

Three studies used community and group models of health behaviour. Two of these used the Diffusion of Innovations model to spread an intervention amongst a social group. A single study used a community organisation model, the Locality Development Model.

Finally, theoretical frameworks for planning health promotion were used by two studies to inform the intervention. The PRECEDE–PROCEED was mentioned by one study, and the Behavioral Ecological Model by another.

The majority of studies mentioned a single theory or model only. Ten studies used more than one theory to inform the intervention. Although many of the models may comprise a combination of theories, for this analysis we are using a named model as a single unit. Combinations differed:

- Seven combined constructs from two theories to inform an intervention [17,19,23,33,36,40,57]; two combined from three theories [43,59] and one used constructs from four theories [71].

- One of the studies combined three theories to create a new theory [59].

- One used the Diffusion of Innovations framework for the process evaluation and to disseminate an intervention with unspecified mass communications theory to inform the health communication channel [40].

- Most of the studies that used the Theories of Reasoned Action and Planned Behaviour tended to use another theory or model too.

More details are given for each study and model, and any multiple combinations below. Unless stated otherwise, studies did not provide much detail beyond stating the fact that a theory or model informed the intervention or evaluation. (See Appendix 7 for more details about the range of theories and models, constructs and use.)

Health Belief Model

Nineteen studies indicated that the Health Belief Model was used to inform the intervention [16,18,27,30,33,36,37,40,42,43,51,52,57,59,61,64,68,71,72]. Seven of these studies mentioned using another theory or model in addition to the Health Belief Model [33,36,40,43,57,59,71], most often Social Cognitive Theory, or the related Theories of Reasoned Action and Planned Behaviour.

In these 19 studies, the Health Belief Model was used for a wide range of overlapping behaviour change interventions across the six disease groups. Seven studies used the Health Belief Model to inform interventions to increase immunisation or vaccination uptake for influenza, human papilloma virus, hepatitis B, measles and other vaccine-preventable diseases [16,18,27,40,42,51,52]. Five studies used the model to inform hand hygiene interventions with a range of populations [18,30,36,37,68] and four studies used the Health Belief Model to inform hygienic food preparation [18,61,57,64] in different settings. Three studies used the model to improve respiratory hygiene practices [30,37,57]. Two studies of Lyme Disease prevention used the Health Belief Model with a view to improving safe tick removal and recognising the symptoms of tick-borne diseases [71,72]. Two studies evaluated Health Belief Model-based interventions designed to modify unsafe drug preparation practices by injecting drug users in order to prevent and control hepatitis C [43,57]. A single study used the Health Belief Model in a community intervention to reduce antibiotic use and prescription among family doctors and parents [33]. Four studies specifically mentioned only using 'constructs' (or major components) of the Health Belief Model to inform the intervention [27,33,36,68]. Finally, only one study based on multiple theories of behaviour change (including the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior, Social Influence Theory and components of the PRECEDE framework) described combining them to create a new health behaviour framework as the conceptual model for their intervention to promote hepatitis B testing [59].

Theory of Reasoned Action

Four of the included studies mentioned using the Theory of Reasoned Action as part of the intervention [23,43,59,71]. In all four studies the Theory was used in conjunction with other theories. Three of these were with the Health Belief Model discussed above [43,59,71]. Meanwhile, the fourth study [23] used a training intervention for health clinic staff based on the Theory of Reasoned Action, Bandura's Social Learning Theory and a theory of self-efficacy to improve the health outcomes of patients with tuberculosis, mainly by improving adherence to the medicine regimen.

Theory of Planned Behavior

Five studies described the Theory of Planned Behavior informing the intervention [17,36,59,67,71]. Four of these used the theory in conjunction with other theories or models; three with the Health Belief Model [36,59,71] and one with Social Cognitive Theory [17]. Two studies used the Theory of Planned Behavior to inform interventions to improve hand hygiene behaviour to prevent or control MRSA [67] and influenza [36]. The Theory of Planned Behavior was mentioned for each of the following behaviour change interventions: avoiding tick bites, removing ticks and recognising Lyme Disease symptoms [71], reducing antibiotic use [17] and increasing hepatitis B screening for non-English speaking migrants to North America [59].

Social Cognitive Theory

Social Cognitive Theory, or its earlier version known as Social Learning Theory, was used to inform the intervention in 13 of the studies [14,17,19,23,26,31,33,40,43,57,60,69,71].

Of the thirteen studies which used Social Cognitive Theory, in seven cases it was used alongside another theory or theories, most often those focussed on the health-related behaviour change of individuals such as the Health Belief Model [33,40,43,57,71], the Theory of Reasoned Action and/or Planned Behaviour [17,23,40,43,71]. One study used the theory alongside a Behavioral Ecological Model [19].

A range of behaviour types were targeted for change via Social Cognitive Theory informed interventions, for diseases from almost all the disease groupings. Three studies aimed to increase immunisations: Glik [40] and Reynolds [31] based education interventions on Social Cognitive Theory to increase influenza immunisations and Vet [60] used Social Cognitive Theory to inform a website intervention using role models to increase hepatitis B vaccinations. To reduce the prescription of antibiotics in order to decrease antimicrobial resistance, three studies used Social Cognitive Theory in their interventions [14,17,33]. Two studies aimed to reduce hepatitis C infection through one-to-one sessions with a healthcare professional based on Social Cognitive Theory [43,57], (see also [55] described below). A training intervention used Social Cognitive Theory's self-efficacy construct to increase stress resilience among healthcare workers during influenza pandemics and reduce hospital staff absenteeism [26]. The authors hypothesised that a healthcare worker's expectations of their personal ability to respond adaptively to stress caused by a pandemic (self-efficacy), is a proximal predictor of their behaviour in that situation. Zerr's [69] intervention to improve hand hygiene among hospital healthcare workers used the Social Cognitive Theory elements of education, role models and demonstrations of alcohol hand gel application to increase workers' confidence in using it effectively (self-efficacy). Educational performances on ferries, informed by Social Cognitive Theory, modelled self body searching for ticks and their effective removal to increase the spectators' confidence in tick removal to prevent Lyme disease [71]. Finally, both Hovell [19] and Lewin [23] used Social Cognitive Theory to improve adherence to tuberculosis medicine regimens.

Locality Development Model

One study used the Community Organisation Locality Development Model in a mass treatment for schistosomiasis infection in a community [70]. The model's constructs used in the intervention were: empowerment, community competence, participation, group consensus, and selection. The behaviour change of interest was treatment uptake for the infection.

Diffusion of Innovations

Two studies used the Diffusion of Innovations theory to inform the intervention. Glik [40] used the theory for a process evaluation, measuring the adoption across the country of their Health-Belief-Model-and-Social-Cognitive-Theory- based educational intervention to increase immunisation among schoolchildren. Slaunwhite [35] used the opinion leadership construct from the Diffusion of Innovations theory as the basis of the study's intervention. A degree of 'opinion leadership' is used in the theory as an indicator for the adoption of new behaviour. An opinion leader or hand-washing 'champion' was selected to promote hand hygiene and hand-washing techniques among their peers.

PRECEDE—PROCEED model

One of the studies used elements of the PRECEDE—PROCEED model to inform the intervention. Taylor's [59] educational intervention to increase hepatitis B screening was informed by multiple models, including the PRECEDE planning model, the Health Belief Model and the Theories of Reasoned Action and Planned Behavior.

Ecological models

One study used an ecological model of health behaviour change to inform the intervention. An intervention to increase medicine adherence among Latino adolescents in California with latent tuberculosis infection was based on a Behavioral Ecological Model and Social Learning Theory [19]. University students were coached to deliver the intervention to adolescents in their homes or over the telephone.

3.4 Theory or model used in the intervention design

The models and theories used most often in the intervention design or its evaluation were those that target individuals' health-related behaviour. The interventions in seven studies were informed by the Health Belief Model, using or measuring perceived beliefs. Nine studies were informed by individual motivational factors – two by the Theory of Reasoned Action, six by the Theory of Planned Behavior and one using constructs from both these theories in an Integrated Behavioral Model. The Common Sense Model, which emphasises the role of an individual's emotions in decision making, was used in one study.

Use of the Transtheoretical Model, also referred to as the Stages of Change Model, was mentioned in eight studies, and one study used it for both the intervention design and its evaluation. One study reported that another stage-based model, the Precaution Adoption Process Model, was used to design its intervention.

Models of interpersonal health behaviour examine the influence of social interactions. One study's intervention design was informed by Social Cognitive Theory, one used the Transactional Model of Stress and Coping as its theoretical framework and one design was informed by the Extended Parallel Process Model. Three studies used the community and group model of health behaviour, Diffusion of Innovations, to design an intervention to be spread among a social group.

Finally, theoretical frameworks for planning health promotion were used by four studies. The PRECEDE–PROCEED was mentioned by three studies to design and evaluate an intervention, and one study used the Social Ecological Model.

The majority of studies mentioned a single theory or model only. Eight studies used more than one theory to develop or evaluate the intervention. Although many of the models may comprise a combination of theories, for this analysis we are using a named model as a single unit. Combinations differed:

- Seven combined constructs from two theories to design or evaluate an intervention [22,24,29,32,48,55,58]; and one combined three theories [59].

- Two of these studies combined theories to create a new framework [58,59].

More details are given for each study and model, and any multiple combinations below. Unless stated otherwise, studies did not provide much detail beyond stating the fact that a theory or model informed the intervention design or evaluation. (See Appendix 7 for more details about the background, constructs and use of the theories and models.)

Health Belief Model

Intervention design

One multi-theory study described using the Health Belief Model and the Theory of Reasoned Action and/or the Integrated Behavioral Model (based on elements of the Theory of Reasoned Action and the Theory of Planned Behavior in the design of the intervention [29]. Constructs of the Health Belief Model (perceived susceptibility, severity, benefits and barriers, cues to action and self efficacy) and from the Integrated Behavioral Model/Theory of Reasoned Action (social norms) were 'translated' into an educational intervention using a brochure and performances ('skits') to increase adolescent influenza immunisations. For example, the 'perceived severity' construct, was translated for this intervention as 'parents and adolescents must feel that the consequences of influenza are serious' [29, p.46S]. Thus the brochure and skits interventions provided information about the seriousness of influenza.

Evaluation of the intervention

Six studies described using the Health Belief Model 'constructs' as part of the study design to evaluate the behaviour change intervention [24,32,46,48,50,53]. Four studies used psychological constructs from the Health Belief Model to measure perceived acceptability [50]; vulnerability and severity [46]; severity, benefits and barriers [48]; and perceived susceptibility, severity, benefits, barriers and cues to action [53] towards the HPV vaccination post-intervention. Measured outcomes, including the hand washing beliefs of staff, in Rosen's [32] evaluation of a nursery-school hand hygiene intervention were based on Health Belief Model and Theory of Planned Behavior constructs. Finally, Looijmans-van den Akker [24] measured the same five Health Belief Model constructs as Juraskova [53] but for an influenza vaccination intervention.

Theory of Reasoned Action

Evaluation of the intervention

Two of the studies used the Theory of Reasoned Action to evaluate their intervention, Dempsey [48] used constructs from the Theory of Reasoned Action (alongside those from the Health Belief Model) to assess parents' motivation to comply with the preferences of their peers and physicians in relation to the HPV vaccination for their children. Secondly, an evaluation of an intervention to increase adult influenza vaccinations used the Triandis model for consumer decision-making, based on the Theory of Reasoned Action, to measure behavioural intention. Constructs for this included attitude about the activity (e.g. belief that getting a flu shot is wise), social influences (e.g. physician or family member recommends the flu shot) and the consequences of the activity (e.g. the flu shot prevents flu) [39, p.1700].

Theory of Planned Behavior

Intervention design

Three studies described the use of the Theory of Planned Behavior in formative research with the target audience to design the intervention. Looijmans-van den Akker's [24] intervention aimed to increase influenza vaccination uptake amongst nursing homes healthcare staff. Qualitative research with the target population was conducted using a discussion guide based on the Theory of Planned Behavior to examine determinants of influenza vaccination at their workplace. The behavioural and organisational determinants from this assessment informed the multi-faceted intervention. Lavela's [22] intervention consisted of a multimedia educational message to improve knowledge, attitudes and vaccination intentions regarding influenza and pneumococcal immunisation among people with spinal cord injuries and disorders. The content of the educational message was developed using the Theory of Planned Behavior (and the Extended Parallel Process Model), and by using the insights gained on self-efficacy and subjective norms through conducting focus groups with people with spinal cord injuries and disorders. York's [65] intervention to improve food preparation and hand hygiene behaviour identified Theory of Planned Behavior attitudinal constructs of the barriers and negative attitudes relating to food safety behaviour in focus groups following food safety training in order to develop the Theory of Planned Behavior-based intervention.

Evaluation of the intervention

Two studies described using the Theory of Planned Behavior as the single theory informing the evaluation of their interventions. Two questionnaires used in Conner's [15] intervention to improve health screening and influenza vaccination rates amongst healthcare workers were based on the Theory of Planned Behavior and measured respondents' attitudes, subjective norms, perceived behavioural control and intentions. Mullan [62] used the same Theory-of-Planned-Behaviour variables to evaluate a safe food handling intervention for university students. One study [32] evaluated a nursery-school hand-hygiene intervention using a questionnaire based on the Theory of Planned Behavior and constructs from the Health Belief Model.

Integrated Behavioral Model

Intervention design

Painter's [29] intervention was designed using a combination of models (the Integrated Behavioral Model in conjunction with the Health Belief Model).

Transtheoretical Stages of Change Model

Eight of the studies used the Transtheoretical Model, sometimes called the 'Stages of Change' model or theory [12,20,25,41,44,54,58,63], as the single behaviour change theory used in all cases. According to this model, behavioural change can be explained as progressing (or changing) through six steps: pre-contemplation; contemplation; preparation; action; maintenance; and termination (see Appendix 7).

Intervention design

Five studies used the Transtheoretical Model in their intervention design. Three studies used one-to-one motivational interviewing techniques based on stages of change theory to change participants' behaviour. One to increase adherence to tuberculosis medicine regimen [20], another to increase the uptake of hepatitis A and B vaccines among individuals on methadone treatment [58], and the third to prevent diarrhoea through a household water storage intervention [63]. Boom's [12] study designed a professional development curriculum around the Transtheoretical Model in order to move healthcare workers through the 'readiness-to-change' stages to increase the number of patients in their practices being immunised against vaccine-preventable diseases. Similarly, the hand-washing promotion intervention in Luby's [25] study was designed to move people along another stage of change with each session.

Evaluation of the intervention

Four studies used the Transtheoretical Model in their data collection tool to evaluate the intervention. The model was used to measure whether participants had progressed along the stages of change in the desired direction or not. Three of the studies were with injecting drug users or methadone users and aimed to prevent or control blood-borne diseases and STIs [44,54,58]. The fourth study assessed whether health centres had improved their vaccination rates for invasive pneumococcal disease after the intervention [41].

Precaution Adoption Process Model

Intervention design

A single study included in the review designed its intervention using the Precaution Adoption Process Model. The aim of the clinic-based intervention in Crosby's [47] study was to encourage adolescent girls who had tested positive for an oncogenic strain of human papillomavirus to adopt protective behaviour, receive the HPV vaccine, obtain regular cervical screenings and practice safe sex. A brief assessment was made by the family doctor as to the girl's 'readiness' to adopt or maintain such protective behaviour. The ensuing discussion was tailored according to this assessment.

Common Sense Model

Intervention design

A single study used the Common Sense Model in its formative research to develop an information leaflet about HPV for adolescent girls [56]. A thematic analysis of qualitative research with women about testing and vaccinations for HPV was mapped to constructs of the model, then used in the leaflet evaluated by the study.

Social Cognitive Theory

Intervention design

One study used Social Cognitive Theory and the Information, Motivation, and Behavioural skills model[5] in the design of its peer education intervention for young injecting drug users to prevent hepatitis C and HIV infection [55]. The peer education sessions were developed following discussions among experts focussing on 'domains that were hypothesized to be theoretically related to behavior change in the outcomes of interest (sex risk and injection risk)' [55, p.S75]. Sessions included traditional Social Cognitive Theory activities such as skills building, role playing and practice, and were piloted with the target audience and revised following focus group discussions.

Transactional Stress and Coping Model

Intervention design

One study used a new model based on the Transactional Stress and Coping Model and the Health Seeking Paradigm[6], called Comprehensive Health Seeking and Coping Paradigm. This new theoretical framework was used in the design of an intervention to strengthen the personal and social environment of the homeless adult participants to increase tuberculosis medicine regimen adherence [28].

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[5] This model is not indexed in the handbook by Glanz et al. (2008)

[6] This model is not indexed in the handbook by Glanz et al. (2008)

Extended Parallel Process Model

Intervention design

One study used the Extended Parallel Process Model to design its intervention alongside the Theory of Planned Behavior [22]. The aim was to design an educational intervention to positively influence intentions and beliefs regarding influenza and pneumococcal vaccinations for veterans with spinal injuries. From the Extended Parallel Process Model, the intervention helped the target audience to make a 'threat appraisal' (of catching an infection) and an 'efficacy appraisal' (self-belief and belief in the message) in order to change vaccination behaviour.

Diffusion of Innovations

Intervention design

Three studies used Diffusion of Innovations interpersonal theory in their intervention design [13,38,45]. In the study by Britto [13], the theory's criteria were used to diffuse a successful pilot immunisation programme to other clinics. Colon [45] developed a pilot intervention to make drug preparation practices among injecting drug users safer. Using the diffusion theory, they aimed to measure the rate of early adoption of the practices. Finally, in a study to improve hand hygiene around a university campus, White [38] used the theory's stage of adopting a new behaviour to guide the development of health messages for a poster campaign.

PRECEDE—PROCEED model

Intervention design and evaluation

Three of the included studies used the PRECEDE–PROCEED model, or elements from it, in the development and evaluation of the interventions [21,49,66]. Two intervention planning constructs from the PRECEDE framework were used in the design of Creedon's [66] hospital ward hand hygiene intervention: an assessment of the behavioural determinants (from phase 2 of the framework) and the educational determinants (from phase 3 of the framework) of the behaviour change intervention. Garrard's [49] intervention used the PRECEDE–PROCEED planning framework to facilitate translating hepatitis C research into clinical practice treatment protocols. The study particularly focused on the following five phases of the framework: educational assessment (phase 3), administrative assessment (phase 4), implementation (phase 5), process evaluation (phase 6) and impact evaluation (phase 7). In an intervention to change respiratory and hand hygiene behaviour, and to reduce the use of antibiotics among a population of recent immigrants from Latin America to New York City, Larson [21] required culturally-specific educational materials. The researchers used the educational assessment phase (phase 3) of the PRECEDE–PROCEED framework to identify materials that would address predisposing, reinforcing and enabling factors towards adopting the behaviour.

Ecological models

Intervention design

One of the studies used an ecological model of health behaviour change to design an intervention. Schensul's [34] study aimed to increase influenza immunisation amongst a residential community of older low income and minority ethnic adults. The study used the Social Ecological model as a theoretical framework to examine nested influences. This enabled the selection of 'committed and pro-active representatives at the micro (family, peer group), meso (committees, service organizations), exo (larger mediating agencies and institutions and alliances) and macro (policy, legislative) levels' [34, p.31]. The selections were matched with identified appropriate interventions for each of the four levels.

3.5 Populations targeted/segmentation

The interventions in the 61 studies included in the review targeted a wide range of populations. The most frequently targeted population type, in just over one-fifth of the studies (n=13), was healthcare workers [12,13,15,23,24,26,31,35,49,66–69].

Parents were also a frequently targeted population, featuring in ten studies [13,14,16,17,21,25,33,42,48,71]. Adolescents were targeted by eight studies [19,29,40,45,51,52,55,71], and general practitioners/family doctors [12,17,31,33,39,41] and injecting drug users [43,44,45,54,55,57] were the focus of six studies each. Children [17,21,37,47,64,37] and adults [16,27,36,39,63] were the focus of five studies each. College students were targeted in four studies [38,50,53,62] and infected individuals were the target population of three studies [20,57,61]. Young women [47,53], immigrants to North America [59,72] and young adults [51,55] were target populations in two studies each.

There were a range of other groups which were the target of a single study and these are detailed in Figure 3.

Figure 3. Targeted populations in terms of number of interventions
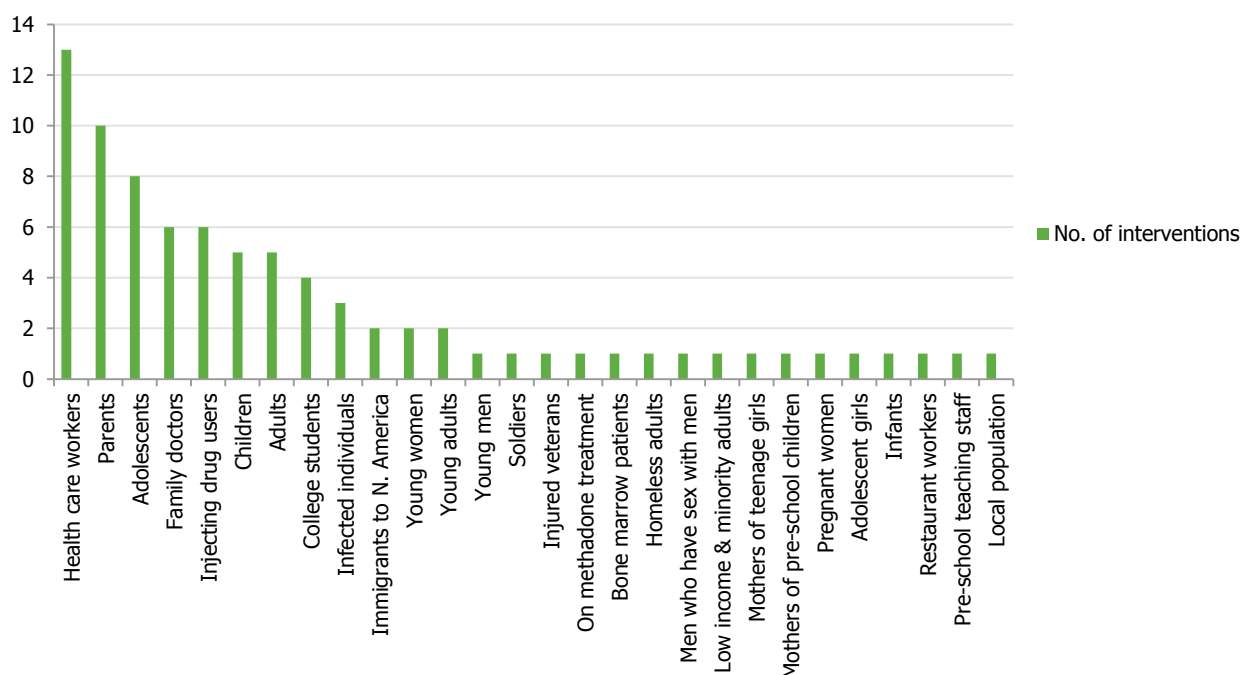
Over one-quarter of interventions in the studies (n=16) targeted more than one population. Parents were frequently targeted in combination with another population ranging from adolescents and children [14,17,21,71] to family doctors [17,33], healthcare workers [13] and bone marrow transplant patients [16]. Healthcare workers were also targeted in combination with family doctors [12,31]. Other combinations such as college students and young men/women or adolescents and young adults were the result of crossover in the population definition among the studies.

Segmentation

Although the studies just described targeted combinations of populations, only four studies segmented these populations into sub-populations and delivered separate interventions to each [13,17,33,39]. These types of studies met with mixed results. For example, the studies by Francis [17] and Samore [33] report on separate interventions administered to parents and family doctors. Both of these studies were successful in terms of reducing the targeted behaviour of antibiotic use/prescription in their relevant sub-populations. Studies by Britto [13] and Zimmerman [39], aimed at increasing rates of influenza vaccination in adults by targeting healthcare workers and adults were not successful.

Six studies used stage of change models, such as the Transtheoretical Model and the Precaution Adoption Process Model, in the design of their intervention (see Section 3.4). These models use a category system for the stages that people pass through in a particular order ahead of behaviour change. They assume there are common barriers to behaviour change for people at the same stage of change, and different barriers for people at different stages [73]. Three studies used motivational interviewing interventions to change behaviour. This involved a health professional tailoring the content of the intervention depending on a respondent's 'readiness to change' stage [20,28,63]. At the start of Crosby's [47] brief HPV protective behaviour intervention, a brief assessment was made by the family doctor as to the girl's 'readiness' to adopt or maintain protective behaviour. The ensuing discussion was tailored according to this assessment. Thus, in these four studies, different respondents received tailored interventions – a form of segmentation – however outcome data were not reported at this level of detail.

3.6 Types of behaviour targeted

Immunisation or vaccination uptake was the most frequently targeted behaviour for change in the 61 studies. Attempts to alter behaviour favouring immunisation/vaccination were the focus of 27 studies [12,13,15,16,18,21,22,24,29,31,34,35,38,39,40-42,46-48,50-53,56,58,60]. Thirteen of these studies specifically targeted the adoption of disease prevention behaviour and increasing awareness and knowledge surrounding the disease as a means of increasing vaccination uptake [13,15,16,18,21,22,27,34,35,39,40,50,52,60]. Five studies targeted parents' attitudes towards vaccinating their child as a means to increasing rates of vaccination among children [18,27,46,48,53].

Hand hygiene was another frequently targeted behaviour, featuring in 13 of the studies [18,21,25,30,32,36-38,65-69]. Six of these studies featured interventions which included the promotion of waterless hand sanitisers [25,32,36-38,67], while four studies aimed to improve hand hygiene practices by implementing a new programme of hygiene practices or food-safety training [32,65,66,69]. Increased signage and visual cues to increase the washing of hands was also featured in three studies [36,37,38]

Interventions which aimed to improve food preparation practices featured in six studies [18,57,61,62,64,65] and interventions addressing the sharing or reuse of equipment for injecting drugs featured in five studies [43,44,54,55,57].

Medicine regimen adherence was targeted in five studies [19,20,23,28,30] and the reduction of antibiotic use/prescription was the focus of four studies [14,17,21,33]. Respiratory hygiene was targeted in four studies [21,57,30,37] as was the reduction of unsafe sexual behaviour [44,52,55,57]. The uptake of health screenings was the targeted behaviour in three studies [15,47,59]. Two studies featured the modification of injecting drug preparation practices [45,57] and two featured tick bite prevention, safe tick removal and recognition of the symptoms of Lyme disease [71,72].

Multiple behavioural targets

Fourteen studies targeted more than one type of behaviour [15,18,21,30,37,44,47,52,55,57,63,65,71,72]. For example, Mayor [57] (a multimedia intervention to reduce hepatitis C virus-associated risk behaviour among injecting drug users) targeted the sharing or reuse of equipment for injecting drugs, respiratory hygiene, food preparation, unsafe sexual behaviour and unhygienic tattooing/body piercings. Another example [21] targeted the reduction of antibiotic use and prescription, influenza vaccination, hand hygiene and respiratory hygiene in order to influence behaviour in relation to upper respiratory infections among a population of recent immigrants from Latin America to New York City.

Attempts to increase immunisation/vaccination uptake were combined with other types of targeted behaviour in five studies [15,18,21,47,52]. These other types of behaviour included health screening uptake [15,47] improving hand hygiene [18,21]; knowledge and practice regarding the cleaning of food preparation areas [18] and the reduction of antibiotic use and prescription [21].

Hand hygiene behaviour was also combined with other target behaviour in five studies [18,21,30,37,65], most often with respiratory hygiene, in studies which targeted antimicrobial resistance and healthcare-associated infections [21,30,37]. Reducing or preventing unsafe sexual behaviour was addressed alongside the sharing or reuse of equipment for drug injection in three studies which targeted blood-borne diseases and STIs [44,55,57].

3.7 Communication channels, activities and settings used

Communication channels and activities

Health communication was not a criterion for including studies in the review, however all but two described some health communication channel or activity. Many studies used more than one communication channel or activity in their interventions (n=148 in 61 studies; average=2.4 channels). The most common activity was classes or lectures, occurring in just over a third of studies (n=21) [12-14,16,18,23,24,28,30,32-35,37,40,49,52,55,58,59,67]. One-to-one conversation (or instruction) [19,20,23,24,28,33,43-45,47,49,55,57,58,63,69,72], posters [14,18,24,25,30,32-34,36,38,39,45,65-69] and leaflets [12,14,18,21,24,28,30,34,41,50,53,56,64,67,69,71] were each used in just over a quarter of the interventions. Eight to twelve interventions used one of the following channels: educational hand-outs [14,17,21,29,33,48,52,61-63,66,72], letters [12,13,15,27,33,39,41,42,48,69], promotional items (e.g. pens, fridge magnets) [12,21,25,32,33,41,61,69,71] or films/DVDs/video tapes [14,18,22,24,32,37,40,59]. A variety of other communication channels and activities were used in the various interventions, for example: workshops/conferences, performances or entertainment, demonstrations, newsletters, reminders in medical records or in-clinic, mass media advertising or a peer chosen to 'champion' a behaviour change.

Digital communications were used as channels to communicate behaviour change in nine studies: eight studies (all published between 2008 and 2010) described interventions that used websites as a communication channel [24,46,52,57,19,23,41,47] and one 2006 study's intervention used email [13]. Of those eight interventions using websites, four could be described as being in an online setting: three provided online training [17,26,64] and in a fourth study, the evaluated intervention was an educational website [60].

Settings

Seventy-six different settings were coded across the 61 studies, reflecting a tendency for interventions to target only one setting for the behaviour change intervention. The most common settings for interventions in the review were healthcare settings (n=24). Eleven interventions were set in hospitals [13,15,16,20,26,35,57,66-68,69], (four of these in a specific ward [20,57,66,67]), 11 interventions were set in health centres or doctors' practices [12,15,17,19,23,33,39,41,47,64,72], (including one intervention that used hospital and health centre settings [15]) and three interventions were set in drug treatment services [28,43,58].

Educational settings were the second most frequent: for 15 interventions, from pre-school [32] through primary and secondary schools [14,29,32,37,40,52,56,70] to universities and colleges [36,38,50,53,59,62]. Other settings included study participants' own homes (n=10) [19,21,25,27,32,33,42,48,61,63] and other types of accommodation (e.g. residential, nursing or care homes/sheltered housing [24,33,44], military barracks [30] or homeless shelters [28]). Examples of less common settings in the review included: restaurants, 'the streets', cinemas and ferries.

3.8 Applicability of the theory/model in the evaluation

None of the evaluations in the studies assessed the applicability of the theory or model.

Some studies made statements about the applicability of a theory for their intervention, but did not evaluate it. For example, authors were explicit about how theoretical constructs were applied to their intervention [29], or described similar studies that used the same theory [62], or simply stated that a certain theory was the most applicable [49]. Other studies discussed applying their intervention to different settings or populations [17,59]. Those that used behaviour change theory constructs in the evaluation tool sometimes gave an indication of a survey's predictive validity and test-retest reliability [44].

3.9 Principal findings from the research objectives

The most common types of communicable diseases targeted by theory-based interventions were respiratory tract infections, with influenza being the most frequently named. Vaccine-preventable diseases and invasive bacterial infections were common targets (most frequently influenza but also measles and pneumococcal disease) while blood-borne diseases and STIs (including human papillomavirus, hepatitis B virus and hepatitis C virus) were the two second most common types targeted by theory-based interventions. Other types of communicable diseases such as food- and waterborne diseases and zoonoses, antimicrobial resistance, healthcare-associated infections and emerging and vector-borne diseases were also targeted although to a much lesser scale.

The models and theories used most often to inform the intervention or programme were those that model individuals' health-related behaviour, such as the Health Belief Model, the Theory of Reasoned Action and the Theory of Planned Behavior. The interpersonal Social Cognitive Theory, or its earlier form of Social Learning Theory, was also frequently cited. The majority of studies only mentioned a single theory or model.

End-users were the population targeted by most of the interventions in the studies. Population types ranged from parents and children (from infants to adolescents), college students, soldiers and new immigrants, to at-risk groups of infected individuals, injecting drug users and pregnant women. Intermediary populations, as targets to prevent or control communicable diseases, were predominantly defined in studies as healthcare workers or family doctors, but also included food industry workers and school staff. The majority of studies only targeted one type of population. However, when populations were combined, the most common combination was parents with adolescents or children.

Preventive behaviour such as immunisation or vaccination uptake and improving hand hygiene practices were the most frequently targeted behaviour for change in the studies.

Many studies used more than one communication channel or activity in their interventions, the most common activity was classes or lectures, occurring in just over a third of studies. One-to-one conversation (or instruction), posters and leaflets were also frequently incorporated in interventions.

Most interventions targeted only one setting for the behaviour change intervention. Healthcare settings such as hospitals (including specific wards), health centres and family doctors' practices were the most commonly targeted settings for the interventions included.

4. Discussion

The role and importance of theory, and research based upon conceptual frameworks in behaviour change for health cannot be understated. Data without a theoretical framework can be interpreted as a collection of facts that are meaningless without context, or cannot be fully understood [74]. In the social sciences, data often only make sense within the theoretical framework in which they are located. Theories are essentially models that explain or predict particular phenomena or outcomes. The relationship between theory and research is an important one and should be reciprocal in nature. Research can be used to inductively develop theories that can then be tested deductively and applied to develop and refine theory. In a sense, a feedback loop between theory and research should operate. A range of behavioural theories and models has been proposed to help measure, explain and predict health and lifestyle behaviour and outcomes. Indeed, theories or conceptual frameworks 'enrich, inform, and complement the practical technologies of health promotion and education' [4, p.38]. We found that a range of theories and models were used to inform the design, development, and implementation of interventions included in the review. The following section aims to answer the final three research objectives using only the highest quality studies from the review. Twenty-one studies were graded as high quality, scoring ≥75% for overall validity using Glynn's [10] critical appraisal tool.

4.1 Extent to which the health behaviour change objective of the intervention/programme was met

Studies reporting a significant change in health behaviour

Of the 21 studies graded as high quality (≥75% overall validity), over half (n=13) reported that the intervention had been successful in significantly changing the behaviour of its participants. These studies reported a significant change in the targeted health behaviour and as such can be assumed to have met their health behaviour change goal. A 5% change in a population's health behaviour has been cited as an achievable and appropriate target for interventions of this type [75].

Interventions in seven studies which aimed to change behaviour to improve a target population's engagement with healthcare services reported significant changes in behaviour. Three interventions increased immunisation or vaccination uptake [15,42,60]; two increased health screening attendance [28,59] and two reduced the use and prescription of antibiotics [17,33]. These types of studies targeted a range of diseases including influenza, tuberculosis, hepatitis B and measles.

Other studies which reported a significant change in health behaviour included three hand hygiene interventions [25,32,36]; one study [55] reported a 29% reduction in unsafe behaviour including needle sharing; and another [63] reported that the intervention was successful in changing water treatment and storage habits. The study by Maunder [26] reported that the intervention appeared to be of significant benefit when training healthcare workers to withstand stress but concluded that this area merited further study.

Parents were targeted in a private home setting in five of the studies which reported a significant change in behaviour [25,32,33,42,63]. In contrast, only one high-quality study targeting parents reported no significant change in their behaviour [48].

The evidence indicates that individual-level behaviour theories – the Health Belief Model, the Theory of Reasoned Action and the Theory of Planned Behavior – and interpersonal behaviour theories – Social Cognitive Theory and the Transactional Stress and Coping Model – were associated with positive outcomes. Both studies that proposed their own new theoretical model achieved their health behaviour goals [28,59].

Studies reporting a lack of significant results

Eight of the 21 studies graded as high quality (≥75% overall validity) reported no evidence of effect and did not exhibit any pattern that might explain the lack of success. Studies by Dempsey [48] and Gerend [50] targeted rates of HPV vaccination and reported no significant effect. Campbell [44] found no significant effect on reducing risk behaviour among injecting drug users. The study authors in Hovell [19] found that the intervention was associated with an increased likelihood to complete a course of treatment for tuberculosis but that this change was not found to be significant. Lewin [23] found no significant difference in medicine regimen adherence for tuberculosis. Studies by Mullan [62] and Trepka [64], which targeted foodborne illnesses stated that the interventions had some effect on food preparation knowledge but were not found to influence hand hygiene or food preparation behaviour. A study by White [38] found a small change in hand-washing behaviour but this was reported as insignificant.

A broader range of theories and models was associated with the studies reporting a lack of significant results. Four of the studies used individual-level behaviour change theories – the Health Belief Model, the Theory of Reasoned

Action and the Transtheoretical (Stages of Change) Model – for the evaluation of the intervention [44,48,50,62]. The other studies mentioned that the same individual-level behaviour change theories informed the interventions [19,23,38,64]. The Hovell [19] study was also informed by a planning model (Social Ecological model) and White's [38] study used the Diffusion of Innovations community model in the intervention design.

4.2 Evidence for effective interventions and programmes using theories/models of behaviour change to prevent relevant communicable diseases

Among the 21 high-quality studies (≥75% overall validity), the prevention (or prevention and control) of communicable disease was an aim of the intervention in 15 studies [15,25,28,32,36,38,42,44,48,50,55,60,62-64] Using the data from Section 4.1, nine of these studies were considered successful in meeting their objective of changing a particular behaviour towards the prevention of communicable diseases [15,25,28,32,36,42,55,60,63]. Six of the prevention studies were unsuccessful, in that there was little or no change in the target behaviour [38,44,48,50 62,64].

Among the 15 prevention studies, there was no comparative evidence available to state whether using the theory made the intervention effective. However, mapping the studies to their theoretical bases we can compare those with an effective intervention (i.e. a 'successful' outcome) to those without. The nine 'successful' studies were spread across six theories or models: four models of individual health behaviour (the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior and Stages of Change theory [15,25,32,36,42,60,63]); and two theories of interpersonal behaviour (Social Cognitive Theory and the Transactional Model of Stress and Coping) [28,55]. In comparison, of the 'unsuccessful' studies, where the intervention made a non-substantive change to the preventive health behaviour, the six studies were spread across five theories or models. Four used models of individual health behaviour (again, the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior and Stages of Change theory) [38,44,48,50,62,64]; and one study [38] used the community change model Diffusion of Innovations in addition to the Health Belief Model.

There were more similarities than differences in terms of the range of health behaviour change theories used between the successful and unsuccessful prevention interventions, assessed as high-validity studies. The main differences were that two successful studies used two theories of interpersonal health behaviour which take account of how their environment interacts with individuals and their health behaviour, and one study with an unsuccessful intervention used a community change model. However, if we examine how theories were used, one of the main differences is that the five interventions which stated they used a theory or model in the design of the intervention were either significantly effective in changing preventive behaviour [25,28,55,63] or changed the behaviour in a non-significant but positive direction [38]. Those studies which stated they used a theory or model in the evaluation of the intervention accounted for two 'successful' preventive behaviour change interventions [15, 32] and four 'unsuccessful' behaviour change interventions [44,48,50,62]. The theory or model was not unsuccessful in these cases, but a useful tool providing insight via the measured theoretical constructs.

4.3 Evidence for effective interventions and programmes using theories/models of behaviour change to control relevant communicable diseases

Among the 21 high-quality studies (≥75% overall validity), the control (or prevention and control) of communicable disease was an aim of the intervention in eight studies [17,19,23,25,26,28,33,59].

Using the data from Section 4.1, six of these studies were considered successful in meeting their objective of changing a particular behaviour with a view to controlling communicable diseases [17,25,26,28,33,59]. Two of the control studies were unsuccessful, in that they found little or no change in the target behaviour [19,23].

Within the eight studies, there was no comparative evidence available to state whether using the theory made the intervention effective or not. However, mapping the studies to their theoretical bases we can compare those with an effective intervention (i.e. a 'successful' outcome) to those without.

The six 'successful' studies were spread across seven theories or models: four models of individual health behaviour (the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior and Stages of Change theory) [17,25,33,59]; two theories of interpersonal behaviour (Social Cognitive Theory and the Transactional Model of Stress and Coping) [26,28]; and one model used as a framework for behaviour change research and practice (the PRECEDE—PROCEED model) [59]. Taylor's study [59] used multiple models: the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior, Stages of Change theory and the PRECEDE—PROCEED model. In the 'unsuccessful' studies, where the intervention made a non-substantive change to behaviour with a view to controlling communicable diseases, the two studies were spread across three theories

or models. They both used models of individual health behaviour: Lewin [23] used the Theory of Reasoned Action and Stages of Change theory. In addition to the Stages of Change theory, Hovell [19] used a version of the Behavioral Ecological Model which focuses on multiple levels of influence on individuals.

There were no substantive differences between the health behaviour change theories or models that the successful and unsuccessful interventions selected in their studies. However, examining how theories were used, one of the main differences to note is that the two interventions which stated they used a theory or model in the design of the intervention were both significantly effective in changing infection control (and preventive) behaviour [25, 28]. The rest of the studies with interventions designed to control communicable disease, both the successful and unsuccessful, only mention a theory or model in relation to their intervention, without specific details on its application.

4.4 Strengths and weaknesses of the review

The main strength of this project is that it is a systematic review of the relevant literature. The studies identified are the result of careful and extensive searches. Systematic review methods are designed to capture and synthesise the research evidence to answer pre-specified research objectives. Systematic reviews are also designed to minimise bias. As such, while we cannot be sure we have found every single relevant study, we can be confident that we have followed best practice with regard to our searches and have taken steps to avoid bias in the study sample retrieved. We have also checked the studies we have included for relevance and methodological rigour. We can therefore be confident that the statements made in this review reflect the current state of English language research evidence in this area.

The review relies only on what was presented in the journal article, which is relevant to assessment against the inclusion criteria (i.e. stated, not implied use of theory) and the quality appraisal (i.e. the study's validity is based on information presented in the journal article only). Systematic review methods cannot compensate for the poor quality of primary research. Publication bias should 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-representation of studies with null and negative effects.

4.5 Relation to other reviews

Theories and models of behaviour change have been growing in importance in the public health community and health services research for both communicable and non-communicable diseases [76,77]. More extensive use of theory in Internet-based interventions has been found to have a significant effect on health-related behaviour [78] and to improve the effectiveness of tailored print health behaviour change interventions [79]. In the communicable diseases field, cognitive behavioural theories have been used to explain unsafe behaviour among injecting drug users at risk of HIV and viral hepatitis [80], and can potentially be applied for stronger intervention in HIV and STI prevention [81,82].

A review of health communication branding by Evans et al. [83] found that not using theory in the design or evaluation of an intervention could be influenced by funding considerations. Their review found that overall psychological theory appeared less often than communications or marketing theory, 'but more frequently in reports on large, well-funded campaigns with more fully articulated behavior change objectives' (p.737). This may also be an issue for communicable disease interventions research.

Painter et al's [77] review found a 'relative absence of applied community-level theory', something our review also found. Among the high-quality studies, only three studies used theories that could incorporate the influence of communities (Diffusion of Innovations, Behavioral Ecological Model and the PRECEDE—PROCEED model).

4.6 Applicability of findings

Although our review could not state whether using the theory itself made the intervention effective, it does appear that there is a large evidence base of good quality studies demonstrating effective interventions with a theoretical basis relevant to communicable disease prevention and control. Suitable theories should be selected by identifying the problem an intervention will be designed to tackle, the goals and objectives set, and units of practice [84], rather than being based on familiarity, intrigue or what is currently in vogue [4]. Therefore, thorough scoping of a health behaviour problem and factors known to moderate input and outcome variables are required at the start of the intervention design process to facilitate the selection of appropriate theories and conceptual models. Behaviour change theory can help guide an intervention's inception and progress, as well as forming a basis for its evaluation. There were no substantial differences between the health behaviour change theories or models that the successful and unsuccessful interventions selected in their studies. Wagner et al.'s [80] review notes that if an intervention fails, it is not necessarily a 'theory failure'.

Both our review and Painter et al.'s [77] systematic review of the use of theory in health behaviour research found a limited number of interventions using community-level theory. A recent UK House of Lords [85] document on behaviour change reported that although basic research can provide information about routine individual human behaviour, there is less experimental evidence about what works to influence behaviour at the community or population level. The lack of community- or population-level theory makes it difficult to develop policy for behavioural change since individual-level theory does not scale up to policy-level so readily.

SLR to examine evidence for effective interventions using theories of behaviour change to prevent communicable diseases   **TECHNICAL** REPORT

30

5. Strategic implications and recommendations

5.1 Current practice and evidence of effectiveness

The majority of studies included in this report were informed by theories or models of individual-level behaviour. Individual-level models assume that individuals act largely autonomously and make predictable and/or rational decisions. Theories which model individuals' health-related behaviour or were informed by individual motivational factors, such as the Health Belief Model, Theory of Reasoned Action, Theory of Planned Behavior and Social Cognitive Theory, were the most common theories to inform the study or interventions. These theories have previously been cited as the most prominent in the field and used consistently in the field of health behaviour over the last 20 years [77]. Some of the interventions which used theories based on individual-level behaviour were found to be effective. There was a lack of evaluative evidence on interpersonal and community-level theories and how these can be used to inform interventions. There was also a lack of evidence on interventions which built and tested new theories, Nyamathi [28] and Taylor [59] being the exceptions.

There was a lack of evaluative evidence on the cost-effectiveness of theory-based interventions. Only one study, from the Netherlands, measured cost. The research reported on cost per nursing home, of implementing an intervention to increase influenza immunisation uptake among healthcare workers in nursing homes as one of the outcome measures [24]. Individual-level research of health behaviour and outcomes is likely to be more costly to conduct than ecological studies, yet as outlined above, the theories intended to modify individual-level behaviour remain the most commonly applied.

Most of the interventions were largely communications-based, using communication channels such as classes/lectures, one-to-one interviews, posters and leaflets. Some interventions included elements of digital communications (websites and email) and three were online training interventions. Few interventions included service modifications, such as improved access.

There was a clear focus on the end-user as the target for the intervention (adults, parents and children, or adolescents). A smaller volume of identified evidence targeted health professionals (healthcare workers and general practitioners) or other intermediaries.

5.2 Recommendations for future research

The studies included in the review highlight a need for more research on the links between behaviour and behavioural determinants. Based on the current research it was not possible to identify links between dependent variables and independent variables or correlate changes in modifiable factors with specific outcomes. Although a range of individual-level models were associated with positive outcomes, there were distinct gaps in the reporting of the processes which led to these outcomes. Many health behaviour change theories and models include common constructs (the empirical variables). For example, self-efficacy is a recognised determinant of outcomes in the Health Belief Model, Theory of Reasoned Action, Social Cognitive Theory, Transactional Model of Stress and Coping and the Transtheoretical Model. It would be useful to better understand which independent and dependent variables link up. There is a need for research reporting to go beyond describing the theoretical model and to measure and test the key variables and how these influence, and are influenced by, health behaviour. This may also provide insight into why multiple theoretical approaches can be effective or ineffective, and provide an overview of the most influential variables, regardless of the hypothetical theory or model deployed.

The majority of the communication channels and techniques in the studies employed traditional media such as leaflets or posters, or new media (emails, websites) in a traditional manner. There is a need to consider how new media (such as social networking sites) can be used in the future, for example in the coordination and delivery of interventions and in more interactive or targeted communicative outreach. The use of new types of media for communication and coordination may raise questions about the suitability of certain theoretical models. Data capture can be cheaper through digital media, creating new opportunities for monitoring and evaluation.

Theories and models are often recommended to inform or implement a programme in order to ensure a level of replication across policy, practice and research. The objective is to facilitate shared learning. However, it is often difficult to be certain what theory or model has been used and to find out why it has been used. Shared learning is perhaps more relevant and achievable than finding out which theory works best. The evidence supports the fact that more than one theory can be effective in achieving the desired impact. However, there is little or no systematic critique of these theories/models in the existing evidence base in terms of their applicability. Many of the studies, possibly due to limited word allowances in academic journals, only mentioned the use of theory, with little information on its application. None of the studies evaluated the applicability or utility of the theory or model

used. A lack of planning models and detailed presentation of implementation means that opportunities for research in practice and shared learning are lost.

Given that there is very little evaluation of the cost-effectiveness of interventions, it is hoped that the introduction of electronic media for the coordination and delivery of interventions may provide new opportunities to improve cost-effectiveness as well as effectiveness. Future research to assess this is already emerging as a priority.

Interpersonal, structural, ecological and social models/theories could be more relevant to or promising for communicable diseases than individual-level models/theories (e.g. utilising the Transactional Model of Stress and Coping for pandemics). This area is currently under-researched. There is a need for researchers to look beyond the individual level to theories which take account of and can have an impact on community-level modifiable health behaviour.

SLR to examine evidence for effective interventions using theories of behaviour change to prevent communicable diseases   TECHNICAL REPORT

32

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Appendix 1. Protocol

1. Background

Behavioural or social theories and models are considered an important tool in effective behaviour change interventions and programmes [1-3]. In this context, theories can be divided into two types. An explanatory theory helps to describe a problem and to identify why such a problem exists. Such theories can predict behaviours and inform the modifiable factors. Change theories guide an intervention's inception and progress, and form a basis for its evaluation. Models draw on more than one theory and are usually informed by empirical findings [4].

Thus behavioural and social theories have the potential to help identify what changes can take place, explain and support change dynamics, identify key influencers on outcomes and select participants who are the most likely to benefit. The use of behavioural and social theories in health intervention planning and management also improves the prospects for replication, modification and scaling up of effective interventions, and improves the learning that can be derived from practice, whether successful or unsuccessful. Examples of health behaviour change and social theories that the review is likely to include are: the Health Belief Model, the Theory of Reasoned Action, the Theory of Planned Behavior, the Integrated Behavioral Model, the Stages of Change (Transtheoretical) Model, the Precaution Adoption Process Model, the Social Cognitive Learning Theory, Theories of Organisational Change, and the PRECEDE–PROCEED planning model.

Theories and models of behaviour change have been growing in importance to the public health community and health services research, for both communicable and non-communicable diseases [5,6]. More extensive use of theory in internet-based interventions has been found to have a significant effect on health-related behaviours [7] and to improve the effectiveness of tailored print health behaviour change interventions [8]. In the communicable diseases field, cognitive behavioural theories have been used to explain injection risk behaviour among injection drug users at risk for HIV and viral hepatitis [9], and have the potential for stronger interventions for HIV prevention [10] and STI prevention [11].

In the area of prevention and control of communicable diseases, relevant health behaviours to change are likely to be hygiene practices (e.g. hand-washing and use of alcohol hand gels, 'respiratory etiquette', self-confinement whilst contagious, food preparation hygiene, needle/syringe exchange), health screening for communicable diseases, medicine regimen-adherence, vaccination uptake, use of physical barriers against infection (e.g. condoms, insect repellents, window and door mesh-screens), information-seeking, and risky sexual behaviours.

This systematic literature review (SLR) aims to assess the effectiveness of interventions that use theories and models of behaviour change to prevent or control communicable diseases relevant to Europe[7] and is believed to be the first review on this topic. The SLR will systematically identify, collate and analyse English language data published in the last ten years. The evidence base will include only studies published as peer reviewed articles or government/health agency reports, which will meet defined relevance and quality criteria. The scope will be limited to studies in which the intervention or programme is based on a theory or model of behaviour change, and the theory must be identified by the study's authors (not on an assessment by the reviewers). The scope of the SLR will not be limited by the intervention country, however only interventions to prevent or control communicable diseases relevant to Europe will be included.

Interventions using theories and models of behaviour change to prevent or control HIV/AIDS and to change risky sexual behaviours (for the prevention or control of chlamydia, genital warts, gonorrhoea and syphilis, for example) are excluded from this review for a number of reasons. Firstly, at the time of writing, there have been eight rigorous, English-language reviews published between 2005 and 2010 that examined HIV and STI prevention and risk reduction (including contraceptive use). A Cochrane Library systematic review evaluated contraceptive (including condom) use studies that had a theoretical basis for behaviour change [12]. Seven further reviews did not stipulate a theoretical basis as an inclusion criteria but reported on theory-based intervention designs in the

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[7] Excluding those described on ECDC's website as prevalent only outside Europe (see '*Types of Interventions*' below).

results of their reviews of HIV and STI interventions [11]; some aimed at young people [13-16], at clinic patients [17]; and for interventions to promote condom use [10].

Secondly, from the initial scoping exercises, a high volume of interventions targeting HIV and risky sexual behaviours from academic and grey literature sources appeared not to be culturally relevant to Europe. Screening these would use up much of the resource available to this project and may skew the report findings. Other blood-borne infections (hepatitis B and hepatitis C) are included in the scope of this SLR, as infection can occur through other risky behaviours.

2. Objectives

The aim of the SLR is to assess the effectiveness of interventions that use theories and models of behaviour change to prevent or control communicable diseases relevant to Europe. The following research questions will be addressed:

1. Which communicable diseases and disease groups (e.g. antimicrobial resistance and healthcare-associated infections; emerging and vector-borne diseases; food- and waterborne diseases and zoonoses; blood-borne diseases (excluding HIV); respiratory tract infections; vaccine preventable diseases and invasive bacterial infections) have been targeted by theory-based interventions?
2. Which theory or model was used to inform the intervention or programme? Was a single theory used or were theories used in combination?
3. How was the theory or model used in the intervention design? Was a single theory used or were theories used in combination in the design?
4. Which populations have been targeted and has the population been segmented into sub-populations?
5. What types of behaviours were targeted for change?
6. What techniques and activities were used?
7. Which health communication channels and setting were used?
8. Did the evaluation assess and report on the applicability of the theory of model, and if so how and what were the findings?
9. To what extent was the health behaviour change goal of the intervention or programme met?
10. What is the evidence for effectiveness of interventions and programmes that use theories and models of behaviour change in changing behaviours to prevent relevant communicable diseases?
11. What is the evidence for effectiveness of interventions and programmes that use theories and models of behaviour change in changing behaviours to control relevant communicable diseases?

3. Methods

3.1 Criteria for considering studies for this review

Types of literature
Studies published in a peer reviewed journal in English will be eligible for inclusion. Conference abstracts published in a peer reviewed journal are likely to contain too little information to be included, however any conference abstracts found via the search strategy will be assessed using the same inclusion criteria. Studies published as reports by governments or health agencies will also be eligible. Theses, web pages and journal articles that have not been accepted for publication by a journal will be excluded. In terms of the date of studies, those published in the last 10 years will be eligible for inclusion. Based on investigations by Glanz et al. [4] into theory use in published health research, a range of health behaviour theoretical formulations are used over this time period.

Types of studies
The types of studies suitable for inclusion will be outcome evaluations, experimental, quasi-experimental, or observational interrupted time series designs. 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.

Types of interventions

The evaluated intervention, programme, strategy, action plan, national policy or campaign must:

- aim to change an individual's or community's health behaviour,
- aim to prevent and/or control a Europe-relevant communicable disease, or group of diseases, and
- use a theory or model of behaviour change.

The list of communicable diseases is generated from the 'Health Topics' list on ECDC's website[8] by examining the information given in the hyperlink for each term, and excluding those described on the website as prevalent outside Europe only. These health topics, diseases, viruses and vectors have been included in the list of search terms in Table A1. Behaviour change interventions only aimed at preventing or controlling HIV/AIDS, and those only targeting risky sexual behaviours are excluded from the SLR. Interventions to prevent or control human-to-human and animal-to-human disease transmission are eligible for inclusion, however animal-to-animal disease transmission is excluded.

To be included in the SLR, the intervention must, according to the article's authors, be based on a behaviour change theory or behaviour change model. A comprehensive handbook, '*Health Behavior and Health Education: Theory, Research, and Practice*' by Glanz, Rimer and Viswanath [1], well respected in its field[9], will be used as the definitive source of eligible theories and models. If the theory or model is described in this book, the study will be eligible for inclusion. Theory-based interventions could be compared with: another intervention based on the same theory, or an intervention based on a different theory, or an intervention not based on a theory or model, or simply usual practice. These studies will be reported even if there are no different effect sizes or if effect sizes cannot be explained by any differences in the intervention's theoretical basis.

It is not necessary for the intervention to include a health communication component to be considered eligible for the review.

Types of outcome measures

As the main focus of the SLR is a *change in behaviour* rather than *what* behaviour is being changed, many proxy outcome measures of risk and protective behaviour will be relevant. These could include measures of: information-seeking rates, screening rates, vaccination/immunization uptake, prescribing rates, medication adherence or other programme adherence rates (e.g. food safety practices, hand washing), injection risk behaviours, purchase or use of protective equipment (e.g. insect repellents, face-masks, antibacterial soaps, mesh screens, disinfectant), plus other behavioural outcomes as defined in individual studies. In addition, measures of beliefs and attitudes towards behaviours, and subjective norms associated with behaviours, will also be relevant.

Biomedical indicators (the prevalence of a communicable disease and mortality rates due to a communicable disease), as the ultimate target of the interventions, will be recorded where it has been reported as a study outcome.

3.2 Search methods for identification of studies

To identify relevant studies published in peer reviewed journals, searches will be run in electronic academic literature databases from the fields of public health, medicine, psychology and social sciences; relevant organisations' websites; and the contents pages of a selection of relevant journals. Groups of search terms will be developed into a search strategy which will combine communicable disease terms (e.g. the names of infections, vectors and disease groups) with behavioural terms, intervention terms and study design terms. These are listed in Table A1. The bibliographic data each database holds about an article (generally its title, abstract, keywords) are searched for instances of these combinations of search terms.

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8 http://www.ecdc.europa.eu/en/healthtopics/Pages/health_topics_disease_group.aspx [accessed 14 March 2011]

9 First published in 1990 and currently in its 4th edition (2008), this 500-page book has been translated into numerous languages and is used around the world. The Handbook's authors acknowledge that 'No single book can be truly comprehensive … We acknowledge that there is substantial variability in the extent to which various theories and models have been codified, tested, and supported by empirical evidence. Of necessity, some promising emerging theories were not included' (p. xxiii).

Table A1. Sample search terms

(Terms will be truncated to include all forms of a 'root word' including plurals)

Communicable Disease Terms (relevant to Europe)		
Academy Rash	Hepatitis B	Rubella
Acute Bacterial Infection of the Respiratory Tract	Hepatitis C	Rubella Virus
Anthrax	HPV Infection	Salmonellosis
Antimicrobial Resistance	Human Papillomavirus Infection	Scarlatina
Babesiosis	Impetigo	Scarlet Fever
Bilharziosis	Infectious Disease	Schistosomiasis
Blood-borne virus	Infectious Mononucleosis	Seasonal Flu
Borreliosis	Influenza	Seasonal Influenza
Botulism	Influenza, Human	Shigellosis
Brucellosis	Intestinal Parasites	Shingles
C. Difficile Infection	Karelian Fever	Sindbis Fever
Campylobacteriosis	Kissing Disease	Slapped Cheek Disease
Chickenpox	Legionellosis	Snail Fever
Childhood Viral Disease	Legionnaires' Disease	Stickers Disease
Clostridium Difficile	Leptospirosis	Strep Throat
Clostridium Difficile Infection	Listeriosis	Streptococcal Pharyngitis
Cowpox	Lyme Borreliosis	TB
Crimean Congo Haemorrhagic Fever	Lyme Disease	Tetanus
Cryptosporidiosis	Measles	Tetanus
Cutaneous Wart	Meningitis	Threadworm
Diarrhoeal Disease	Meningitis C	Tick-Borne Encephalitis
Diphtheria	Meningococcal Infection	Tick-Borne Relapsing Fever
E.Coli	MRSA	Tick-Borne Viral Disease
Echinococcosis	Multi-Resistant Staphylococcus Aureus	Toxoplasmosis
Enterobiasis Threadworm	Mumps	Trichinellosis
Enterobius Vermicularis	Norovirus Infection	Tuberculosis
Enteroviruses	Ockelbo Disease	Tularaemia
Epstein-Barr Virus	Papillomavirus Infections	Typhoid
Erythema Infectiosum	Paratyphoid Fever	Variant Creutzfeldt-Jakob Disease
Escherichia Coli	Pertussis	Varicella Infection
Fifth Disease	Pfeiffer's Disease	VCJD
Flu	Pinworm	Vector-borne disease
Food-Borne Infection	Plague	Verruca
Giardiasis	Pneumococcal Infection	Viral Conjunctivitis
Glandular Fever	Pogosta Disease	Water-borne disease
Haemophilus Influenzae Infection	Polio	West Nile Fever
Haemophilus Influenzae Type B	Poliomyelitis	West Nile Virus
Haemorrhagic Fever with Renal Syndrome	Poliovirus	Whooping Cough
Hand Foot and Mouth Disease	Puumala Virus	Yersiniosis
Hantavirus	Q Fever	Zoonosis
Head Lice	Rabies	Zoonotic Disease
Healthcare-Associated Infection	Rodent-Borne Viruses	
Hepatitis A	Rotavirus Infections	
Intervention Terms		
action	guideline	protocol
activity	incentive	scheme
campaign	intervention	service
education	outreach	strategy
framework	program	training
guidance	programme	

Behaviour Change Terms		
animal handling	food handling	regimen adherence
animal petting	food safety	reminder system
barrier	hand adj (gels or alcohol or sanitiser)	risk taking
behavio$ral surveillance	hand hygiene	risky behaviour
behavio$ral monitoring	handwashing	screening
clean	immuni$ation	sterilisation
control	infection	surgical mask
cross contamination	information seeking	testing
cross infection	insect repellent	transmission
crowded settings	medicine adherence	vaccination
disease transmission	needle reuse	(alter$ or modif$ or chang$) adj2 behavio$
disinfectant	needle sharing	(alter$ or modif$ or chang$) adj2 practice$
face mask	patient compliance quarantine	
food contamination	prevention	

Study Design Terms		
baseline	effectiveness	pilot
before and after	evaluation	pre post
before-and-after	evaluative	pre-post
clinical trial	examine	program evaluation
cohort	experimental	prospective
comparative	follow-up	random
control	investigate	
effective	matched	

During the early stages of the development of this review, it was expected that search terms related to behavioural change theories and models (e.g. model$, theor$, framework$, construct$ and specific theories' names) would be used as search terms. To test this method, the included studies of a selection of systematic reviews of theory-based intervention studies were looked up in the Medline database to examine their indexing. Fewer than half would have been identified had the theory terms been a prerequisite of the search, as the theory or model is mentioned in the full text of the article only, rather than in its title, abstract or keywords.

Electronic academic literature databases
The following academic literature databases will be searched using the terms listed in Table A1. The strategy will be adapted to each database's search terminology and indexing structure:

BIOSIS Previews (via Web of Knowledge)
CINAHL (via EBSCOHost)
Cochrane Library
Health Source (via EBSCOHost)
Maternity and Infant Care (via OvidSP)
Medline (via PubMed)
MIT CogNet

PsycINFO (via EBSCOHost)
Social Services Abstracts (via CSA Illumina)
Sociological Abstracts (via CSA Illumina)
Web of Science Indices (via Web of Knowledge)
Zetoc Search

Hand-searching
The bibliographies from included studies will be checked for further studies, as will the most recent reviews which were identified at the scoping stage. After analysis of the search results, the journals that contain the largest number or relevant studies will be hand-searched to identify further relevant studies that were neither indexed by the databases nor identified by the search strategy. It is anticipated that American Journal of Infection Control, Eurosurveillance, Health Promotion Practice and The Lancet Infectious Diseases may be indicated for this process.

Websites

Using selected terms from the electronic academic literature databases search strategy, we will search relevant websites which contain published research. These include (but are not restricted to) the following:

- Centers for Disease Control and Prevention
- Copac National, Academic, and Specialist Library Catalogue
- DG SANCO
- DG Research & Innovation
- EDEN (Emerging Diseases in a changing European eNvironment) project
- EuroHealthNet
- 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)
- International Union for Health Promotion and Education
- LENUS: The Irish Health Repository
- NHS Evidence in Health and Social Care
- WHO: World Health Organization

Note that many of the websites listed above contain links to other relevant organisations and networks. This type of 'snowball sampling' will lead to further websites to search for relevant studies. General internet searches will also be run via Google or Yahoo search engines, using selected search terms from the strategy.

Personal contact

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

3.3 Data collection and analysis

Storage

Search results will be imported into a reference management database such as EPPI-Reviewer 4 [18], 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, at least two researchers will independently screen the titles and abstracts of the studies stored in the SLR 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 and abstract alone will not be sufficient to indicate whether a study is based on a behaviour change theoretical construct, as indicated in Section 3.2. 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 SLR's included studies give an indication of the strength of evidence the SLR provides. NICE guidelines [19] will be used as the source for quality appraisal checklists for different 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 this has 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 intervention, statistical methods and its generalisability (external validity). Exact quality criteria will be confirmed after reviewing the full text results. If there are few studies providing evidence for effective health communication interventions that use theories and models of behaviour change, to keep the review as relevant as possible, 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 to limit the review to higher 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); study characteristics (aims, objectives, design); study participant characteristics; details of the behaviour change theory(ies) or model(s) used (type and extent of use e.g. informed, applied, tested); 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. A coding system will be piloted to classify the degree of theory use in

each study's intervention, with reference to Painter et al. [6] and Michie and Prestwich's [5] coding schemes. 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, discuss the theories and models used, and highlight their respective utility – for example relevance, effectiveness, acceptability and replicability. An assessment will be made by the reviewers whether a meta-analysis of outcome data is appropriate for studies that have used the same theoretical basis for interventions, 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. A plain language summary will be included in the final report.

References for Appendix 1

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Appendix 2. Sample search strategy

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

#	Searches
1.	academy rash.ab,ti.
2.	anthrax.de.
3	anthrax.ab,ti
4	antimicrobial resistance.ab,ti
5	babesiosis.de
6	babesiosis.ab,ti.
7	bilharziosis.ab,ti.
8	blood-borne virus$.ab,ti.
9	bloodborne virus$.ab,ti.
10	borreliosis.ab,ti.
11	botulism.de.
12	botulism.ab,ti.
13	brucellosis.de.
14	brucellosis.ab,ti.
15	campylobacter infections.de.
16	campylobacter$.ab,ti.
17	chickenpox.de.
18	chickenpox.ab,ti.
19	clostridium difficile.de.
20	(clostridium difficile or c difficile or c diff).ab,ti.
21	communicable diseases.de.
22	communicable disease?.ab,ti.
23	cowpox.ab,ti.
24	(crimean congo h?emorrhagic fever or CCHF).ab,ti.
25	cryptosporidiosis.ab,ti.
26	(cutaneous wart$ or verruca$).ab,ti.
27	"diarrhoea prevention and control".de.
28	diarrh?eal disease$.ab,ti.
29	diphtheria.de.
30	dip?theria.ab,ti.
31	echinococcosis.ab,ti.
32	(enterobiasis or threadworm$ or pinworm$).ab,ti.
33	enterovirus$.ab,ti.
34	(enterovirus or enterovirus infections).de.
35	epstein barr virus.de.
36	epstein barr virus.ab,ti.
37	erythema infectiosum.de.
38	erythema infectiosum.ab,ti.
39	fifth disease.ab,ti.
40	escherichia coli infections.de.
41	(escherichia coli infection? or e coli infection?).ab,ti.
42	flu.ab,ti.
43	foodborne.ab,ti.
44	giardiasis.de.
45	giardiasis.ab,ti.
46	glandular fever.ab,ti.
47	(haemophilus influenzae or haemophilus influenzae type b).de.
48	h?emophilus influenzae.ab,ti.
49	h?emorrhagic fever.ab,ti.
50	(hand foot and mouth disease).ab,ti.
51	hantavirus$.ab,ti.
52	(head lice or head louse or headlice or headlouse).ab,ti.
53	healthcare associated infection?.ab,ti.
54	hepatitis a.de.
55	(hepatitis a or hep a virus or hav).ab,ti.
56	hepatitis b.de.
57	(hepatitis b or hep b virus or hbv).ab,ti.
58	hepatitis c.de.
59	(hepatitis c or hep c virus or hcv).ab,ti.
60	papillomavirus human.de.
61	(human papillomavirus or hpv).ab,ti.
62	impetigo.de.
63	impetigo.ab,ti.
64	infectious disease?.de.
65	infectious disease?.ab,ti.
66	infectious mononucleosis.ab,ti.
67	influenza.de.
68	influenza.ab,ti.
69	intestinal parasite?.ab,ti.
70	karelian fever.ab,ti.
71	legionellosis.ab,ti.
72	legionnaire$ disease.ab,ti.
73	leptospirosis.ab,ti.
74	kissing disease.ab,ti.
75	listeriosis.de.
76	listeriosis.ab,ti.
77	lyme disease.de.
78	(lyme borreliosis or lyme disease).ab,ti.
79	measles.de.
80	measles.ab,ti.
81	meningococcal infections.de.
82	(meningococcal infection? or meningitis).ab,ti.
83	meningitis.de.
84	"staphylococcus aureus prevention and control".de.
85	(multi-resistant staphylococcus aureus or MRSA).ab,ti.
86	mumps.de.
87	mumps.ab,ti.
88	norovirus infection?.ab,ti.
89	ockelbo disease.ab,ti.
90	paratyphoid fever.ab,ti.
91	pertussis.ab,ti.
92	pfeiffer$ disease.ab,ti.
93	plague.ab,ti.
94	pneumococcal infection.de.
95	pneumococcal infection.ab,ti.
96	pogosta disease.ab,ti.
97	(polio or poliomyelitis or poliovirus).ab,ti.
98	(poliomyelitis or poliovirus).de.
99	puumala virus.ab,ti.
100	q fever.ab,ti.
101	Rabies.de.
102	rabies.ab,ti.
103	rodent?.ab,ti.
104	rotavirus infection?.ab,ti.
105	rotavirus infections.de.
106	rubella.ab,ti.
107	("rubella prevention and control" or rubella virus).de.
108	salmonellosis.ab,ti.
109	salmonella infections.de.
110	salmonella infection?.ab,ti.
111	(scarlatina or scarlet fever).ab,ti.

48

112 (schistosomiasis or snail fever).ab,ti.
113 shigellosis.ab,ti.
114 shingles.ab,ti.
115 sindbis fever.ab,ti.
116 (slapped cheek disease or stickers disease).ab,ti.
117 streptococcal infections.de.
118 (streptococcal pharyngitis or strep throat).ab,ti.
119 tetanus.de.
120 tetanus.ab,ti.
121 (tickborne or tick-borne).ab,ti.
122 (tbe or tbrf).ab,ti.
123 (toxoplasmosis or "toxoplasmosis prevention and control").de.
124 toxoplasmosis.ab,ti.
125 trichinellosis.ab,ti.
126 tuberculosis.de.
127 (tuberculosis or TB).ab,ti.
128 tularaemia.ab,ti.
129 typhoid.ab,ti.
130 (variant creutzfeldt-jakob disease or vcjd).ab,ti.
131 varicella.ab,ti.
132 (vector-borne or vectorborne).ab,ti.
133 viral conjunctivitis.ab,ti.
134 (water-borne or waterborne).ab,ti.
135 (west nile virus or west nile fever).ab,ti.
136 west nile virus.de.
137 whooping cough.de.
138 whooping cough.ab,ti.
139 yersiniosis.ab,ti.
140 (zoonos#s or zoonotic disease?).ab,ti.
141 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 or 105 or 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
142 (case control study or cohort study or longitudinal study or observational study or prospective study or randomised controlled trial).pt.
143 editorial.pt.
144 clinical trials.de.
145 cohort studies.de.
146 (controlled clinical trials or controlled trials).de.
147 (evaluation studies or evaluation study).de.
148 follow up studies.de.
149 pilot projects.de.
150 (program evaluation or programme evaluation).de.
151 (prospective studies or prospective study).de.
152 (random allocation or randomised controlled trial or randomised controlled trials).de.
153 baseline.ti,ab.
154 "before and after".ti,ab.
155 "clinical trial".ti,ab.
156 cohort.ti,ab.

157 comparative$.ti,ab.
158 (control$ adj1 trial$).ti,ab.
159 (control adj1 group$).ti,ab.
160 effective.ti,ab.
161 effectiveness.ti,ab.
162 experimental.ti,ab.
163 (evaluation$ or evaluative).ti,ab.
164 matched.ti,ab.
165 pilot$.ti,ab.
166 "pre-post".ti,ab.
167 prospective.ti,ab.
168 (random$ adj1 allocat$).ti,ab.
169 142 or 144 or 145 or 146 or 147 or 148 or 149 or 150 or 151 or 152 or 154 or 155 or 156 or 157 or 158 or 159 or 160 or 161 or 162 or 163 or 164 or 165 or 166 or 167 or 168
170 169 not 143
171 (action or actions).ab,ti.
172 activit$.ab,ti.
173 (campaign or campaigns).ab,ti.
174 education$.ab,ti.
175 framework$.ab,ti.
176 guidance.ab,ti.
177 guideline$.ab,ti.
178 incentiv$.ab,ti.
179 intervention$.ab,ti.
180 outreach.ab,ti.
181 (program or programs or programme or programmes).ab,ti.
182 protocol$.ab,ti.
183 scheme$.ab,ti.
184 service$.ab,ti.
185 (strategy or strategies).ab,ti.
186 training.ab,ti.
187 education.de.
188 training.de.
189 171 or 172 or 173 or 174 or 175 or 176 or 177 or 178 or 179 or 180 or 181 or 182 or 183 or 184 or 185 or 186 or 187 or 188
190 ((alter$ or modif$ or chang$) adj2 behavio$).ab,ti.
191 ((alter$ or modif$ or chang$) adj2 practice$).ab,ti.
192 (Adher$ adj2 (Medic$ or Regimen$ or treatment$)).ab,ti.
193 (animal$ adj2 (handl$ or pet$)).ab,ti.
194 (Antibiotic$ adj2 (resist$ or misus$)).ab,ti.
195 attitudes health personnel.de.
196 barrier$.ab,ti.
197 Behavio?ral monitoring.ab,ti.
198 Behavio?ral surveillance.ab,ti.
199 behaviour.de.
200 cleanliness.de.
201 clean$.ab,ti.
202 close contact.ab,ti.
203 (contact$ adj trac$).ab,ti.
204 (cover$ adj2 (mouth$ or nose$)).ab,ti.
205 cross infection.de.
206 cross infection.ab,ti.
207 cross contaminat$.ab,ti.
208 crowd$.ab,ti.
209 disease transmission.de.
210 disease transmission.ab,ti.
211 disinfection.de.
212 disinfect$.ab,ti.
213 (face mask or face masks).de.

214   (face mask$ or facial mask$).ab,ti.
215   food contamination.de.
216   (food adj (contaminat$ or handling or safety)).ab,ti.
217   handwashing.de.
218   (Hand? adj2 (Gel$ or alcohol$ or saniti#er$)).ab,ti.
219   (hand? adj2 (hygein$ or wash$)).ab,ti.
220   (Health adj (advi$ or attitude$ or knowledge or practice$)).ab,ti.
221   (hospital adj2 infection$).ab,ti.
222   immuni#ation?.de.
223   immuni#ation?.ab,ti.
224   (information adj seek$).ab,ti.
225   (inject$ adj (equipment or paraphernalia)).ab,ti.
226   inoculat$.ab,ti.
227   (insect$ adj2 repel$).ab,ti.
228   ((needle$ or inject$) adj2 (reus$ or share$ or sharing)).ab,ti.
229   (pandemic adj2 prepar$).ab,ti.
230   patient compliance.de.
231   patient compliance.ab,ti.
232   Personal protect$ measure$.ab,ti.
233   (protect$ adj cloth$).ab,ti.
234   protective clothing.de.
235   Quarantine$.ab,ti.
236   (remind$ adj2 system?).ab,ti.
237   (Respiratory adj2 hygien$).ab,ti.
238   (Risk$ adj1 (behavio$ or tak$)).ab,ti.
239   ((screen$ or test$) adj2 (hepatitis or hep B or Hep C or HBV or HCV or influenza or rubella or TB or tuberculosis or typhoid or toxoplasmosis or varicella or infectious disease?)).ab,ti.
240   sterili#e.ab,ti.
241   surgical mask$.ab,ti.
242   (Tick$ adj2 (bite$ or bitten or remov$)).ab,ti.
243   ((Tissue$ or handkerchie$) adj2 (cough$ or sneeze$)).ab,ti.
244   vaccin$.ab,ti.
245   (vaccination or vaccinations or vaccines).de.
246   190 or 191 or 192 or 193 or 194 or 195 or 196 or 197 or 198 or 199 or 200 or 201 or 202 or 203 or 204 or 205 or 206 or 207 or 208 or 209 or 210 or 211 or 212 or 213 or 214 or 215 or 216 or 217 or 218 or 219 or 220 or 221 or 222 or 223 or 224 or 225 or 226 or 227 or 228 or 229 or 230 or 231 or 232 or 233 or 234 or 235 or 236 or 237 or 238 or 239 or 240 or 241 or 242 or 243 or 244 or 245
247   141 and 170 and 189 and 246
248   limit 247 to yr="2001 -Current"

Appendix 3. Database and website searches

Electronic academic literature databases (subscription access)

Interface	Database
Cochrane Library	Cochrane Central Register of Controlled Trials (CENTRAL)
Cochrane Library	Health Technology Assessment (HTA) Database
CSA Illumina	Social Services Abstracts
CSA Illumina	Sociological Abstracts
EBSCOHost	CINAHL
EBSCOHost	Health Source
EBSCOHost	PsycINFO
MIT CogNet	MIT CogNet
OvidSP	Maternity and Infant Care
PubMed	Medline
Web of Knowledge	BIOSIS Previews
Web of Knowledge	Web of Science Indices
Zetoc Search	MIMAS

Websites and open access databases

Centers for Disease Control and Prevention
Copac National, Academic, and Specialist Library Catalogue
DG SANCO
DG Research & Innovation
EDEN (Emerging Diseases in a changing European eNvironment) project
EuroHealthNet
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 (*link had expired at time of publication*)
ICA Health Communication (a Johns Hopkins University database) *(listed in review protocol but not searched as the domain had expired on 17 August 2011)*
International Union for Health Promotion and Education
LENUS: The Irish Health Repository
NHS Evidence in Health and Social Care
WHO Library and Information Networks for Knowledge Database (WHOLIS)
WHO: World Health Organization

General Google searches – example search strategies

"Antimicrobial Resistance" OR "Healthcare-Associated Infections" OR "Emerging Disease" OR "Vector-Borne Disease" OR "Food-borne disease" OR "Waterborne Disease" OR Zoonoses OR "Respiratory Tract Infections" OR "Vaccine Preventable Disease" OR "Invasive Bacterial Infection" "theory of reasoned action" filetype:pdf

"Antimicrobial Resistance" OR "Healthcare-Associated Infections" OR "Emerging Disease" OR "Vector-Borne Disease" OR "Food-borne disease" OR "Waterborne Disease" OR Zoonoses OR "Respiratory Tract Infections" OR "Vaccine Preventable Disease" OR "Invasive Bacterial Infection" "stages of change" filetype:pdf

Zoonoses OR "Waterborne Disease" OR "Vector-Borne Disease" OR "Vaccine Preventable Disease" OR "Respiratory Tract Infections" OR "Invasive Bacterial Infection" OR "Healthcare-Associated Infections" OR "Food-borne disease" OR "Emerging Disease" OR "Antimicrobial Resistance" "social cognitive theory" filetype:pdf

Zoonoses OR "Waterborne Disease" OR "Vector-Borne Disease" OR "Vaccine Preventable Disease" OR "Respiratory Tract Infections" OR "Invasive Bacterial Infection" OR "Healthcare-Associated Infections" OR "Food-borne disease" OR "Emerging Disease" OR "Antimicrobial Resistance" "behaviour change theory" filetype:pdf

Appendix 4. Flow chart of the review study selection process

Total papers
identified in searches
n=25,221

Duplicates n=5,933

Titles & Abstracts
screened n=19,288

Excluded n=17,923
Unobtainable n=13

Electronic copies
retrieved for free-text
search n=1,273

Paper copies
retrieved and full
text assessed n=79

Excluded n=1,049

Full text assessed
n=224

Excluded n=221

Papers included in
review n=82
Studies included in
review n=61

Appendix 5. Theory/models free-text search strategy

"behavio* change theor*"
"common sense model"
"Communication Theory"
"Community Building"
"Community Organization"
"Diffusion of Innovation"
"Diffusion of Innovations"
"ecological model of health behavior"
"ecological model of health behaviour"
"ecological psychology"
"ecosocial model"
"environmental psychology"
"Health Belief Model"
"Integrated Behavioral Model"
"Integrated Behavioural Model"
"operant learning theory"
"Organizational Change"
"Organizational Development Theory"
"patient centred communication"
"patient provider interaction"
"Precaution Adoption"
"PRECEDE-PROCEED"
PRECEDE ~ PROCEED
(PRECEDE ~ model) AND *Green*
"enabling constructs"
(PROCEED ~ model) AND *Green*
"organizational constructs"
"self-management model"
"Social Cognitive Theories"
"Social Cognitive Theory"
"social ecology"
"Social Learning Theory"
"Stage of Change"
"Stages of Change"
"Stage theories"
"Stage theory"
"structural-ecological model"
"systems theory"
"Theory of Planned Behavior"
"Theory of Planned Behaviour"
"Theory of Reasoned Action"
"triadic influence"
"Transactional Model"
"Transtheoretical"
Ajzen
Bagozzi
Bandura
DiClemente
Fishbein
Folkman
Glanz
Lazarus
Leventhal
Prochaska
Rimer ~ theory
Viswanath[10]

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[10] Key: ~ = NEAR (searches for instances of the terms near one another); * = prefix (searches for words beginning with those letters)

Appendix 6. Data extraction tables

STUDY Journal title Country/Countries Validity Scores	INTERVENTION Aim Setting Target population Target Disease Group(s) Target disease(s) Target Behaviour(s) for change Theory/model used	EVALUATION DESIGN Study design Sample size Sample characteristics Main outcome measures Follow-up period Analysis method	EVALUATION RESULTS Main primary outcome measures results Main secondary outcome measures results	NOTES Funding source
Abou-Saleh (2008) Harm Reduction Journal UK **A:** 50% **B:** 43% **C:** 100% **D:** 75% **Overall:** 63%	**Intervention's aim** To develop and evaluate the comparative effectiveness of behavioural interventions of enhanced prevention counselling (EPC) and simple educational counselling (SEC) in reducing hepatitis C viral (HCV) infection in sero-negative injecting drug users (IDU). Prevention of communicable disease(s) **Intervention's Setting** Drug services in London and Surrey, United Kingdom. **Intervention's target population** Injecting drug users. **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Hepatitis C viral (HCV) **Target Behaviour(s) for change** Reducing needle and syringe-sharing. **Theory/model** Health Belief Model Theory of Reasoned Action Social Cognitive Theory (Social Learning Theory)	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size 95 Intervention/Post-test sample size 78 at six months and 62 at twelve months **Sample characteristics** Mean age 32 years. 70 males 25 females. 10% were married, 42% had at least one child, 43% were unemployed and 48% had educational qualifications. There were no significant differences on these basic demographic characteristics between both those followed-up and those not followed up and between those allocated to EPC and those allocated to SEC. **Main outcome measures** Relevant primary outcomes The primary outcome measure was the number of new cases of HCV infection by seroconversion detected by HCV positive antibody at 6 and 12 months from recruitment. Relevant secondary outcomes: Secondary outcome measures were those administered at baseline e.g. Injecting Risk Questionnaire, the HIV Risk Taking Behaviour and Alcohol Use Disorders Identification Test (AUDIT) Questionnaire, Self-efficacy, outcome expectancies (situational confidence), stages of change in the 'readiness to change' model were assessed using the Readiness to Change questionnaire, and general knowledge on hepatitis C measured using a custom-designed questionnaire. **Follow-up period** 6 and 12 months from baseline. **Analysis method** Intention to treat analysis. Chi-square analyses were performed for all categorical data and Mann-Whitney U-Tests for ordinal data that were not normally distributed to apply parametric tests.	**Main primary outcome measures results** Behavioural primary outcomes The difference in seroconversion was not significant between the two interventions at either six months or twelve months, but it was however in the anticipated direction, with fewer of those allocated to EPC seroconverting compared to those that received SEC. The difference was even more pronounced (but still not significant) when only those who received at least one session of the intervention were included as no patients who received at least one session of EPC seroconverted at either six months or twelve months. **Main secondary outcome measures results** Attitudinal/Beliefs secondary outcomes There were no significant differences between the EPC and SEC groups on any of the secondary outcome measures (effect of treatment). However there were significant changes in a number of measures for both groups at 6 months follow-up (effects of time). Table 3 shows significant changes for ASI alcohol use, medical subscale, economic subscale, satisfaction subscale and HIV-RTBS injecting risk, sexual risk behaviour and overall scores.	**Funding source** Funded as part of the UK Department of Health Policy Research Programme

STUDY Journal title Country/Countries Validity Scores	INTERVENTION Aim Setting Target population Target Disease Group(s) Target disease(s) Target Behaviour(s) for change Theory/model used	EVALUATION DESIGN Study design Sample size Sample characteristics Main outcome measures Follow-up period Analysis method	EVALUATION RESULTS Main primary outcome measures results Main secondary outcome measures results	NOTES Funding source
Adeneye (2007) Research in Social and Administrative Pharmacy Nigeria **A:** 25% **B:** 29% **C:** 80% **D:** 66% **Overall:** 46%	**Intervention's aim** Raising awareness of the risk of schistosomiasis from bathing rivers and streams. Obtaining community support and involvement with the treatment programme. Prevention of communicable disease(s) **Target Disease Group(s)** Emerging and vector borne diseases **Target disease(s)** Schistosomiasis **Theory/model** Community organization: locality development model	**Study design** Randomised controlled trial **Sample size** Total sample size Note that the total population across the six communities was 9259. The sample size for the survey is not presented in the study text. A sample of 82 was included in the qualitative research sample utilising focus groups and depth interviews to assess changes in knowledge of schistosomiasis. **Sample characteristics** Whole community populations, no sample characteristics provided. **Main outcome measures** Relevant primary outcomes Increased awareness of the risks of schistosomiasis from bathing/swimming in rivers or streams. Reduced levels of people bathing/swimming in rivers or streams. Generating support and participation in mass treatment programme. **Follow-up period** N/A **Analysis method** Qualitative data was analysed using textual analysis software: Text base Beta. No information was provided regarding analytical techniques used for the survey data.	**Main primary outcome measures results** Behavioural primary outcomes Participation in mass treatment for schistosomiasis. Avoidance of bathing or swimming in rivers or streams due to the disease risk. Attitudinal/Belief primary outcomes Increased knowledge of the links between bathing in rivers or streams and developing schistosomiasis.	**Funding source** The Nigerian Institute of Medical Research and the German Technical Cooperation (GTZ)
Boom (2008) Health Promotion Practice USA **A:** 50% **B:** 80% **C:** 100% **D:** 80% **Overall:** 74%	**Intervention's aim** This study evaluates the effectiveness of an academic detailing intervention to increase childhood immunization rates in paediatric and family medicine practices. Prevention of communicable disease(s) **Target Disease Group(s)** Vaccine preventable diseases and Invasive bacterial infections **Target disease(s)** E.g. pertussis, influenza, measles. **Theory/model** Stages of Change (Transtheoretical) Model	**Study design** Randomised controlled trial **Sample size** Total sample size 189 Intervention/Post-test sample size 69 Control/Pre-test sample size 64 **Sample characteristics** Pediatric and family medicine providers in the Greater Houston area. Intervention sample characteristics Specialty - Pediatric 35, Family medicine 27 Size - Small 43, Large 19 VFC (vaccines for children) status - VFC 52, Non-VFC 10. Control sample characteristics Specialty - Pediatric 38, Family medicine 23 Size - Small 33, Large 28	**Main primary outcome measures results** Behavioural primary outcomes At baseline, 58% of practices in the control group met the minimum UTD criteria for children aged 12-23 months compared to 59% of practices in the intervention group. At 1-year follow-up, 55% of practices in the control group and 60% of practices in the intervention group met the minimum UTD criteria.	**Funding source** The Centers for Disease Control and Prevention (CDC) and the Texas Department of State Health Services

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		VFC status - VFC 50, Non-VFC 11 Exclusions In the intervention group eight practices were dropped from analyses because they had less than two records for the CASA (Clinical Assessment Software Application). In the control group two practices with less than two records in a CASA were dropped from analysis. **Main outcome measures** Relevant primary outcomes The percentage of children in each practice aged 12-23 months meeting minimum UTD criteria determined the immunization status for each practice. **Follow-up period** Immunization status for the practices was evaluated at baseline and 1 year later, post intervention. **Analysis method** Univariate analyses were conducted to determine the relationship of mean immunization percentage for the intervention and control groups with each independent variable of interest, practice size, clinical specialty, and VFC status.		
Britto (2006) The Joint Commission Journal on Quality& Patient Safety USA **A:** 40% **B:** 67% **C:** 100% **D:** 50% **Overall:** 63%	**Intervention's aim** To increase uptake of influenza immunisation among patients in a paediatric hospital. Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections **Target disease(s)** Influenza **Theory/model** Diffusion of Innovations	**Study design** Interrupted time series **Sample size** Total sample size: Total population eligible for immunisation 1,269. Cystic Fibrosis Clinic (205 eligible patients over the course of the intervention), Teen Health Clinic (447 patients) , Cardiology Clinic (44 patients) High Risk Infants Clinic (229 patients), Gastroenterology Clinic (189 patients) , Nephrology Clinic (123 patients), Pulmonary Clinic (32 patients) **Sample characteristics** Seven Clinics took part in the intervention. Cystic Fibrosis Clinic: patients with cystic fibrosis patients Teen Health Clinic: patients with asthma, diabetes, sickle cell disease Cardiology Clinic: hypoplastic left heart patients High Risk Infants Clinic: Bronchopulmonary dysplasia patients Gastroenterology Clinic: liver transplant patients Nephrology Clinic: renal failure patients	**Main primary outcome measures results** Behavioural primary outcomes Overall, 60.0% of the target population was immunised over the course of the intervention. The cystic fibrosis had an immunisation rate of >90%, while the rate in other clinics ranged from 32.7% to 66.4%. Immunisation rates increased in all clinics over the course of the intervention. **Main secondary outcome measures results** Behavioural secondary outcomes One clinic did not immunise patients, but sent letters to patients urging them to be immunised by their primary care physician and made tracking calls. The other six clinics all used reminder postcards and pre-printed immunisation order sheets. Four clinics made reminder phone calls, and five clinics used each of the remaining strategies.	**Funding source** Funded in part by the Robert Wood Johnson Foundation (Grant #045413).

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		Pulmonary Clinic: ventilator dependent patients **Main outcome measures** Relevant primary outcomes Influenza immunisation uptake. Relevant secondary outcomes Compliance with elements of the quality improvement programme. **Follow-up period** 16 weeks. **Analysis method** The proportion of target population immunised was calculated on the basis of the data from the online tracking system.		
Campbell (2009) Psychology of Addictive Behaviors USA **A:** 75% **B:** 71% **C:** 100% **D:** 60% **Overall:** 76%	**Intervention's aim** This study tested the impact of the Therapeutic Alliance Intervention (TA) and the Counselling and Education Intervention (C&E) (Coyle, 1993) on reducing HIV/HCV risk behaviours among injection drug users in residential detoxification and on improving treatment participation after detoxification. Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** HIV/HCV **Theory/model** Stages of Change (Transtheoretical) Model	**Study design** Randomised controlled trial **Sample size** Total sample size 632 at baseline Intervention/Post-test sample size TA = 209 at baseline, C&E = 212 at baseline Control/Pre-test sample size Treatment as usual (TAU) = 211 at baseline **Sample characteristics** Participants averaged 36 years of age with a range from 19 to 65. Approximately 24% were female, 8% were African American, 10% were multi-racial and 9% reported Latino or Hispanic ethnicity. Overall, 82% of participants scored in the preparation stage for quitting drug use, and 14% were in pre-contemplation or contemplation stage at baseline. Over 80% reported injecting heroin within the past 30 days, nearly 60% reported stimulant (i.e., amphetamine or cocaine) injection, and 38% reported injecting 'speedballs', a combination of heroin and cocaine. Intervention sample characteristics TA - Mean age 36.3 (range 19-61); Female 23.4%; White/Caucasian (%) 69.4 African American (%) 10.1 Multi-Racial (%) 11.5 Others (%) 9.0; Ethnicity: Hispanic/Latino (%) 9.1; Stage of Change: Preparation (%) 79.0 Pre-contemplation/Contemplation (%) 18.7 Unstageable (%) 2.3; Drug Use Past 30 Days: Heroin Use (%) 83.9 Stimulant Use (%) 56.7 Other Opiates (%) 52.3 Speedball Use (%) 33.8 C&E - Mean Age 35.7 (range 19-65); Female 23.1%; White/Caucasian (%) 77.4 African American (%) 5.2 Multi-Racial (%) 8.5 Others (%) 8.9; Ethnicity:	**Main primary outcome measures results** Behavioural primary outcomes Four types of treatment are reported: 1) outpatient, 2) methadone maintenance/other opiate replacement treatment, 3) residential/inpatient, and 4) 12-step meetings. Outpatient - The participants in the two intervention groups were more likely to report at least one outpatient treatment visit and to enter care sooner than those in TAU. Group differences in entry into other treatments (methadone maintenance/other opiate replacement, residential/inpatient, and 12-step meetings) were not as prominent.	**Funding source** Study conducted within the National Drug Abuse Treatment Clinical Trials Network and supported through cooperative agreements with the National Institute on Drug Abuse Northern New England, Great Lakes, Rocky Mountain, Oregon/Hawaii, and Pacific Northwest Nodes. Data analysis received assistance from the Biostatistics Shared Resource of Oregon Health and Science University and from the Oregon Clinical and Translational Research Institute

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		Hispanic/Latino (%) 7.6; Stage of Change: Preparation (%) 81.1 Pre-contemplation/Contemplation (%) 13.2 Unstageable (%) 5.3; Drug Use Past 30 Days: Heroin Use (%) 77.1 Stimulant Use (%) 61.1 Other Opiates (%) 52.7 Speedball Use (%) 40.4 Control sample characteristics TAU - Mean age 35.6 (Range 19 - 62); Female (%) 26.5; Race: White/Caucasian (%) 73.9 African American (%) 9.0 Multi-Racial (%) 9.0 Others (%) 8.1; Ethnicity: Hispanic/Latino (%) 10.9; Stage of Change: Preparation (%) 84.4 Pre-contemplation/Contemplation (%) 10.0 Unstageable (%) 5.6; Drug Use Past 30 Days: Heroin Use (%) 81.3 Stimulant Use (%) 61.4 Other Opiates (%) 54.5 Speedball Use (%) 39.6 Exclusions: The most common reasons for study exclusion were patients' reporting no drug injection in the prior 30 days (n = 13) and patients' requesting residential treatment (n = 15). **Main outcome measures** Relevant primary outcomes Self-reported treatment entry Relevant secondary outcomes Dates of treatment services **Follow-up period** 8, 16 and 24 weeks post-baseline **Analysis method** Product-limit survival analysis supplemented by the proportional hazards regression model for multivariate analyses. Variables related to outpatient treatment entry (p < .10) were included in analysis of covariance		
Cebotarenco (2008) Health Education Research Moldova **A:** 50% **B:** 29% **C:** 100% **D:** 83% **Overall:** 61%	**Intervention's aim** Decrease antibiotic use for colds and flu. Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections **Target disease(s)** Common cold and influenza **Theory/model** Social Cognitive Theory (Social Learning Theory)	**Study design** Randomised controlled trial **Sample size** Total sample size 3586 sixth level school students and 2716 adults pre-test. 2999 seventh level school students and 2156 adults post-test. Intervention/Post-test sample size 1686 seventh level school students and 1149 adults post-test. Control/Pre-test sample size 1788 sixth level school students and 1315 adults pre-test.	**Main primary outcome measures results** Behavioural primary outcomes Students' and adults' antibiotic use for colds and flu in intervention and control groups Attitudinal/Belief primary outcomes Students' and adults' beliefs related to antibiotic use: bacteria cause the common cold, viruses cause the common cold, bacteria cause the flu, viruses cause the flu, antibiotics treat bacterial infections, antibiotics treat both bacterial and viral infections, it's never useful to take antibiotics for a cold or flu, you should stop taking antibiotics if you feel better	**Funding source** RPM Plus (Management Sciences for Health), USAID, 585 Applied Research on Child Health (ARCH) Boston University and the World Health Organization EDM

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		Sample characteristics Students aged 12-13 years. 46.6% of the intervention sample were male, and 47.7% in the control group. **Main outcome measures** Relevant primary outcomes Participants reported incidence of cold or flu treated with antibiotics in the last winter. Relevant secondary outcomes Increased knowledge about the cause of colds and flu. Increased knowledge of the usefulness of antibiotics. **Follow-up period:** Approximately one year **Analysis method:** Logistic regression		
Colon (2009) AIDS and Behavior Puerto Rico **A:** 33% **B:** 29% **C:** 100% **D:** 80% **Overall:** 57%	**Intervention's aim** To promote new drug preparation practices among injecting drug users. Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** HIV, Hepatitis C **Theory/model** Diffusion of Innovations	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size 37 Intervention/Post-test sample size 32 (5 lost to follow-up) Control/Pre-test sample size 37 **Sample characteristics** Baseline participants: 70.3% male. Mean age 36.8 years (range 23-59). Mean 11 years of schooling. 40.5% had not completed high school. 21.9% of participants reported having a full or part time regular job. 54.1% of participants reported being homeless. History of injecting drug use: mean 15.3 years (range <1 year to 41 years). Mean number of daily injections: 8 (range 0-35). **Main outcome measures** Relevant primary outcomes Adoption of promoted drug preparation practices. Change in the proportion of drug preparation materials collected from shooting galleries testing positive for red blood cells. Relevant secondary outcomes Changes in traditional drug preparation practices **Follow-up period** For behavioural outcomes, follow up was 18 weeks. Collection of drug preparation materials for biological testing occurred at 5 points: 4 weeks prior to the intervention period; 1 week prior to the intervention period; and weeks 8, 14 and 18 of the intervention.	**Main primary outcome measures results** Behavioural primary outcomes Use of promoted drug preparation practices was absent at baseline. At follow-up, 65.6% of participants had adopted practice 1 (p<0.001); 56.3% had adopted practice 2 (p<0.001); 34.4% had adopted practice 3 (p=0.003); and 53.1% had adopted practice 4 (p<0.001). Other primary outcomes Proportion of collected drug preparation materials testing positive for red blood cells: 4 weeks pre-intervention (n=59): 40.7% (95% CI 29.1% - 53.4%) 1 week pre-intervention (n=37): 43.2% (95% CI 28.6% - 59.0%) Intervention week 8 (n=42): 28.6% (95% CI 17.2% - 43.6%) Intervention week 14 (n=57): 24.6% (95% CI 15.3% - 37.1%) Intervention week 18 (n=50): 12.0% (95% CI 5.6% - 23.8%) 66% reduction (OR=0.34) in the presence of red blood cells during the 16 week period. **Main secondary outcome measures results** Behavioural secondary outcomes Participants who reported carrying a source of water (other than the promoted bottle with dropper): 37.5% at baseline, 6.3% at follow-up (p=0.006). Participants carrying cookers: 59.4% at baseline, 56.3% at follow-up (p>0.999). Participants carrying injection syringes: 62.5% at baseline, 68.8% at follow-up (p=0.687).	**Funding source** Not stated

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		Analysis method Single tailed tests of proportions to test if the rates of adoption were significantly larger than 15% at $p<0.05$ (i.e. threshold of adoption required to trigger a self-sustaining diffusion according to Diffusion of Innovations literature). To test for efficacy potential, lab results (coded 1 if any red blood cells observed, 0 otherwise) were regressed against intervention week. Multivariate logistic regression was used to model the test result data. Nonparametric tests for paired data (McNemar for dichotomous measures and Wilcoxon signed-rank for continuous measures) were used to assess changes in the traditional practices between baseline and follow-up.	Participants drawing drug from cooker after another IDU on the last day of injection: 15.6% at baseline, 6.3% at follow-up (p=0.453). Participants who received drug through backloading on last day of injecting: 40.6% at baseline, 9.4% at follow-up (p=0.006). Mean number of new syringes obtained in the last 7 days: 17.3 at baseline, 20.0 at follow-up (p=0.361). Mean number of times syringe was cleaned with bleach on last day of injection: 0.4 at baseline, 1.9 at follow-up (p=0.016)	
Conner (2011) Health Psychology UK **A:** 63% **B:** 66% **C:** 100% **D:** 80% **Overall:** 75%	**Intervention's aim** To test the efficacy of interventions based on the question-behaviour effect in promoting the adoption of disease prevention behaviours Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory Infections, Antimicrobial resistance & Healthcare-associated infections **Target disease(s)** Influenza **Theory/model** Theory of Planned Behavior	**Study design** Randomised controlled trial **Sample size** Total sample size: Study 1 - 384; Study 2 - 1200 Intervention/Post-test sample size: Study 1 - 199; Study 2 - 600 Control/Pre-test sample size: Study 1 - 185; Study 2 - 600 **Sample characteristics** Study 1 - Age 36.4 (3.55); Gender Male 183 (47.7) Female 201 (52.3) 106 (27.6) 95 (24.7) Study 2 - Age 38.1 (12.2) Gender Male 199 (16.6) Female 1,001 (83.4) Hospital A 599 (49.9) B 300 (25.0) C 301 (25.1) Employee type Nurses 600 (50.0) Auxiliary 301 (25.1) Technical 299 (24.9) Employment status Part-time 634 (52.8) Full-time 566 (47.2) Working hours Daytime 817 (68.0) Evening/nights 383 (32.0) Intervention sample characteristics Study 1 - Age 36.2 (3.62); Gender Male 93 (24.2) Female 106 (27.6) Study 2 - Age 38.0 (11.8) Gender Male 99 (8.3) Female 501 (41.8) Hospital A 299 (24.9) B 150 (12.5) C 151 (12.6) Employee type Nurses 300 (25.0) Auxiliary 151 (12.6) Technical 149 (12.4) Employment status Part-time 313 (26.1) Full-time 287 (23.9) Working hours Daytime 398 (33.2) Evening/nights 202 (16.8)	**Main primary outcome measures results** Behavioural primary outcomes Study 1 - Those completing the questionnaire were significantly more likely to attend than those not completing the questionnaire. Study 2 - Analysis indicated that the vaccination rates were significantly higher in the experimental condition (42.0%) than the control condition (36.3%). Attitudinal/Belief primary outcomes: Study 1 - we compared the proportions of patients who attended health checks for positive completers (those with high scores on the cognitions), negative completers (those with low scores on the cognitions), non completers, and those who did not receive a questionnaire. The positive completers were more likely to attend than the negative completers for attitude, perceived behavioural control and intentions. Study 2 - contrast analysis between conditions indicated clearly that completion of the questionnaire was a prerequisite for the question-behaviour effect to occur. Participants who received and completed the questionnaire were more likely to get vaccinated than participants who received but did not complete the questionnaire.	**Funding source** In part by a grant from the UK Economic and Social Research Council (RES-062-23-2220) and in part by a grant from Centre Hospitalier Universitaire de Québec.

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		Control sample characteristics Study 1 - Age 36.5 (3.48); Gender Male 90 (23.4) Female 95 (24.7) Study 2 - Age 38.2 (12.5) Gender Male 100 (8.3) Female 500 (41.7) Hospital A 300 (25.0) B 150 (12.5) C 150 (12.5) Employee type Nurses 300 (25.0) Auxiliary 150 (12.5) Technical 150 (12.5) Employment status Part-time 321 (26.8) Full-time 279 (23.3) Working hours Daytime 419 (34.9) Evening/nights 181 (15.1) Exclusions Study 2 - 5 were excluded for missing data or contraindication to vaccination **Main outcome measures** Relevant primary outcomes Study 1 - An objective measure of behaviour (the key outcome measure) was obtained by checking medical records to verify whether or not each participant attended for health check in the next four months following the invitation. Study 2 - An objective measure of behaviour, that is, vaccination (the key outcome variable) was obtained for each participant. At the end of the vaccination campaign, data were extracted from the vaccination database of the three hospitals. **Follow-up period:** 2 months following intervention. **Analysis method:** Intention-to-treat analysis.		
Cox (2010) Health Psychology USA **A:** 63% **B:** 60% **C:** 100% **D:** 80% **Overall:** 74%	**Intervention's aim** To determine the most effective ways to present human papillomavirus (HPV) vaccine risk and benefit information to mothers in Hispanic, African American, and White communities, to increase mothers 'intentions to vaccinate their daughters against HPV. Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s):** HPV **Theory/model** Health Belief Model	**Study design** Randomised controlled trial **Sample size** Total sample size:471 mothers of girls aged 11-16 **Sample characteristics** Characteristic total sample: Daughter's mean age in years 13.7%. Mother's education: Not finished high school 4.9%; high school graduate 50.8%; Some college 22.2%; Trade school 5.8%; College graduate or more 16.3% Mother's ethnicity: African American 21.4%; Hispanic 19.7%; Non-Hispanic White 58.4%; Other ethnicities <1%. Mother's age in years: 18-34 2.1%; 35-44 64.5%; 45 or older 31.1% **Main outcome measures** Relevant primary outcomes Mothers' intention to vaccinate their daughters against	**Main primary outcome measures results** Behavioural primary outcomes Significant interactive effect of risk presentation and rhetorical question on perceived message comprehension, $F(2, 465) = 3.80$, $p = .023$, measure of effect size $\eta^2 = .016$. Analysis revealed a significant main effect of risk presentation on total shot intention, $F(2, 465) = 5.68$, $p = .004$, $\eta^2 = .024$, with the graphic presentation producing significantly higher mean vaccination intentions (M = 12.96) than did either the nongraphic (M = 11.89) or no-statistics control (M =11.88) conditions.	**Funding source** In part by Kelley School of Business, Indiana University. **Notes** One researcher served as a paid research consultant on a Merck research study of HPV vaccine acceptability and acceptance.

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		HPV. Relevant secondary outcomes: Mothers' self-reported message comprehension and perceptions of daughters' vulnerability to HPV infection, infection severity, vaccine efficacy, and obstacles to immunization **Follow-up period:** N/A **Analysis method:** ANOVA, Baron and Kenny's test, Sobel test, bivariate regression		
Creedon (2005) Journal of Advanced Nursing Ireland **A:** 33% **B:** 86% **C:** 100% **D:** 67% **Overall:** 71%	**Intervention's aim** 1. To observe healthcare workers' compliance with hand hygiene guidelines during patient care in an ICU before and after implementation of a hand hygiene programme. 2. To investigate their predisposition (knowledge, attitudes and beliefs) to compliance with hand washing guidelines before and after implementation of the programme. Both prevention & control of communicable disease(s) **Intervention's setting** A medical/surgical intensive care unit (ICU) with eight beds in a large urban teaching hospital **Intervention's target population** Healthcare workers: nurses, doctors, care-assistants and physiotherapists involved in delivering direct patient care in the ICU. **Target Disease Group(s)** Antimicrobial resistance & Healthcare-associated infections **Target disease(s)** Nosocomial infection **Target Behaviour(s) for change** Hand washing practices **Theory/model** PRECEDE-PROCEED PRECEDE framework - a modified version using the Behavioural and Educational assessments only.	**Study design** Before-and-after study (with different sample after intervention) **Sample size** Total sample size: 73 healthcare workers Intervention/Post-test sample size post-test sample: 40 healthcare workers Control/Pre-test sample size pre-test sample: 33 healthcare workers **Sample characteristics** Pre-test: 23 nurses, 5 doctors, 2 physiotherapists, 3 care assistants Post-test: 22 nurses, 8 doctors, 4 physiotherapists, 6 care assistants **Main outcome measures** Relevant primary outcomes: Compliance with hand washing guidelines (measured by observational data of hand washing indications vs. hand washing practices collected by author). Relevant secondary outcomes: Attitudes, beliefs and knowledge regarding compliance with hand washing guidelines (measured by self-report questionnaire) **Follow-up period:** 4 week pre-test followed 7 weeks' later by 4 week post-test **Analysis method:** Observed data A: descriptive statistics, pre- post- compliance percentages tested with chi-square test. MATLAB used to calculate differences between rates and 95% CI. Questionnaire data A: non-parametric Mann–Whitney U-tests on differences between means and SD (95% CI) for ordinal attitudes and beliefs scores. Knowledge analysed with chi-square test.	**Main primary outcome measures results** Behavioural primary outcomes At pre-test, 77 hand washing practices out of 152 indications for hand washing observed (51%); at post-test: 135 hand washing practices out of 162 indications for hand washing observed (83%). A 32% (23, 42 95% CI) statistically significant increase in group compliance (p<0.001). There was increase in compliance rate for nurses, doctors and others, but only statistically significant for nurses (p<0.001). Compliance with specific hand washing guidelines: statistically significant increase in compliance for 'Between contact with patients' from 48% to 93% (p<0.001) and 'After touching inanimate objects likely to be contaminated followed by a patient care activity' from 40% to 86% (p<0.001). Compliance decreased, non-statistically significantly for 'Beginning/resuming care', and non-statistically significant increases in compliance for 'Before invasive procedures', 'After direct contact with body substances' and 'After taking care of an infected patient or one who is likely to be colonized'. **Main secondary outcome measures results** Attitudinal/Beliefs secondary outcomes Attitudes and beliefs towards compliance with guidelines: for 4 measures, pre-test and post-test mean scores were over 5, thus positive. There was no statistically significant difference between groups. A fifth belief measure, about their own skin condition, increased statistically significantly from neutral to positive after the intervention (p<0.001). Knowledge of specific guidelines was already	**Funding source** Not stated

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			high and increased post intervention.	
Crosby (2008) Journal of Pediatric and Adolescent Gynecology USA **A:** 33% **B:** 40% **C:** 60% **D:** 50% **Overall:** 44%	**Intervention's aim** To test the feasibility of a brief, clinic-based, behavioural intervention designed to foster the adoption of three protective behaviours among adolescent females testing positive for any of 13 oncogenic strains of HPV. Control of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s):** HPV **Theory/model** Precaution Adoption Process Model	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 28 Intervention/Post-test sample size: 11 Control/Pre-test sample size: 17 **Sample characteristics** Mean age of the sample was 19.6 years (SD 5 1.6). One third of the teens identified as African American and the remainder identified as white. A history of abnormal cervical cytology was reported by 61.5% and 46.4% reported ever having a sexually transmitted infection. Intervention sample characteristics Black or African American 72.7%; High school graduate 72.7%; Ever had an STD 63.6%; Ever had HPV 9.1%; Ever have abnormal Pap 80.0% Control sample characteristics Black or African American 62.5%; High school graduate 76.5%; Ever had an STD 47.1%; Ever had HPV 23.5%; Ever have abnormal Pap 50.0% **Main outcome measures** Relevant primary outcomes: Self-reported rate of penile-vaginal sex and unprotected penile-vaginal sex. Relevant secondary outcomes: Intentions to return for next scheduled cervical cytology screening. **Analysis method:** Non-statistical comparison	**Main primary outcome measures results** Behavioural primary outcomes At follow-up, teens testing positive reported having penile-vaginal sex a mean of 7.7 times in the past 30 days compared to 9.7 times among those testing negative. Those testing positive also reported that unprotected penile-vaginal sex occurred a mean of 4.0 times compared to 5.0 times among those testing negative Attitudinal/Belief primary outcomes Of those testing positive, 100% indicated they would "definitely return" for their next scheduled cervical cytology screening as compared with 87% of those testing negative.	**Funding source:** Partial support from the Digene Corporation, from the Markey Cancer Center, University of Kentucky and from a DDI Endowment fund
Daltroy (2007) Health Education and Behavior USA **A:** 63% **B:** 50% **C:** 100% **D:** 80% **Overall:** 71%	**Intervention's aim** To evaluate a theory-based educational program to prevent Lyme disease and other tick-borne illnesses (TBI) Prevention of communicable disease(s) **Target Disease Group(s)** Emerging and vector borne diseases **Target disease(s)** Lyme disease, Ehrlichiosis, and Babesiosis **Theory/model** Health Belief Model Theory of Reasoned Action Theory of Planned Behavior	**Study design** Randomised controlled trial **Sample size** Total sample size: 30164 Intervention/Post-test sample size: 13562 Control/Pre-test sample size: 16602 **Sample characteristics** Intervention sample characteristics Age: 14-29 27.24%; 30-49 47.13%; 50-70+ 25.63%. Male 42.63%. Educational attainment: High school or less 16.61%; Trade school/some college 17.8%; College graduate 65.6%. Number of children on boat less than 14 years: 0 60.6%; 1-2 31.09%; 3+ 8.31%. Prior visit to Nantucket (before enrolment): Yes 19.27%; No 80.73%. Nantucket zip code: 3.52%.	**Main primary outcome measures results** Behavioural primary outcomes Although a main effects model showed lower rates of self-reported TBI among experimental participants than control participants (relative risk [RR] = 0.79), the difference was not statistically significant. However, interaction analyses showed a significant impact of the intervention among long-term visitors (greater than 2 weeks) versus short-term visitors. **Main secondary outcome measures results** Behavioural secondary outcomes Experimental and control participants reported similar number of days spent and hours per day in tick areas. However, experimental participants	**Funding source** National Institutes of Health grants, Charles Engelhard Fund, American Lyme Disease Foundation, GlaxoSmithKline, Arthritis Foundation, Pasteur Merieux Connaught, and the US Centers for Disease Control and Prevention.

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	Social Cognitive Theory (Social Learning Theory)	Planned length of stay: Less than 1 week 52.5%; 1-4 weeks 40.8%; More than 4 weeks 6.7%. Know someone with Lyme disease: 49.21%. Prior Lyme disease 5.45%. Control sample characteristics Age: 14-29 30.58%; 30-49 45.38%; 50-70+ 24.04%. Male 40.24%. Educational attainment: High school or less 14.9%; Trade school/some college 17.8%; College graduate 65.6%. Number of children on boat less than 14 years: 0 65.09%; 1-2 27.24%; 3+ 7.66%. Prior visit to Nantucket (before enrolment): Yes 19.92%; No 80.07%. Nantucket zip code: 3.91%. Planned length of stay: Less than 1 week 51.07%; 1-4 weeks 41.56%; More than 4 weeks 7.37%. Know someone with Lyme disease: 47.28%. Prior Lyme disease 5.42%. **Main outcome measures** Relevant primary outcomes Rates of self-reported TBI Relevant secondary outcomes Level of self-reported tick avoidance/prevention and tick check/removal behaviours **Follow-up period** 2 months following intervention **Analysis method** Logistic regression models, chi-square and Mantel-Haensel chi-square tests and Student's t test.	were more likely than control participants to take precautions against TBI, and to check themselves for ticks daily.	
Dempsey (2006) Paediatrics USA **A:** 75% **B:** 80% **C:** 100% **D:** 60% **Overall:** 78%	**Intervention's aim** The objectives of this study were (1) to determine the overall acceptance of HPV vaccines for preadolescent children by parents, (2) to evaluate the influence of written educational information about HPV on parental acceptability of HPV vaccines, and (3) to identify independent predictors associated with HPV vaccine acceptability by parents. Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Human Papillomavirus (HPV) **Theory/model**	**Study design:** Randomised controlled trial **Sample size** Total sample size: 1600 Intervention/Post-test sample size: 429 Control/Pre-test sample size: 411 **Main outcome measures** Relevant primary outcomes The primary outcome measured in this study was parental acceptability of HPV vaccines. **Follow-up period:** Unclear **Analysis method** Mean vaccine acceptability scale scores were compared between the 2 experimental groups using unpaired t-tests with unequal variance assumptions. Repeated measures analysis of variance was used to make comparisons of vaccine acceptability among the 3 proposed ages of vaccination. Bivariate associations	**Main primary outcome measures results** Attitudinal/Belief primary outcomes There was no significant difference between the 2 groups with respect to the mean parental vaccine acceptability scale scores suggesting that receipt of the HPV information sheet did not substantially alter parental acceptability of HPV vaccines.	 **Notes** One author received a speaking honoraria funded by Merck and one author received partial research

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	Health Belief Model Theory of Reasoned Action	between vaccine acceptability and predictor variables were assessed using Pearson product-moment correlations for continuous predictors and t tests for categorical and dichotomous predictor variables. Multivariate linear regression analysis was used to determine significant independent predictors of vaccine acceptability.		funding from Merck.
Ferguson (2010) Bone Marrow Transplantation Australia **A:** 33% **B:** 67% **C:** 60% **D:** 67% **Overall:** 57%	**Intervention's aim** The intervention aimed to improve awareness of respiratory virus (RV) infection and influenza vaccination among Hematopoietic Stem Cell Transplantation (HSCT) patients otherwise known as bone marrow transplant patients. Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections **Theory/model** Health Belief Model	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 205 Intervention/Post-test sample size: 139 (of which 43 were patients) Control/Pre-test sample size: 205 **Sample characteristics** Intervention sample characteristics Patients Male 25 (58%); female 18 (42%); median age 49.5 years; range 21-71 years Family/friends Male 34 (35%); female 62 (65%), median age 46.5 years; range 13-83 years. 49% lived with the patient preparing for HSCT. **Main outcome measures** Relevant primary outcomes Awareness of RV infection post-HSCT, effective prevention strategies, household influenza vaccination on admission for HSCT.	**Main primary outcome measures results** Behavioural primary outcomes Household vaccination at HSCT admission was 71% for attenders and 30% for non-participants (RR 2.38, 95% confidence interval (CI) 1.49–3.80, P<0.0001). Attitudinal/Belief primary outcomes Results showed that the intervention increased awareness that influenza post- HSCT could be fatal or require intensive care (68–87%, P=0.003), knowledge of effective prevention strategies (41–78%, P<0.0001) including vaccination (11–58%, P<0.0001), and belief among family/friends (but not patients) that household vaccination reduces influenza risk post-HSCT (57–97%, P<0.0001 and 76–81%, P=0.2, respectively).	**Funding source** The National Health and Medical Research Council of Australia (NHMRC) through a Centre of Clinical Research Excellence Grant (# 264625), and a NHMRC post-graduate medical award.
Francis (2009) British Medical Journal England, Wales **A:** 100% **B:** 57% **C:** 100% **D:** 100% **Overall:** 88%	**Intervention's aim** Training clinicians in the use of an interactive booklet on respiratory tract infections in children, designed to enhance communication within the consultation, and act as a take home resource for parents, would have an effect on rates of reconsultation and antibiotic prescribing. Control of communicable disease(s) **Intervention's Setting** General Practitioner's practices **Intervention's target population** Children (6 months to 14 years) presenting to primary care with an	**Study design:** Randomised controlled trial **Sample size:** Total sample size: 528 children from 61 GP practices (558 recruited: 3 withdrew, 27 lost to follow-up) Intervention/Post-test sample size: 256 children from 30 GP practices Control/Pre-test sample size: 272 children from 31 GP practices. **Sample characteristics** Intervention sample characteristics Mean age 5.1 years (SD3.9). 45.3% males. Duration of illness 3.2 days (SD1.7). Symptoms at baseline: 63.4% cough; 27.1% earache; 31.1% runny nose; 32.6% sore throat; 37.7% fever; 13.2% looks unwell. Control sample characteristics	**Main primary outcome measures results** Behavioural primary outcomes There were no significant differences in terms of Primary care reconsultation within 14 days. Intervention: n=33 (12.9%); Control: n=44 (16.2%); Odds ratio from multilevel modelling (95% CI): 0.75 (0.41 to 1.38) **Main secondary outcome measures results** Behavioural secondary outcomes Children in the intervention group were significantly less likely to receive a prescription for antibiotics at the index consultation and less likely to take antibiotics during the first two weeks. Antibiotic prescribed at index consultation (intracluster correlation	**Funding source** Study: primarily by a Joint Medical Research Council and Welsh Assembly Government Special Training Fellowship in Health Services Research award. Funding for the development of the study website was provided through an unrestricted educational grant from Pfizer UK. All authors

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	acute respiratory tract infection (7 days or less) **Target Disease Group(s)** Antimicrobial resistance & Healthcare-associated infections Respiratory tract infections **Target disease(s)** Respiratory tract infection (cough, cold, sore throat, earache for seven days or less) **Target Behaviour(s) for change** To reduce antibiotic prescribing and GP reconsultations for the same illness episode **Theory/model** Theory of Planned Behavior Social Cognitive Theory (Social Learning Theory)	Mean age 5.3 years (SD3.8). 53.5% males. Duration of illness 3.3 days (SD1.8). Symptoms at baseline: 58.8% cough; 24.3% earache; 34.2% runny nose; 39.4% sore throat; 38.4% fever; 16.9% looks unwell. Exclusions Excludes children with asthma and those with serious ongoing medical conditions (e.g. malignancy or cystic fibrosis). **Main outcome measures** Relevant primary outcomes A reconsultation during the 14 days after the first consultation Relevant secondary outcomes Clinical outcomes: antibiotic prescribing, antibiotic consumption. Patient-related outcomes: future consulting intentions, parental satisfaction, perception of the usefulness of information received, reassurance, and enablement. **Follow-up period:** 14 days **Analysis method:** Random intercept logistic regression models (using 2 levels: practice and patient) for both primary and secondary outcomes.	coefficient=0.24) Intervention: n=50 (19.5%); Control: n=111 (40.8%) OR (95% CI): 0.29 (0.14 to 0.60). Antibiotics taken within first two weeks (including antibiotics prescribed after index consultation). Intervention: n=55 (22.4%); Control: n=111 (43.0%) OR (95% CI): 0.35 (0.18 to 0.66). Attitudinal/Beliefs secondary outcomes Parents of children in the intervention group were significantly less likely to report that they would consult in the future if their child had a similar illness. Parent intends to consult if their child has similar illness in future. Intervention: n=136 (55.3%); Control: n=201 (76.4%) OR (95% CI): 0.34 (0.20 to 0.57). There were no significant differences in terms of satisfaction, level of reassurance, parental enablement, or the parent's rating of the usefulness of information. Parental enablement score ($\geq$5). Intervention: n=99 (40.2%); Control: n=94 (35.9%) OR (95% CI) 1.20 (0.84 to 1.73). Parent reports satisfied/very satisfied with consultation. Intervention n=222 (90.2%); Control n=246 (93.5%) OR (95%CI): 0.64 (0.33 to 1.22). Parent reports very reassured after consultation. Intervention n=177 (72.0%); Control n=198 (75.3%) OR (95% CI): 0.84 (0.57 to 1.25). Parent reports information received was useful/very useful. Intervention n=210 (85.4%); Control n=224 (85.2%) OR (95% CI): 1.01 (0.60 to 1.68)	declare that the work was conducted independently from the study funders.
Garrard (2006) The Journal of Continuing Education in the Health Professions USA **A:** 17% **B:** 43% **C:** 80% **D:** 67% **Overall:** 50%	**Intervention's aim** To increase access to care and to improve care for patients with hepatitis C. Control of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Hepatitis C **Theory/model** PRECEDE-PROCEED	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: Clinicians from 28 Veterans Affairs Medical Centres (54 individual participants) Intervention/Post-test sample size: 28 medical centres Control/Pre-test sample size: 28 medical centres **Sample characteristics** Veterans Affairs Medical Centres. Exclusions Participation in previous hepatitis C training programmes coordinated by the same team.	**Main primary outcome measures results** Behavioural primary outcomes In 93% of the medical centres, there were organizational changes such as hepatitis C support group-initiated group education, in-service training, improvement in patient notification or scheduling processes, hiring of new clinical staff, development of a business plan, and discussions about changes with administration. 64% of medical centres established collaborative relationships between gastroenterology-hepatology and mental health clinicians.	**Funding source** The training program was funded by the Veterans Affairs Hepatitis C Resource Centers.

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		Main outcome measures Relevant primary outcomes Organisational change, including initiation or increase in collaboration between hepatitis C clinics and mental health care providers. Relevant secondary outcomes Change in knowledge and confidence. Change in screening and treatment rates. **Follow-up period:** 6 months. **Analysis method** Changes in knowledge and confidence were evaluated using paired t-tests. Evidence for system change was examined in a content analysis with medical centre as the unit of analysis.	**Main secondary outcome measures results** Behavioural secondary outcomes Almost half of medical centres (13/28) established regular use of depression and alcohol use screening tools. At one month follow up, hepatitis C screening increased in four centres; of the remainder, screening had stabilized or no change was reported. This pattern continued in months 3 and 6. Over 6 months, at least 7 centres reported an increase in the number of hepatitis C patients receiving antiviral treatment. Attitudinal/Beliefs secondary outcomes Mean scores in knowledge and confidence about hepatitis C screening, diagnosis, treatment and follow up increased significantly (p<0.001 and p<0.01 respectively).	
Gerend (2009) Sexually Transmitted Diseases USA **A:** 63% **B:** 67% **C:** 100% **D:** 80% **Overall:** 75%	**Intervention's aim** To test whether informing men about the benefits of male HPV vaccination for their female sexual partners (prevention of cervical cancer) would boost their interest in the vaccine over and above informing them about the benefits for men alone (protection against genital warts and anogenital cancers). **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Human papillomavirus (HPV) **Theory/model** Health Belief Model	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 356 Intervention/Post-test sample size: 356 **Sample characteristics** Male university students. Age Range: 18–24 (mean 18.8, SD 1.2) Race: Hispanic or Latino: 49 (14%); White 298 (84%); Black or African American 16 (4%); American Indian or Alaska Native 1 (<1%); Asian 7 (2%); Native Hawaiian or other Pacific Islander 4 (1%); Mixed race 11 (3%); Other race 13 (4%); Not reported 6 (2%). Yr in college: Freshman 221 (62%); Sophomore 90 (25%); Junior 29 (8%); Senior 16 (5%). Relationship status: Not dating 124 (35%); Single, but dating 131 (37%); Single, but in a committed relationship 98 (28%); Married 2 (<1%); Not reported 1 (<1%). Ever had sex: 273 (77%). Age at first intercourse: mean 16.5 (SD 1.3.) No. lifetime sexual partners: mean 3.7 (SD 5.8). Have current sexual partner: 163 (46%). Ever tested for STIs: 58 (16%). **Main outcome measures** Relevant primary outcomes HPV Awareness and Knowledge. (Vaccine Acceptability	**Main primary outcome measures results** Attitudinal/Belief primary outcomes Eighty-three percent (n = 295) of respondents had heard of HPV. The majority (58%) heard about HPV from a health education class, television (47%), or a friend (33%). About half (51%) indicated they had heard of the HPV vaccine. HPV knowledge at baseline was limited. There was considerable confusion between genital warts and genital herpes and less than 25% were aware of the connection between HPV and anogenital cancers in men. Knowledge scores increased substantially from baseline (M = 3.93, SD = 2.20) to post-test (M = 7.45; SD = 1.21), F (1354) = 893.6, P <0.001, but this increase did not vary by condition (P >0.25). At post-test, some confusion remained about the relationship between genital warts and genital herpes; however, the percentage of participants with correct answers increased to nearly 100% for most items.	**Funding source** Not stated.

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		- only post-test). **Follow-up period:** Immediately after intervention. **Analysis method:** Mixed design analysis of variance and multiple regression analysis.		
Girgis (2011) Canadian Journal on Medicine Egypt **A:** 33% **B:** 43% **C:** 40% **D:** 80% **Overall:** 48%	**Intervention's aim** To change mothers' behaviour to prevent the viral infectious disease among their children by using health belief models through: assessing the mothers' knowledge and practices, developing and implementing nursing intervention program according to mothers' needs. **Target Disease Group(s)** Foodborne & Waterborne Diseases & Zoonoses Respiratory Tract Infections Vaccine Preventable Diseases and Invasive Bacterial Infections **Target disease(s)** Hepatitis (A), seasonal flu, H1N1Flu and chicken pox. **Theory/model** Health Belief Model	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size 171(81 from nurseries in Benha governate; 90 from the paediatric outpatient clinic in El-Menoufya governate) Intervention/Post-test sample size 171(81 from nurseries in Benha governate; 90 from the paediatric outpatient clinic in El-Menoufya governate) **Sample characteristics** The 2 groups (both intervention) consisted of mothers of five (and under) year-old children without chronic diseases. Mothers' age: range 20-40+ years; most (>68%) aged 30-39 years. Received higher education: 43-44% to 4% illiterate. Rated their family income as 'enough' 75% (25% 'not enough'). Occupation: housewife 60-77%. The children's characteristics: Male 45.7% (Benha) 69.5% (El-Menoufya); Ranking first child 24.7% (Benha) **30.5**% (El-Menoufya), second child **42.0**% (Benha) 29.5% (El-Menoufya), third child 28.3% (Benha) 19.1% (El-Menoufya), fourth child 5.0% (Benha) 20.9% (El-Menoufya **Main outcome measures** Relevant primary outcomes Knowledge of viral infection: Hepatitis A, Seasonal Flu, H1N1 Flu, and Chicken Pox. Behaviour: Behaviours for the prevention and control of communicable disease **Follow-up period:** Not stated. **Analysis method:** Paired t-test, Chi-square test and ANOVA test.	**Main primary outcome measures results** Behavioural primary outcomes Responses to Behaviour questions related to infection: There were statistically significant differences between pre/post nursing interventions regarding mother's behaviour related to the infectious diseases (hepatitis A, seasonal flu and chicken pox), while the total behaviour mean scores improved from 21.02±6.358 to 28.432±10.934, in Benha group; and from 20.56±7.098 to 33.122±10.244 in El-Menoufya group. Responses to Behaviour questions related to hygiene practices: General, significant improvement of mothers' hygienic practices (personal hygienic measures, cleaning food and environment and house cleanliness). The only exception was in Benha group, where a non-significant improvement was found in preventing children from buying food from street vendors outside the school. Attitudinal/Belief primary outcomes Knowledge improved: mothers' knowledge pre/post nursing intervention in both groups regarding viral infectious diseases (hepatitis A, seasonal flu,H1N1 flu and chicken pox), in relation to mode of transmission, causes, incubation period, signs and symptoms, lab investigations and vaccinations. There were statistically significant differences between pre/post nursing interventions about mothers' knowledge related to the mentioned infectious diseases in all categories.	**Funding source** Not stated.
Glik (2004) American Journal of Health Behavior USA **A:** 44%	**Intervention's aim** A comprehensive integrated immunization promotion curriculum (Immunization Plus!) which aims to provide information to young adolescents, their parents, and teachers about up-to-date adolescent immunization recommendations to raise	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: Total n=929 students i) teacher training + curriculum: n=301 (12 classrooms,	**Main primary outcome measures results** Behavioural primary outcomes Changes over time Immunisation status: of the 3 intervention conditions, only the curriculum + teacher training intervention increased statistically significantly (p<0.01).	**Funding source** California Department of Health Services (Immunization Branch) and the Merck Corporation.

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B: 60% **C:** 80% **D:** 83% **Overall:** 64%	middle school student awareness, attitudes, and proactive immunization behaviour, and to increase rates among middle school students. Prevention of communicable disease(s) **Intervention's Setting** Schools **Intervention's target population** 6th grade pupils (chosen for being the population most affected by the new legislation change for Hep B vaccinations entry requirement for 7th grade) **Target Disease Group(s)** Vaccine preventable diseases and Invasive bacterial infections Bloodborne diseases (incl. HIV and STI) **Target disease(s)** 10 key vaccine-preventable diseases (not specified, although Hep B mentioned) **Target Behaviour(s) for change** Immunization **Theory/model** Health Belief Model Guided the intervention development Social Cognitive Theory (Social Learning Theory) Guided the intervention development Diffusion of Innovations Guided the process evaluation of the dissemination and utilization of the curriculum (Glik et al IEJHE 2000) Other: mass communications theory (unspecified)	32.4% of sample) ii) curriculum: n=279 (10 classrooms, 30.0% of sample) iii) video only: n=192 (9 classrooms, 20.7% of sample) iv) no intervention: n=157 (9 classrooms, 16.9% of the sample) Variations in conditions as 40/48 selected classes took part in the study and an average of 85% students per classroom participated. **Sample characteristics** Gender: equal numbers of boys and girls across the four conditions Ethnicity: Hispanic (49.5%); Hispanic mixed-race (1.7%); White (19.9%); White mixed-race (2.2%); Black (14.1%); Asian Americans (10.1%); Native Americans (2.2%). Language at home: 44.8% only English; 21.3% English & Spanish; 20.8% only Spanish; 13.1% other languages. Socio-economic status (proxy): average 25.6% students eligible for aid (above the state average in 16/22 schools). Attend ≥1/year: average 73% students across the four conditions. **Main outcome measures** Relevant primary outcomes Knowledge about immunisations and communicable diseases; Attitudes towards immunisations (fear of shots, fear about Dr visit, concern about health); and Health-related behaviours (immunisation status, intention to get immunised if not, talked to parents about immunisations). Measured by self-report questionnaire. **Follow-up period** Post-test: 1-2 weeks after intervention completed; follow-up: 2 months later. (Data reported in paper from post-test) **Analysis method** Used General Linear Models and General Estimating Equations to assess the changes over time within the 4 conditions, whether changes over time were mediated by other factors, and differences across groups. Patterns of significance were similar at post-test and follow-up, thus only analyses using outcomes at post-test are presented.	Intention to get immunised, if not: increased in all 3 intervention conditions but only statistically significantly in curriculum + training (p<0.05) and curriculum (p<0.05) at post-test and follow-up. Talked to parents about immunisations: statistically significant increase in all 3 intervention conditions, curriculum + training (p<0.01), curriculum (p<0.01) and video only (p<0.01) at post-test and follow-up. No increase in the no-intervention condition. Attitudinal/Belief primary outcomes: Changes over time, fear of shots: decreased statistically significantly in curriculum + training (p<0.01) and curriculum (p<0.05) at post-test and follow-up, non-significant increase in video only condition Fear about Dr visit: decrease in all 3 intervention conditions but only statistically significantly in curriculum + training (p<0.05) at 2 months follow-up. Concern about health: increased in all 3 intervention conditions but only statistically significantly in curriculum + training (p<0.01) and curriculum (p<0.05) at post-test and follow-up. **Main secondary outcome measures results** Behavioural secondary outcomes Behavioural predictors: Curriculum intervention vs. no curriculum was a significant predictor (p<.001) on whether the student had talked to their parents about immunisations (OR 3.44 CI 1.94, 5.54), n=733. Those with less fear of shots and more frequent Dr visits were significantly more likely to be immunised (OR .634 CI 0.41, 0.94 p<0.1 and OR .374 CI 0.27, 0.59 p<0.001 respectively) (n=699).	
Gonzales (2006) Health Education Research USA	**Intervention's aim** To examine risk perceptions and behavioural intentions concerning Hepatitis B among a convenience sample of young adults aged 18–24 years old who participated in a Hepatitis B campaign that	**Study design:** Non-randomised controlled study **Sample size:** Total sample size 1203 **Sample characteristics** Gender: Male 638; Female 560; Missing 5. Age: 18-19=289; 20-21=158; 22-24=157 (mean age=20.10).	**Main primary outcome measures results** Behavioural primary outcomes Information-seeking behavioural intentions for Hepatitis B were fairly low. Significantly more females reported higher intentions to seek out information than males. Results also showed that the	**Funding source** California Dept of Health Services, Immunization Branch

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A: 50% **B:** 29% **C:** 100% **D:** 50% **Overall:** 54%	aired a prevention-based advertisement in movies. Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Hepatitis B **Theory/model** Health Belief Model	Ethnicity: Asian 1019; Black 23; Latino 167; White 250; Other 53. **Main outcome measures** Relevant primary outcomes Information-seeking behavioural intentions. **Follow-up period:** 1 month. **Analysis method:** Analysis of variance testing was performed to assess for associations, main effects and interactions between Hepatitis B risk perceptions and behavioural intentions by socio-demographic factors.	White/Asian/other group reported significantly lower tendencies to seek out information than African–Americans and Latinos. Attitudinal/Belief primary outcomes Participants perceived their Hepatitis B risk to be low. Significantly differing by age, older respondents were more likely to perceive greater risk for themselves than younger respondents. A significant interaction between age and ethnicity showed that African–American 18-year olds were least likely to think they were at risk for Hepatitis B than 18-year-old Latino and White/Asian/other groups. Gender and age also significantly interacted by personal risks as 18-year-old males had lower personal risk perceptions for Hepatitis B than their female age counterparts.	
Gottvall (2010) International Journal of STD & AIDS Sweden **A:** 55% **B:** 67% **C:** 100% **D:** 60% **Overall:** 68%	**Intervention's aim** To evaluate the effect of an educational intervention about HPV and preventive methods for cervical cancer (e.g. vaccination, condom use and Pap smear testing) on knowledge of HPV and attitudes to preventive methods. Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Human papillomavirus (HPV) **Theory/model** Health Belief Model	**Study type** Before-and-after study (with same sample after intervention) **Sample size** Intervention/Post-test sample size Baseline: 114 students, Intervention: 109 students, Follow-up: 92 students Control/Pre-test sample size Control Group 1- Baseline: 121 students, Follow-up: 110 students, Control Group 2 - Follow-up: 74 students **Sample characteristics** Mean age: 16 years. 76% of Swedish origin. 46% had sexual intercourse. 21% used no contraceptive at first sexual intercourse. Intervention sample characteristics Follow-up: 48 girls; 44 boys. Control sample characteristics Follow-up control Group 1: 75 girls; 35 boys. Follow-up control Group 2; 37 girls; 37 boys. **Main outcome measures** Relevant primary outcomes: Knowledge of HPV. Relevant secondary outcomes: Attitudes to cervical cancer prevention such as condom use, HPV vaccination and girls' attitude to attending Pap smear in the future. **Follow-up period:** 2 months **Analysis method:** Data analysed using SPSS. Correlation between ordinal scaled variables tested	**Main primary outcome measures results** Other primary outcomes Knowledge of HPV in the intervention group increased significantly after the intervention. Among the students who had heard about HPV at follow-up, a majority (76%) of intervention group reported receiving their HPV information mainly from school, whereas a majority (63%) of control group 1 reported the media to be the main source. **Main secondary outcome measures results** Behavioural secondary outcomes Baseline HPV vaccination: 3 girls (3%) intervention group, 5 girls (4%) control group 1 (p=.703). Follow-up HPV vaccination: 15 girls (16%) intervention group, 15 girls (14%) in control group 1 (P=.667). Attitudinal/Beliefs secondary outcomes Baseline intention to HPV vaccinate: 19 students (17 girls, 2 boys) (15%) intervention group, 9 students (8 girls, 1 boy) (7%) control group 1 (p=.163). Follow-up intention to HPV vaccinate: 7 students (8%, 4 girls and 3 boys) intervention group, 11 students (11%, 8 girls and 3 boys) control group 1 (p=.344). There was a fair correlation between believing that the intervention had increased the knowledge and a higher knowledge score	

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		with Spearman's rank-order correlation. Differences considered significant if P<0.05.	(rs=0.410, P<0.001).	
Hoffman (2005) Journal of the American Dietetic Association USA **A:** 33% **B:** 86% **C:** 100% **D:** 40% **Overall:** 65%	**Intervention's aim** To assess the needs of people with HIV, to develop education materials targeted to their needs, and to evaluate acceptance of the materials in relation to food safety to mitigate the risk of food borne illness. Both prevention & control of communicable disease(s) **Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses **Target disease(s)** Food borne illnesses among people HIV/AIDS **Theory/model** Health Belief Model	**Study design** Before-and-after study (with different sample after intervention) Using focus groups (n=4) with HIV infected people, and survey of health care providers (n=25). **Sample size** Total sample size Four focus groups with HIV infected people (n=32) Survey with health care workers (n=25) **Sample characteristics** 32 people infected with HIV 25 health care providers of people infected with HIV **Main outcome measures** Relevant primary outcomes Acceptability of educational materials Relevant secondary outcomes Interest among health care providers of distributing educational materials **Analysis method** Focus groups were analysed by coding comments into grids by focus group and discussion topic, and themes summarised across focus groups. Intercoder reliability between two researchers was conducted. Survey data was entered into Microsoft Excel and analysed using SAS, with descriptive statistics produced.	**Main primary outcome measures results** Behavioural primary outcomes Almost all HIV infected people ate cold deli lunchmeats without reheating, and 60% ate soft cheeses. Raw or undercooked eggs, smoked fish served cold, and raw sprouts were consumed by 40%. Following exposure to educational materials 30 of 32 participants indicated that they would wash hands before handling food or eating. Acceptance of other guidelines was generally high, except for recommendations to avoid unheated lunchmeats, avoid soft cheeses and use a thermometer to determine safe cooking temperatures. Attitudinal/Belief primary outcomes Participants generally had a weakly positive attitude about food safety with most mean scores between 2.5 and 3.0 on a 4 point scale. **Main secondary outcome measures results** Behavioural secondary outcomes 21 of 25 health care providers indicated they would distribute the educational materials, and only two said they would need further information. Eighteen said food safety was currently addressed in their clinic or agency, and ten said they personally provided food safety education materials to HIV/AIDS patients. Of these eight said that some information provided in the educational materials was new to them.	**Funding source** The US Department of Agriculture—CSREES under agreement 2001-51110-11364 and 2002-35201-11700.
Hovell (2003) Adolescent Health USA **A:** 63% **B:** 71% **C:** 100% **D:** 75% **Overall:** 75%	**Intervention's aim** Increasing Latino adolescents' adherence to treatment for latent tuberculosis (TB) infection. Control of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections **Target disease(s)** Tuberculosis **Theory/model** Social Cognitive Theory (Social	**Study design:** Randomised controlled trial **Sample size** Total sample size: 286 Intervention/Post-test sample size: Adherence Coaching: 92 Attention Control: 98 Control/Pre-test sample size: Usual Care: 96 **Sample characteristics** Intervention sample characteristics Attention Control: n=98 (34.3%) Gender: Males 58 (59%); Females 40 (41%)	**Main primary outcome measures results** Behavioural primary outcomes Members of the adherence coaching group took significantly (P<.05) more pills than members of the usual care and self-esteem groups (F₂,₂₈₂=5.69, P<.01). Results showed that 51.1% of coached adolescents completed their course of treatment, as opposed to 41.8% & 37.5% of youths in the attention control & usual care groups, respectively. These differences were not statistically significant. However, the statistical	**Funding source** Grants from the National Heart, Lung and Blood Institute (1RO1HL5573801); the Alliance Healthcare Foundation (98-36); and the Universitywide AIDS Research Program, University of California

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	Learning Theory) Behavioural ecological model	Place of birth: US 32 (33%); Mexico 66 (67%). Acculturation Level: Hispanic 36 (37%); Bicultural 47 (49%); American 14 (14%). Mean age: 16 (SD 1.63), age range 12-19 Adherence Coaching: n=92 (32.2%) Gender: Males 50 (54%); Females 42 (46%) Place of birth: US 37 (40%); Mexico 55 (60%). Acculturation Level: Hispanic 24 (26%); Bicultural 61 (67%); American 6 (7%). Mean age: 16 (SD 1.73), age range 12-19 Control sample characteristics Usual Care: n=96 (33.6%) Gender: Males 51 (53%); Females 45 (47%). Place of birth: US 32 (33%); Mexico 64 (67%) Acculturation Level: Hispanic 26 (27%); Bicultural 58 (60%); American 12 (13%). Mean age: 15 (SD 1.62), age range: 12-18 **Main outcome measures** Relevant primary outcomes Reported isoniazid (INH) adherence (number of pills taken in past 30 days), urine assays. **Follow-up period: s**ix months and nine months **Analysis method:** ANOVA, ANCOVA and multivariate regression in SPSS 6.1.3,	power to detect differences of the observed size was about 0.38, resulting in it being unlikely to detect actual differences of this magnitude.	(IS99-SDSUF-206)."
Janmeja (2005) Respiration India **A:** 38% **B:** 75% **C:** 80% **D:** 66% **Overall:** 61%	**Intervention's aim** To evaluate the role of behaviour modification by psychotherapy in improving compliance with short-course anti-TB chemotherapy in India. Control of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections **Target disease(s)** Tuberculosis **Theory/model** Stages of Change (Transtheoretical) Model	**Study design** Non-randomised controlled study **Sample size** Total sample size: 200 Intervention/Post-test sample size: 100 Control/Pre-test sample size: 100 **Sample characteristics** 76% of group A and 73% of group B were male. The majority of the subjects of both groups were young adults. Most of them were married (75 and 72% in groups A and B, respectively). The vast majority of the patients in both groups came from urban or semi-urban backgrounds. Whereas 40% of group A and 36% of group B were illiterate, males were more likely to be literate (73.33 and 72.06%, respectively) than females (20 and 46.88%, respectively in groups A and B). Most of the male subjects were unskilled (48.7 and 50% in groups A and B) or skilled (13.2 and 16.2%) labourers and farmers (19.7 and 19.1%, respectively). However, most of the females were housewives (70.8	**Main primary outcome measures results** Behavioural primary outcomes All prescribed doses were collected by 72% of patients in group A and by 43% in group B, respectively. 11% in group A and 5% of group B collected between 80 and 99% of the doses. While only 17% patients in group A collected fewer than 80% of doses, the proportion of patients with such poor compliance was as much as 52% in group B.	**Funding source** Not stated.

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		and 59.4% in groups A and B, respectively). Forty-four and forty-two percent of group A and group B belonged to the low-income group and 54 and 55% were from the middle-income group, respectively. **Main outcome measures** Relevant primary outcomes: Compliance with the treatment. **Follow-up period:** Six months. **Analysis method:** Not detailed.		
Jenks (2005) Journal of Travel Medicine USA **A:** 50% **B:** 57% **C:** 100% **D:** 60% **Overall:** 65%	**Intervention's aim** To increase awareness of, and educate new immigrants to endemic areas about Lyme Disease. Prevention of communicable disease(s) **Target Disease Group(s)** Emerging and Vector-borne diseases **Target disease(s)** Lyme Disease **Theory/model** Health Belief Model	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 80 Intervention/Post-test sample size: 40 **Sample characteristics** *N.B Sample characteristics only reported for participants followed-up at post-test. Demographic N (%): Sex: Male 36 (90); Female 4 (10). Country of Origin: Ecuador 31 (77.5); Guatemala 5 (12.5); Honduras 1 (2.5); Mexico 1 (2.5); Peru 1 (2.5); Colombia 1 (2.5). Type of employment: Landscaping 22 (55); Construction 7 (17.5); Office cleaning 4 (10); Cooking 2 (5); Carpenter 2 (5); Mechanics 2 (5); Waiting tables 1 (2.5). **Follow-up period:** 2.3 months (median) **Analysis method:** McNemar's Test	**Main primary outcome measures results** Behavioural primary outcomes: N/A Attitudinal/Belief primary outcomes: Pre-test no participants were aware of Lyme Disease. After the intervention, all 40 participants recognized that the rash shown during the intervention consultation is associated with Lyme disease. At the pre-test, only 27.5% were aware that ticks in the area could transmit infection, whereas after the intervention, 92.5% correctly identified the tick as the vector of disease. Pre-test 67.5% of participants thought that the smaller tick was more dangerous, post-test 75% of the patients correctly understood that the engorged tick poses a greater risk. McNemar analysis showed a significance of $p < .001$ for all paired pre- and post-test responses.	**Funding source** Not stated
Juraskova (2011) Women's Health Issues Australia **A:** 50% **B:** 67% **C:** 80% **D:** 67% **Overall:** 64%	**Intervention's aim** examine the effect of 'cervical cancer' (CC) versus 'Cervical Cancer plus Genital Warts' (CC + GW) information framing on both intention to vaccinate against HPV and actual HPV vaccine uptake behaviour, **Target Disease Group(s)** Blood-borne diseases (incl. HIV and STI) **Target disease(s)** Human papillomavirus (HPV) **Theory/model** Health Belief Model	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 159 Intervention/Post-test sample size: 81= CC condition; 78 = CC + GW condition. **Sample characteristics** Female university students who had not had HPV vaccine. The mean age of the participants was 19 years (SD = 1.18). The majority of participants came from a highly educated background. Most (82%) knew family/friends with cancer other than cervical cancer, and 2 participants were previously diagnosed with an STI. A minority of	**Main primary outcome measures results** Behavioural primary outcomes Improved vaccination intention: (5-point Likert agree-disagree scale) 'I intend to receive the HPV vaccination in the near future' Pre-intervention: Overall: (n=157): mean: 3.95 (SD:1.03) Post-intervention: Overall: (n=157): mean: 4.16 (SD:.95) Vaccine uptake behaviour: Students who had already received HPV vaccine were excluded from study. The current study assessed pre- and post-	**Funding source** Not stated.

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		participants (22%) had three or more lifetime sexual partners, and 45% had never been in a sexual relationship. **Main outcome measures** Relevant primary outcomes Vaccine Intention. Actual vaccine uptake behaviour. Knowledge of HPV infection - discount: only assessed pre-test. Relevant secondary outcomes Information framing effect on Vaccination Intention and behaviour **Follow-up period** immediately after, and 2 months follow-up for vaccine uptake behaviour **Analysis method** One-way between groups analyses of covariance; multiple linear regression; multiple logistic regression.	intervention intentions to receive the HPV vaccine, as well as actual vaccine uptake behaviour at the 2-month follow-up. A subsample of 135 participants was contacted for participation in the follow-up. Of these, 73 reported their behaviour at 2 months (response rate 54%). Overall, only 37% of the follow-up study respondents received the HPV vaccine within the 2-month period following the main study; however, three quarters (76%) indicated that they had taken steps to learn more about the HPV vaccine. Post-intervention intention 2 to receive HPV vaccination was entered into a logistic regression equation and found to be a significant predictor of actual HPV vaccine receipt within the 2-month follow-up period. For each increased intention 2 unit, the log odds of receiving the vaccine increased by 72.9% (odds ratio [OR], 2.07; p = 0.023; 95% CI 1.11–3.89). Post-intervention intention was also a significant predictor of information-seeking behaviour. As intention 2 increased by 1 unit, the log odds of seeking vaccine information increased by 52.7% (OR, 1.69; p = .043; 95% CI, 1.02–2.82). **Main secondary outcome measures results** Behavioural secondary outcomes Information framing and HPV vaccine intention Among all participants, the mean post-intervention intention 2 score (mean [M] = 4.16) was significantly higher than the mean pre-intervention intention 1 score (M = 3.95; p = .001). A minority of participants (6%) did not intend to receive the HPV vaccine after the intervention, 15% were neutral, and the vast majority (79%) intended to receive the vaccine. Most of the participants (95%) preferred an HPV vaccine that protects against both genital warts and cervical cancer. Knowing someone with cervical cancer and knowing someone with any other cancer were significantly positively correlated with intention 2 to receive vaccination. After adjusting for these two covariates, no significant differences between the CC and CC + GW groups on post-intervention intention 2 scores were found (F[1,155] = 0.09; p	

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			> .05). Information framing and HPV vaccine behaviour :of those surveyed at two months, 44% of the CC + GW group and 32% of the CC group had received HPV vaccination at follow-up. Chi-square tests showed no significant associations between groups and follow-up vaccination behaviour [χ^2(1, 75) = 0.56; p = .456].	
Knittel (2010) Harm Reduction Journal USA **A:** 33% **B:** 43% **C:** 100% **D:** 50% **Overall:** 54%	**Intervention's aim** Reduce risk of injecting drug users (IDUs) from becoming infected with HIV and Hepatitis C (HCV) through promotion of a needle exchange programme (NEP). Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** HIV and HCV **Theory/model** Stages of Change (Transtheoretical) Model	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 88 (74 baseline only; 17 follow up only; 14 baseline and follow up) Intervention/Post-test sample size: 14 **Sample characteristics** Baseline only n= 74 Sex: 78.3% male Age in 2006: mean 48 (SD 12) Race/ethnicity: black/African American 40 (50.4%); white/Caucasian 32 (43%); Native American/Alaskan Native 2 (2.7%); not recorded 0 (0%); Follow up only n=17 Sex: 52.9% male Age in 2006: mean 47 (SD 9) Race/ethnicity: black/African American 2 (11.8%); white/Caucasian 0 (0%); Native American/Alaskan Native 0 (0%); not recorded 15 (88.2%); Baseline and follow up n=14 Sex: 78.6% male Age in 2006: mean 54 (SD 8) Race/ethnicity: black/African American 8 (57.1%); white/Caucasian 5 (35.7%); Native American/Alaskan Native 0 (0%); not recorded 1 (7.1%). **Main outcome measures** Relevant primary outcomes: Injection frequency, sharing injection materials, condom use. **Follow-up period:** Six months **Analysis method:** T-tests. Logistic regression.	**Main primary outcome measures results** Behavioural primary outcomes Compared to the baseline group, participants at follow-up were significantly less likely to report giving another IDU a previously used syringe (OR = 0.38, p =0.042). In addition, follow-up individuals were more likely to clean their skin with alcohol either before or after injecting than the baseline comparison group (OR = 3.71, p = 0.01). NEP participants also reused their syringes significantly fewer times before getting new ones (p = 0.012). Attitudinal/Belief primary outcomes In relation to self-reported willingness to change injection-related HIV risk behaviour (i.e., Stages of Change), respondents reported an increase of 0.24 stages from baseline to follow-up but this was not statistically significant. **Main secondary outcome measures results** Behavioural secondary outcomes Individuals in the follow up group were more likely to be willing to go to drug treatment (OR = 1.84) and less likely to report having more than one sexual partner (OR = 0.42).	**Funding source** The University of Michigan Medical School Summer Biomedical Research Program.
Larson (2009) Nursing Research Public Health Reports USA	**Intervention's aim** To deliver and assess the impact of an educational intervention to influence knowledge, attitudes and behaviours regarding upper respiratory infections (URIs) among urban Latinos.	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: N= 2788 (509 households) Intervention/post-test sample size: education group	**Main primary outcome measures results** Behavioural primary outcomes The Hand Sanitizer group was significantly more likely to report that no household member had symptoms (p<0.01). However, there were no significant differences in rates of infection by	**Funding source** The Centers for Disease Control and Prevention (CDC; Stopping URIs and Flu in the Family: The

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A: 60% **B:** 71% **C:** 100% **D:** 50% **Overall:** 70%	Both prevention & control of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Upper respiratory infections (common cold and influenza) **Theory/model** PRECEDE-PROCEED	**Sample characteristics** All participants lived in multiple-unit apartment buildings. Mean number of household members was 5.1 (range = 3–12). Most participants were Latinos born outside the United States (90.9%), primarily in the Dominican Republic. 67.8% had a high school education or lower; and the majority (62.5%) spent less than 20 hours a week outside the home (Table 1). Most participants (99.9%) were the female heads of household. The mean duration of households in this component of the study was 26.8 weeks (range = 12–39 weeks). **Main outcome measures** Relevant primary outcomes Rates of influenza and URI **Follow-up period:** Up to 19 months **Analysis method:** Chi-square, Mann-Whitney, t-tests, multiple logistic regression, Poisson Models.	intervention group. The proportion of households that reported 50% or more of members receiving influenza vaccine increased during the study (p<0.001). Mask wearing as well as increased crowding, lower education levels of caretakers, and index cases 0–5 years of age (compared with adults) were associated with significantly lower secondary transmission rates (all p<0.02). Attitudinal/Belief primary outcomes Knowledge improved significantly more in the Hand Sanitizer group (p<0.0001).	Stuffy Trial, Grant 1 U01 CI000442)."
Latka (2008) AIDS USA **A:** 57% **B:** 83% **C:** 100% **D:** 75% **Overall:** 77%	**Intervention's aim** A behavioural intervention, which taught peer education skills, to reduce injection and sexual risk behaviours associated with primary HIV and hepatitis C virus infection (HCV) among young injection drug users (IDU). Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** HIV and hepatitis C virus infection (HCV) **Theory/model** Social Cognitive Theory (Social Learning Theory) Other: Information-Motivation-Behavioral Skills (IMB) model	**Study design** Randomised controlled trial **Sample size** Total sample size: 854 Intervention/Post-test sample size 431 - peer education skills. Control/Pre-test sample size 423- time-equivalent attention control. **Sample characteristics** Age in years Mean (IQR): 23.8 (21–27) Minors: 15–17 years: 2.7% Male 66.5%; Female 32.8%; Transgender: 0.7%. Race/ethnicity: non-Hispanic black 8.4%; non-Hispanic white 63.3%; Hispanic 17.1%; Other/mixed 11.2%. Homeless in the past 6 months: 43.2%. Exclusions: Enrolled participants were slightly older than non-enrolled eligible participants. Enrolled participants were less likely to have been homeless during the 6 months before baseline (43.2% versus 50.8%; p<0.001), but were similar on all other sociodemographic and outcome variables (data not shown). **Main outcome measures** Relevant primary outcomes: Self-reported injection behaviour and incidence of HCV infection (serological testing).	**Main primary outcome measures results** Behavioural primary outcomes Injection risk behaviours: All six injection outcome variables and the composite index measure decreased significantly at follow-up compared with baseline among peer education intervention (PEI) participants, as did all but one measure in the video discussion intervention (VDI) arm. Declines in the PEI arm compared with the VDI arm ranged from 26 to 39% across measures, although none reached statistical significance individually. The intervention effect was, however, statistically significant for the composite measure [unweighted average of participants' responses to the six outcome measures; proportional odds ratio (POR) 0.64; 95% CI 0.44, 0.94]. Furthermore, a weighted average from models of the six individual outcome measures demonstrated a 29% greater decline in overall risk among PEI compared with VDI participants (POR 0.71; 95% CI 0.52, 0.97). HCV infection rate: The overall incidence of HCV infection was	**Funding source** This study was funded in its entirety by a cooperative agreement from the US Centers for Disease Control and Prevention.

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		Follow-up period: 3 and 6-month follow-up **Analysis method:** POR, proportional odds ratio.	18.1/100 person-years (95% CI 14.4, 23.0). Using Poisson regression to control for site, race, sex, age, and cohort size, the study found no difference in HCV incidence rates between PEI and VDI participants (relative risk 1.15; 95% CI 0.72, 1.82). No participants seroconverted to HIV positive in either trial arm during the 427 person-years of follow-up.	
LaVela (2008) The Journal of Spinal Cord Medicine USA **A:** 33% **B:** 66% **C:** 100% **D:** 66% **Overall:** 65%	**Intervention's aim** To test the feasibility and effectiveness of a multimedia educational message to influence negative perceptions, increase knowledge, and positively influence intentions and beliefs regarding influenza and pneumococcal vaccinations in a group of veterans with spinal cord injuries. Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza, pneumonia **Theory/model** Theory of Planned Behavior Extended Parallel Process Model	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 36 patients and 25 healthcare providers **Sample characteristics:** Male 100%. Race/ethnicity: Black/African American 42%; White/Caucasian 42%; Hispanic 6%; Other 11%. Education: Some High School 14%; High School Graduate 11%; Some College 53%; College Graduate 22%. Mean Age: 58 years (range: 32-87) Marital Status: Married 53%; Divorced/separated/widowed 28%; Never married 19%. Level of injury (n=31): Paraplegia 29% Mean duration of injury (n=31): 15 years (range: 1-59) No data was provided on sample of healthcare providers **Main outcome measures** Relevant primary outcomes Beliefs towards respiratory infections. Intentions to get vaccinated. Knowledge of risks and benefits to vaccination, and towards respiratory infections. **Follow-up period:** N/A **Analysis method:** T-test	**Main primary outcome measures results** Attitudinal/Belief primary outcomes Participants demonstrated positive changes in beliefs from pre-test to post-test on several items including believing flu (P = 0.012) and pneumonia (P = 0.002) are serious in persons with spinal cord injuries and disorders; getting the flu (P = 0.001) or pneumonia vaccine (P = 0.013) will protect my friends/ family; whether or not I get pneumonia this year is in my control (P = 0.004); getting the pneumonia vaccine will help me avoid getting pneumonia (P = 0.032); I will be taking care of myself by getting a pneumonia vaccine (P = 0.021); and I would get the pneumonia vaccine if encouraged to do so by health care provider (P = 0.044) and/or family (P = 0.017). In addition, from pre-test to post-test individuals better understood that side effects of the influenza vaccination could include feeling ill (e.g., cold-like symptoms rather than influenza; P = 0.047).	**Funding source** Department of Veterans Affairs
Lewin (2005) Bulletin of the World Health Organization South Africa **A:** 100% **B:** 100% **C:** 100% **D:** 100% **Overall:** 100%	**Intervention's aim** To improve the treatment outcomes in TB patients attending clinics with low rates for the successful treatment of TB (<70%). Control of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections **Target disease(s)** Tuberculosis. **Theory/model**	**Study design:** Cluster randomized controlled trial **Sample size** Total sample size: 1200 patients pre-intervention, and 1177 patients post-intervention from 24 clinics. Intervention/Post-test sample size: 12 clinics assigned to the intervention group (11 received the intervention, 1 clinic refused the intervention). Data collected on 600 TB patients (50 per clinic) pre- and post-intervention. Control/Pre-test sample size: 12 clinics assigned to the control group. Data collected on 600 TB patients pre-intervention (50 per clinic) and on 577 TB patients post-	**Main primary outcome measures results** Behavioural primary outcomes Rates of successful treatment improved more in intervention clinics (7.5% increase, 95% CI 0.2% to 14.9%) than in control clinics (2.7% increase, 95% CI -4.6% to 10.0%) (4.8% difference, 95% CI -5.5% to 15.2%), but this was not statistically significant. The estimated effect of the intervention on successful treatment of new patients was 6.9% (95% CI -1.2% to 22%) and for re-treatment	**Funding source** The Commonwealth Programme of the Nuffield Foundation (project CW28); the UK Department for International Development (project R561); the Health Systems Trust (project 226/98); and the

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	Theory of Reasoned Action Social Cognitive Theory (Social Learning Theory) Other: Theory of self-efficacy	intervention (50 per clinic, except 1 clinic where n=27). **Sample characteristics** TB patients over 14 years with sputum-smear positive pulmonary TB who started a new course of TB treatment during the course of the study. Intervention sample characteristics Pre-intervention: mean age 34.5 years; 66.5% male; 66.2% new patients; 33.8% re-treatment patients. Post-intervention: mean age 35.2 years; 65.5% male; 65.2% new patients; 34.8% re-treatment patients. Control sample characteristics Pre-intervention: mean age 35.2 years; 64.7% male; 64.2% new patients; 35.8% re-treatment patients. Post-intervention: mean age 35.5 years; 64.8% male; 67.6% new patients; 32.4 re-treatment patients. Exclusions Patients who had transferred in from another health facility after the first 2 weeks of treatment. Patients with recurrent TB who had already been in the trial. Patients in whom there was evidence of multi-drug resistant TB. **Main outcome measures** Relevant primary outcomes Rate of successful treatment, defined as patients who had completed treatment, or were 'cured'. **Follow-up period** Outcomes measured in patients at 2 and 5 months after treatment initiation. **Analysis method** Intention to treat analysis that took into account the effects of clustering. Two-way analysis of variance for analysis of the differences between the pre- and post-intervention outcomes with stratification and intervention as the main two effects. All statistical tests were two-sided and 95% confidence intervals were calculated for the effects of the intervention on various outcomes.	patients only was 4.1% (95% CI -13.5% to 21.7%). Other primary outcomes Bacteriological 'cure' rate improved by 2.5% in intervention clinics following the intervention, while it decreased by 7.9% in the control group (10.4% difference, 95% CI -1.2% - 22%), but the difference was not statistically significant.	Medical Research Council of South Africa. The protocol was developed as part of the European Union funded INCO, fourth and fifth framework concerted action project entitled 'Afro-implement' (project ERB3514PL972571)."
Lloyd (2009) Journal of Adolescent Health England **A:** 38% **B:** 50%	**Intervention's aim** To assess emotional and motivational responses to HPV information in adolescent girls in the "catch-up" vaccination age range (13–16 years), and to assess whether a tension exists between provision of health information and minimizing negative affect.	**Study design:** Randomised controlled trial **Sample size:** Total sample size n=174 Intervention/Post-test sample size HPV information leaflet: n=56 Control/Pre-test sample size Chlamydia information leaflet: n=59 Environmental information leaflet: n=59 **Sample characteristics**	**Main primary outcome measures results** Attitudinal/Belief primary outcomes Attitude towards the information: HPV information rated more interesting (p=.03), scary (p=.007), and reassuring (p<.001) than the environmental information but not the Chlamydia information (respectively, p=.55, p=.85, and p=.41). Anxiety towards HPV: mean scores did not differ by	**Funding source** Sanofi Pasteur, M.S.D. (The funder had no input into the research design, fieldwork or write-up.)

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C: 80% **D:** 60% **Overall:** 54%	Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Human papillomavirus (HPV) **Theory/model** Common Sense Model	Girls aged 13-16 years, mean age 14.3 years; 79% Caucasian British, 8% Asian/Asian British, 13% "mixed"/"other" ethnicities. Exclusions: Those having received an HPV vaccination **Main outcome measures** Relevant primary outcomes Knowledge about HPV; anxiety towards HPV; attitude towards the information; intentions towards screening, HPV test, HPV vaccination. **Follow-up period:** Not applicable **Analysis method:** Differences in outcomes were compared using between subjects analyses of variance	information leaflet (F=.57, p=.59) Intentions: respondents had positive intentions toward HPV testing (91% likely/very likely), HPV vaccination (82%) and cervical screening (91%). Significant between-group differences in intentions to attend screening (F=3.1, p=.05) and accept HPV vaccination (F=3.1, p=.05), but not in intentions to have an HPV test (p=.09). HPV vaccination and testing were better accepted by the HPV leaflet group than the environmental group (respectively, p=.02, p=.03), but not more so than the Chlamydia leaflet group. Other primary outcomes Knowledge about HPV: adolescents given HPV information demonstrated significantly more HPV knowledge (F=31.2; p<.001) than the Chlamydia (p<.001) or environmental (p<.001) groups.	
Looijmans-van den Akker (2010) Vaccine The Netherlands **A:** 57% **B:** 75% **C:** 80% **D:** 80% **Overall:** 71%	**Intervention's aim** To increase influenza immunisation uptake among healthcare workers (HCW) in nursing homes. Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza **Theory/model** Health Belief Model Theory of Planned Behavior	**Study design:** Cluster randomised controlled trial **Sample size:** Total sample size 6636 healthcare workers from 23 nursing homes. Intervention/Post-test sample size 16 nursing homes (number of HCW not specified). Control/Pre-test sample size 17 nursing homes (number of HCW not specified). **Sample characteristics** Intervention sample characteristics Baseline HCW influenza immunisation rate 20%. Average number of HCW per nursing home: 193 (range 35-352). Control sample characteristics: Baseline HCW influenza immunisation rate 21%. Average number of HCW per nursing home: 209 (range 51-389). Exclusions: Two nursing homes dropped out of the intervention group after randomisation, but prior to the start of the programme, due to general organisational difficulties that meant they were unable to implement the programme. One nursing home was excluded (from the control group) because influenza vaccination was not offered during the study period. **Main outcome measures** Relevant primary outcomes	**Main primary outcome measures results** Behavioural primary outcomes Influenza vaccine uptake was on average 9% higher in the intervention group than in the control group (RR 1.59, 95% CI: 1.08–2.34, p = 0.02). Overall, 25% of all HCWs in the intervention group were vaccinated against influenza compared to 16% in the control group. In the intervention homes the vaccination rate of HCWs per nursing home ranged from 6% to 81% and in the control homes from 0.4% to 36%. Vaccination rates were on average higher among physicians and nurses than nursing assistants. **Main secondary outcome measures results** Behavioural secondary outcomes There was variation in compliance with elements of the intervention across nursing homes. There was a non-significant trend towards higher immunisation uptake when nursing homes complied with more elements of the intervention (p=0.08). Other secondary outcomes Overall, the intervention cost €22, 742 which was an average of €1421 per intervention home.	**Funding source** The Netherlands Organisation for Health Research and Development (ZonMw, grant nrs. 6300.0005 and 6330.0026)

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		Influenza immunisation uptake. Relevant secondary outcomes Compliance with elements of the programme. Cost of implementation of the programme. **Follow-up period:** 2 months. **Analysis method:** Generalised Estimation Equation analysis with nursing homes as the clustering variable was used to analyse data on influenza vaccine uptake. Adjusted relative risk (RR), 95% confidence interval and a level of significance for influenza vaccination of all HCW, and for physicians, nurses and nursing assistants separately. For each group of nursing homes with similar compliance, mean HCWs vaccination rates before and after the intervention and the standard deviation of these means (SD) were calculated. Vaccination rates across these compliance groups were compared using the one-way ANOVA test and reported by level of statistical significance.		
Luby (2010) Tropical Medicine and International Health Bangladesh **A:** 75% **B:** 60% **C:** 100% **D:** 83% **Overall:** 79%	**Intervention's aim** To pilot two intensive hand hygiene promotion interventions, one using soap and one using a waterless hand sanitizer, in low-income housing compounds and assess subsequent changes in hand washing behaviour and hand microbiology. Both prevention & control of communicable disease(s) **Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses Respiratory tract infections **Target disease(s)** Diarrhoea and respiratory disease. **Theory/model** Stages of Change (Transtheoretical) Model	**Study design:** Randomised controlled trial **Sample size** Total sample size: 692, Intervention/Post-test sample size Soap: 234, Waterless Hand Sanitizer: 211, Control/Pre-test sample size: 247. **Sample characteristics:** Compound residents were of similar age, sex, education and income across the three groups. **Main outcome measures** Relevant primary outcomes Hand washing behaviour: Proportion of hand washing opportunities where the compound resident washed his/her hands with soap and/or waterless hand sanitizer. Relevant secondary outcomes Hand contamination: the concentration of thermotolerant coliforms, faecal streptococci and C. perfringens from hand rinse specimens. **Follow-up period:** Post intervention observations were conducted twice, 2 weeks apart. **Analysis method:** For estimates of proportions, exact confidence limits for binomial random variables were used. Proportions were compared by calculating risk differences and 95% confidence limits. P-values and confidence intervals were estimated using the	**Main primary outcome measures results** Behavioural primary outcomes Hand washing behaviour: Following the intervention, residents of compounds that received soap and hand washing promotion washed their hands with soap more frequently, including increasing to over 25% before preparing food, eating and feeding a child and to over 85% after faecal contact. Residents of compounds that received waterless hand sanitizer and hand washing promotion washed their hands with soap or sanitizer more frequently, though to a lesser magnitude than in the soap and hand washing promotion compounds. **Main secondary outcome measures results** Behavioural secondary outcomes Hand Contamination: Combining all hand washing opportunities, hand rinse samples from soap and sanitizer intervention compounds had significantly lower concentration of C. perfringens at the follow up evaluation than controls and significantly lower concentrations of thermotolerant coliforms and faecal streptococci than at baseline.	**Funding source** The Procter and Gamble Company, manufacturer of First Defence®.

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		cluster effect–adjusted standard error to account for clustering of observations within compounds. Linear regression models of the natural logarithm of the reported duration of hand washing were used to test hypotheses about the duration of hand washing. Linear mixed effect regression models were used to test hypotheses about the microbiological data.		
Maunder (2010) BMC Health Services Research Canada **A:** 75% **B:** 57% **C:** 100% **D:** 80% **Overall:** 76%	**Intervention's aim** The study aimed to identify the optimal dose of training for healthcare workers to withstand stress during an influenza pandemic. Control of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza **Theory/model** Social Cognitive Theory (Social Learning Theory)	**Study design:** Randomised trial, no control group **Sample size:** Total sample size: n=158 Intervention/Post-test sample size Completed short course: n=45 Completed medium course: n=44 Completed long course: n=38 **Sample characteristics** Job type: Health professional Nurse n=144 (54%); Health professional Other n=52 (20%); Other staff n=69 (26%). Gender: female n=229 (86%); male n=36 (14%). Intervention sample characteristics Job type: Health professional Nurse n=66 (52%); Health professional Other n=39 (31%); Other staff n=22 (17%). Gender: female n=117 (92%); male n=10 (8%). **Main outcome measures** Relevant primary outcomes Confidence in being well supported by the hospital and being well prepared for the pandemic. Pandemic self-efficacy, confidence in training and support and interpersonal problems, Enhanced level of adaptive strategies of coping (increasing problem solving and seeking support and decreasing escape-avoidance). **Analysis method:** T-test.	**Main primary outcome measures results** Attitudinal/Belief primary outcomes Using an intention-to-treat analysis, the intervention was associated with significant improvements in confidence in support and training, pandemic self-efficacy and interpersonal problems. Participants who under-utilized coping via problem-solving or seeking support or over-utilized escape-avoidance experienced improved coping. Comparison of doses showed improved interpersonal problems in the medium and long course but not in the short course. There was a trend towards higher drop-out rates with longer duration of training.	**Funding source** Canadian Institutes of Health Research and Mount Sinai Hospital
Mayor (2010) Ethnicity and Disease Puerto Rico **A:** 40% **B:** 83% **C:** 80% **D:** 66% **Overall:** 68%	**Intervention's aim** A multimedia educational intervention was developed and implemented to reduce HCV associated risk behaviours among IDUs. Both prevention & control of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Hepatitis C **Theory/model**	**Study design:** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 138 Intervention/Post-test sample size: 110 **Sample characteristics** Of the 110 HIV infected participants, 90 (81.8%) male, all had history of IDU and 96 (86.3%) were co-infected with HCV. Of the male participants, 12.2% reported having sex with another man. The mean age was 42.2 years +/- 9.3 years. The mean educational level was 10th grade.	**Main primary outcome measures results** Behavioural primary outcomes The study found a significant reduction in the practice of active IDU (in the previous month) after the intervention Those individuals who remained active in IDU reported an improvement in their HCV risk-reduction behaviour. The frequenting of shooting galleries and the use of potentially contaminated injecting paraphernalia were less often reported in these persons, though these differences did not reach statistical significance.	**Funding source** Sponsored by the NIH Grant U54RR019507 and RCMI grant G12RR03035.

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	Health Belief Model Social Cognitive Theory (Social Learning Theory)	Almost half of the participants (47.3%) reported having IDU in the six months prior to study enrolment. The HIV mean disease duration was 5.26 +/- 5.0 years; 21.8% had CD4+T cell count 200 cells/ml and 20.0% had received highly-active antiretroviral therapies at enrolment or in the previous 12 months. **Main outcome measures** Relevant primary outcomes Risk behaviour changes Relevant secondary outcomes Hepatitis and HCV knowledge changes. **Follow-up period:** Unclear, possibly one month after final session **Analysis method:** Univariate and bivariate analyses.	**Main secondary outcome measures results** Attitudinal/Beliefs secondary outcomes The study found a slight increase in the already high levels of knowledge regarding HCV-infection-associated risk behaviours (e.g. injecting drug, sharing razors, making tattoos, doing piercings). The misconceptions that coughing, sneezing, sharing food or utensils, or homosexual contact contributes to the spread of HCV decreased significantly after the intervention. Conversely, there was a significant increase in identification of cocaine sniffing as an HCV-infection risky behaviour.	
McCaul (2002) Health Psychology USA **A:** 50% **B:** 75% **C:** 80% **D:** 60% **Overall:** 64%	**Intervention's aim** The intervention tested how cues to action, in the form of a reminder letter, action letters or no letters, sent to patients impacted on take up of influenza vaccinations. Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza **Theory/model** Health Belief Model	**Study design:** Randomised controlled trial **Sample size** Total sample size: n=23733 Intervention/Post-test sample size: n=15837 Control/Pre-test sample size: n=7896 **Sample characteristics** Sex: Male 10150; Female: 13583 Intervention sample characteristics Sex: Male 6730; Female 9107. Control sample characteristics Sex: Male 3420; Female: 4476. **Main outcome measures** Relevant primary outcomes Uptake of influenza vaccinations **Follow-up period:** 6 months **Analysis method:** T-test	**Main primary outcome measures results** Behavioural primary outcomes Overall vaccination rates for the study were just under 25%. Neither the gain-framed (23.5%) nor the loss-framed (24.5%) message improved vaccination rates compared with the brief reminder (24.5%). The action-plan approach was very effective, producing a significantly higher vaccination rate (28.2%) than the no-treatment control condition (19.6%), z =12.01, p < .01. At the county as opposed to individual level, the action instructions (M = 29.36%) produced a higher vaccination rate than that observed in the control counties (M = 19.83%), t(26) =3.24, p =0.003 (two-tailed).	**Funding source** North Dakota Health Care Review, Inc.
Mertz (2010) Infection Control and Hospital Epidemiology Canada **A:** 75% **B:** 43% **C:** 60% **D:** 33% **Overall:** 57%	**Intervention's aim** A multifaceted intervention to increase rates of adherence to hand hygiene among healthcare workers (HCWs) and to assess the effect on the incidence of hospital-acquired methicillin-resistant Staphylococcus aureus (MRSA) colonisation. Both prevention & control of communicable disease(s) **Target Disease Group(s)** Antimicrobial resistance & healthcare-associated infections **Target disease(s)**	**Study design** Randomised controlled trial **Sample size** Total sample size: 30 (Hospital units) Intervention/Post-test sample size: 15 (Hospital units) Control/Pre-test sample size: 15 (Hospital units) **Sample characteristics** 3 acute care sites of Hamilton Health Sciences, a tertiary centre with a catchment are population of 2.2 million residents. All 30 hospital units (wards) serving adult patients were enrolled. Units cluster-randomised stratified by hospital site and unit type. During the baseline period, rates of adherence were similar within the 2 groups (control and intervention).	**Main primary outcome measures results** Behavioural primary outcomes Hand hygiene adherence. At baselines, rates of adherence were similar within the 2 groups (15.8% Intervention and 15.9% Control). In the study, hand hygiene was performed for 7,017 of 15,427 opportunities, yielding an adherence rate of 45.5%. A significantly higher adherence rate was observed in the intervention group (mean difference, 6.3% [95% CI, 4.3%-8.4%]; P<.001). **Main secondary outcome measures results** Behavioural secondary outcomes Proxy outcome	**Funding source** Physicians' Services Incorporated Foundation of Ontario, Canada; Swiss National Science Foundation (grant). **Notes** Upsurge in both groups' compliance, probably explained by

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	Methicillin-resistant Staphylococcus aureus (MRSA) **Theory/model** Theory of Planned Behavior	**Main outcome measures** Relevant primary outcomes Adherence to hand hygiene. Relevant secondary outcomes Unit-specific incidence of hospital-acquired MRSA colonisation. **Follow-up period** Trial conducted for 1 year: June 2007- May 2008. (Baseline: October-December 2006). **Analysis method** Unpaired t tests on the annual unit-specific rates of hand hygiene adherence and Mann-Whitney U tests for comparison of rates of MRSA colonisation were performed.	The results of tests on 8,034 swab samples collected specifically for the purpose of the study plus the results of 130 unit-wide point prevalence surveys and of routine MRSA screenings by infection control staff were available. Hospital-acquired MRSA was identified in 110 patients (53 in the control group and 57 in the intervention group). There was no significant different in the incidence of MRSA colonization between the study groups...after exclusion of suspected outbreaks, the MRSA colonization incidence rates were again very similar.	the installation of alcohol-based gel dispensers outside all patient rooms before the onset of the intervention throughout the hospital, including in the control units; the likelihood that HCWs worked across units in control and intervention; the Hawthorne effect.
Mullan (2010) Food Control Australia **A:** 50% **B:** 83% **C:** 100% **D:** 80% **Overall:** 75%	**Intervention's aim** The intervention aimed to identify whether either of the two interventions delivered would lead to an increase in safe food handling behaviour relative to a control group. The first intervention involved a combination of increasing knowledge and creating implementation intentions, and the second was the same but also involved increasing perceived behavioural control (PBC). Prevention of communicable disease(s) **Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses **Target disease(s)** Foodborne illnesses **Theory/model** Theory of Planned Behavior	**Study design:** Randomised controlled trial **Sample size** Total sample size: n=195 Intervention/Post-test sample size: n=124 Control/Pre-test sample size: n=60 **Sample characteristics** Mean age: 19.9 years (SD 4.1) Age range: 17-46 Sex: Female 148 (76%); Male 47 (24%). Living situation: Living at home with parents 125 (64%); Renting 49 (25%); In colleges 8 (0.4%); Home owner 6 (0.3%); Other 7 (0.3). Ethnic group: Australian Caucasian 45%; Asian 33%; European 10%; Middle Eastern 4%; Other: 8%. Socio-economic group: Upper middle class 36%; Middle class 27%; Working class 16%; Lower class 4%; Student: 17%. Intervention sample characteristics: N/A Control sample characteristics: N/A **Main outcome measures** Relevant primary outcomes Attitudes were measured using six semantic differential scales, e.g. (preparing food hygienically every meal would be: bad–good, unnecessary–necessary, unpleasant–pleasant, unenjoyable-enjoyable, beneficial–harmful, foolish–wise). Participants rated on a scale of 1–7 with a higher score indicating a more positive attitude. An alpha coefficient of .72 (M = 6.39, SD = .63) was reported. Subjective Norm was measured by a single item "people	**Main primary outcome measures results** Behavioural primary outcomes The analysis showed that there were no differences between conditions in increasing behaviour ($F_{2,182} = 1.107$, p = .333). Attitudinal/Belief primary outcomes The ANOVA revealed that there were significant differences between study conditions in increasing PBC ($F_{2,182} = 3.44$, p < .05). Bonferroni post hoc analyses showed that Intervention B (the PBC group) significantly increased PBC compared to Intervention A and the control group. The increase in PBC in intervention B was confirmed by a paired t-test (t = 2.12, p = .031). Other primary outcomes An analysis of variance showed that there was a highly significant difference between conditions in increasing knowledge $F_{2,182} = 7.09$, p = .001. Bonferroni post hoc analyses revealed that participants in the intervention B group significantly increased their knowledge scores at time two compared to the control group (p = .001).	**Funding source** Not stated

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		who are important to me think I should prepare food hygienically every meal over the next 4 weeks" (unlikely–likely), scored 1–7 with a higher score indicating more normative pressure (M = 6.16, SD = 1.40). PBC was measured using the mean of four, seven-point (1–7) items including two items for controllability and two for self-efficacy. Behavioural intention was assessed using as a single item on a seven point scale "I intend to prepare food hygienically every meal over the next 4 weeks" – strongly disagree to strongly agree (M = 6.25, SD = 1.26). Past behaviour was measured by participants indicating how many meals in the week preceding the study they had prepared food hygienically (M = 9.33; range 2–21; SD = 4.63). To account for how many meals a week students typically cooked, they were also asked "over the last week think about how many times you have prepared food for yourself or others at home" (M = 11.23; range 2–21; SD = 4.63). A past behaviour proportion was then calculated by dividing the number of times students prepared the meal hygienically by the number of meals cooked (M = 0.82, SD = 0.22). This measure was also used as the baseline behaviour score. In between the two past behaviour questions students were asked to write down six food hygiene rules to assist them in remembering if they had used such rules whilst preparing their meals. Behaviour was measured 4 weeks later at time two using the format described above for past behaviour, giving the proportion of meals prepared hygienically (M = 0.85, SD = 0.20). Knowledge of food hygiene was measured by asking participants to list the six most important rules they should follow to prepare food hygienically in order to prevent foodborne disease and keep food safe to eat. **Follow-up period:** 4 weeks **Analysis method:** Hierarchical regression, ANOVA, Bonferroni post hoc analysis in SPSS 15.		
Nevo (2010) Simulation in Healthcare USA	**Intervention's aim** To improve hand hygiene compliance among healthcare workers (HCW). Prevention of communicable disease(s) **Target Disease Group(s)**	**Study design:** Randomised controlled trial **Sample size** Total sample size: 150 HCW (75 physicians and 75 nurses) Intervention/Post-test sample size	**Main primary outcome measures results** Behavioural primary outcomes Overall, baseline hand hygiene compliance was 36.7% pre-examination and 33.3% post-examination.	**Funding source** In part by Health Resources and Services Administration (HRSA)

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A: 38% **B:** 67% **C:** 100% **D:** 100% **Overall:** 71%	Antimicrobial resistance & Healthcare-associated infections **Target disease(s)** Healthcare-associated infections. **Theory/model** Health Belief Model	30 participants in each of the four experimental setting group (15 physicians and 15 nurses) i.e. 120 in total Control/Pre-test sample size 30 participants in the control group (baseline setting) (15 physicians and 15 nurses). **Sample characteristics** Nurses and physicians from the medical-surgical units of a tertiary care teaching hospital who volunteered to take part in the study. **Main outcome measures** Relevant primary outcomes Hand hygiene compliance i.e. use of the hand sanitizer or hand-washing at the sink with soap and water before and after the examination. **Follow-up period:** One 5-minute examination. **Analysis method:** Generalized linear model to perform a repeated measures logistic regression on the data. The between-subjects factor was the cue, and the within-subject factor was pre- or post-examination hand hygiene.	Pre-examination compliance was higher than baseline in all experimental settings (Setting 1: 53.3%; Setting 2: 60.0%; Setting 3: 66.7%; Setting 4: 93.3%). The difference was significant for setting 3 and setting 4 (p=0.02 and p<0.001 respectively). Post-examination compliance was significantly higher in experimental setting 4 (93.3%, p<0.001). It was higher in setting 2 (50.0%), but this was not significant, and it was lower in settings 2 and 3 (both 30%), but the difference was not significant. Pre-examination compliance was significantly better than post-examination compliance for settings 2 and 3 (p<0.01). There was no significant difference in pre- and post-examination compliance rates for each of the other settings.	Grant Award #C76HF10860.
Nyamathi (2007) Health Psychology USA **A:** 75% **B:** 57% **C:** 100% **D:** 80% **Overall:** 76%	**Intervention's aim** The project aimed to assess predictors of latent tuberculosis infection (LTBI) completion among a sample of 494 homeless adults who received an intervention programme. Both prevention & control of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections **Target disease(s)** Tuberculosis **Theory/model** New: Comprehensive Health Seeking and Coping Paradigm (CHSCP) based on Transactional Model of Stress and Coping Other: Health Seeking Paradigm	**Study design:** Randomised controlled trial **Sample size** Total sample size: 520 (494 completed the study) Intervention/Post-test sample size: Not stated **Sample characteristics** Sex: male 396; female 98. Ethnic group: African American 82%; Hispanic 9%; White: 7%; Other: 2%. Mean Age: 41.5 years (SD=8.5). Years in Education: 3-19 (Mean=12) **Main outcome measures** Relevant primary outcomes Competed treatment, depression, TB risk assessment, alcohol use, heroin or cocaine use Relevant secondary outcomes TB knowledge, ease of treatment, dissatisfaction with treatment **Follow-up period:** Six months **Analysis method:** Structural Equation Modelling (SEM)	**Main primary outcome measures results** Behavioural primary outcomes The analysis demonstrated that treatment completion was significantly associated with having been a participant in the nurse care management (NCM) intervention (r = .22, p =.001). 64% of those in the NCM condition completed their LTBI treatment; and 42% of those in the standard care condition completed LTBI treatment. Significant correlates of completion of the treatment course included homeless shelter residence, less alcohol and heroin or cocaine use and less depression at 6-month follow-up. It is worth noting that the association with TB knowledge was non-significant at baseline. At baseline, the mean knowledge scores were 7.3 and 7.6 for the standard care and NCM groups, respectively (p = .05). At follow-up, mean knowledge scores were 9.3 for standard care and 11.4 for NCM (p =.001). Attitudinal/Belief primary outcomes Significant correlates of completion of the treatment course included greater ease of treatment, less dissatisfaction with treatment and	**Funding source** The National Institute on Drug Abuse

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			more TB knowledge at follow-up. Significant correlates of the NCM intervention included homeless greater risk assessment, greater ease of treatment, considerably less dissatisfaction with treatment and greater TB knowledge at follow-up.	
Nyamathi (2010) Research in Nursing & Health USA **A:** 50% **B:** 71% **C:** 100% **D:** 80% **Overall:** 72%	**Intervention's aim** To promote hepatitis A and hepatitis B vaccination completion among clients undergoing methadone maintenance (MM) treatment. **Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses Blood-borne diseases and STIs **Target disease(s)** Hepatitis A and Hepatitis B **Theory/model** Stages of Change (Transtheoretical) Model	**Study design:** Randomised controlled trial **Sample size** Total sample size: 256 individuals were enrolled into the study (148 eligible for immunisation). Intervention/Post-test sample size: 90 individuals allocated to Motivational Interviewing Single (MI-Single) (77 received intervention; 50 eligible for vaccine), 79 individuals allocated to Motivational Interviewing Group (MI-Group) (67 received intervention; 43 eligible for vaccine), 87 individuals allocated to Nurse-Led Hepatitis Health promotion (HHP) (77 received intervention; 55 eligible for vaccine) **Sample characteristics** Individuals undergoing MM treatment. Mean age 46.3 years. 55% male. 51.0% African American, 13.3% White, 30.5% Latino, 5.3% other ethnicity. 81.5% high school graduates. 55.6% partnered. 16.7% employed. **Main outcome measures** Relevant primary outcomes Completion of the three-series hepatitis A/hepatitis B vaccine. **Follow-up period:** 6 months **Analysis method** Chi-square tests and Fisher's exact tests were used to assess statistical differences in completion. T-tests for normally distributed continuous variables and non-parametric Wilcoxon's rank-sum tests for non-normal continuous variables were conducted to detect significant differences between completers and non-completers. Backward multiple logistic regression analysis was used to create a model for vaccine completion.	**Main primary outcome measures results** Behavioural primary outcomes Overall, 70% (103/148) of eligible individuals completed vaccination. 65% of MI-Single individuals completed vaccination. 69% of MI-Group individuals completed vaccination, and 74% of HHP individuals completed vaccination. There was no significant difference between completion rates between intervention groups.	**Funding source** National Institute on Alcohol Abuse and Alcoholism Contract Grant #AA015759.
Painter (2010) Health Promotion Practice USA	**Intervention's aim** to enhance influenza vaccination rates among a multi-ethnic sample of adolescents attending middle and high school in rural Georgia. Prevention of communicable disease(s)	**Study design:** Non-randomised controlled study **Sample size** Total sample size: No baseline reported. Cycle 1: 1106 students. Cycle 2: 1038 students. Intervention/Post-test sample size: No baseline reported.	**Main primary outcome measures results** Behavioural primary outcomes During the 2008 to 2009 influenza season in County 1, there were 70 students vaccinated out of 370 students (18.9%). During the same year in County 2, there were 110 out of 736 students	**Funding source** The Centers for Disease Control and Prevention. **Notes** Painter, 2010 (Health Promot Pract) describes

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A: 62% **B:** 14% **C:** 60% **D:** 40% **Overall:** 44%	**Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza **Theory/model** Health Belief Model Integrated Behavioral Model	Cycle 1: 370 in County 1; 736 in County 2. Cycle 2: 375 in County 1; 663 County 2. Control/Pre-test sample size: Not reported **Sample characteristics** Middle and high school students. Reflecting the high minority and low-income population in County 1, the 2007-2008 academic year data indicated that 95% of students were African American and 95% of students were eligible to receive free or reduced-price meals. County 2 data indicated that 38% of students were African American, and 59% were eligible to receive free or reduced-price meals. Intervention sample characteristics County 1 and County 3 were the sites of 2 different multi-component interventions. County 3, 'standard of care condition ', was not reported on. **Main outcome measures** Relevant primary outcomes Vaccinations rates **Follow-up period:** Unclear. Implicitly vaccination rates recorded as over the flu season. **Analysis method:** Relative Risk. No description of methods.	vaccinated (14.9%). In the first year, students in County 1 were 25% more likely to be vaccinated than students in County 2 (RR = 1.26, 95% CI: 0.96-1.66). During the current 2009-2010 influenza season, in County 1 we have vaccinated 114 out of 375 students (30.4%), a 62.2% increase from the previous influenza vaccination season. Currently, in County 2 we have vaccinated 10.5% of students (70 out of 663). For the current influenza season, students in County 1 are almost 200% more likely to get vaccinated than students in County 2 (RR = 2.88, 95% CI: 2.20-3.77).	the development of the intervention: educational skit (i.e. a short comedy sketch) and brochure – their basis in literature and development through focus groups. Gargano 2010 reports vaccination results from intervention cycle 1 and 2. No control comparison, no baseline reported. Painter 2010 (Health Educ Res) reports on baseline survey of intention to receive immunisation drawn from students in school-based intervention county and a standard-of-care-condition.
Pooya (2006) American Journal of Infectious Diseases Iran **A:** 50% **B:** 14% **C:** 40% **D:** 25% **Overall:** 33%	**Intervention's aim** To prevent viral upper respiratory tract infections among soldiers. Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Viral upper respiratory tract infections (especially common cold) **Theory/model** Health Belief Model	**Study design** Randomised controlled trial **Sample size** Total sample size: 225 enrolled, 178 followed up. Intervention/Post-test sample size: Group 1: 59, Group 2: 60: Group 3: 32, Group 4: 27. **Sample characteristics** No details provided. Intervention sample characteristics No details provided. Exclusions Intolerable gastrointestinal complications. **Main outcome measures** Relevant primary outcomes Number of zinc sulphate pills consumed. Frequency of common cold. Frequency of preventative behaviours: avoiding hand shaking, using a handkerchief when suffering from common cold, hand hygiene, using a mask. **Follow-up period:** 6 weeks. **Analysis method:** Logistic regression, independent	**Main primary outcome measures results** Behavioural primary outcomes Consumption of zinc sulphate pills was significantly higher among those in groups who received education compared to those in groups who had not received education (p=0.01). Two preventative behaviours (avoiding hand shaking, and handkerchief use) were performed significantly more frequently in groups who received education compared to those in groups who had not (p=0.02 and p=0.002 respectively). Rates are not reported. Other primary outcomes Relative frequency of common cold was 70.2% overall. Group 1: 57.6%; Group 2: 78.3%; Group 3: 62.5%; Group 4: 88.9% (p=0.015). The effectiveness of HBM education in preventing common cold RR=0.91 (95% CI 0.493-1.313).	**Funding source** University of Isfahan, Iran.

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		samples t-test, odds ratio analysis and chi-square. Best case-worst case analysis was done to examine the effect of missed data.		
Quick (2002) American Journal of Tropical Medicine Zambia **A:** 63% **B:** 80% **C:** 100% **D:** 83% **Overall:** 79%	**Intervention's aim** Diarrhoea prevention through a water quality intervention that consists of water treatment, safe storage, and community education. Prevention of communicable disease(s) **Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses **Target disease(s)** Diarrhoea, E. Coli **Theory/model** Stages of Change (Transtheoretical) Model	**Study design** Non-randomised controlled study **Sample size** Total sample size: 260 households, 1,584 persons. Intervention/Post-test sample size: 166 households Control/Pre-test sample size: 94 households. **Sample characteristics** Of the 260 households, 166 were from Ipusukilo, and 94 were from Luangwa. Median estimated asset value was $20 (range 0-$860). Only 11 (4%) of households had access to electricity. Median age: 16 (0-79). Female: 50.8%. There were no statistically significant demographic or socioeconomic differences between intervention and control households. **Main outcome measures** Relevant primary outcomes Water testing and diarrhoea surveillance. Relevant secondary outcomes Water treatment with sodium hypochlorite use **Follow-up period:** 5 week baseline period followed by 8-week period following the launch. **Analysis method** The Fisher two-tailed test was used to analyse categorical data, analysis of variance was used for data that were continuous and normally distributed, and the Kruskal-Wallis test was used for analysis of continuous data that were not normally distributed... Generalized estimating equations (GEEs) were used for the analysis of repeated observations of diarrhoea in families and individuals over time in intervention and control households, controlling for clustering within households.	**Main primary outcome measures results** Behavioural primary outcomes E. coli colonies were detectable in stored water samples from only 12 (30.8%) of 39 intervention households and 21 (95.4%) of 22 control households (P<0.001). Despite the steady decrease in diarrhoea cases over the course of the study, univariate GEE analysis revealed a statistically significant difference in household diarrhoea rates (estimated odds ratio [OR] = 0.53, 95% confidence interval [CI] = 0.3, 0.98) and individual diarrhoea rates (estimated OR = 0.52, 95% CI = 0.3, 0.9) between the intervention and control groups in the post-launch period. **Main secondary outcome measures results** Behavioural secondary outcomes Water treatment reported Of all 235 households, only 35.2% reported ever treating water. Sodium hypochlorite use was reported by respondents in 156 (96.9%) of 161 intervention households at the end of the study. Water storage behaviour 57% of total study population had used wide mouth containers. Of 90 vessels made available at a discounted price to this impoverished population, 67 (74%) were purchased. Most of those who did not purchase the vessel expressed a desire to own the vessel but indicated that money was the main barrier to purchasing it. Despite this economic barrier, water storage in narrow-mouthed vessels promoted by study personnel increased from 48.0% to 89.2% in the intervention population.	**Funding source** The United States Agency for International Development-Zambia and the Office of Health Communication, the National Center for Infectious Diseases and the Centers for Disease Control and Prevention.
Quinley (2004) Journal of Community Health USA	**Intervention's aim** To examine whether adding a simple telephone follow-up to an existing mailed physician performance feedback under the Medicare program would increase the impact on billed	**Study design** Randomised controlled trial **Sample size** Total sample size: 1061 Intervention/Post-test sample size: 811 Control/Pre-test sample size: 250	**Main primary outcome measures results** Behavioural primary outcomes High Volume and African American intervention groups had greater percentage point improvement in vaccination vs. control, but this did not reach significance.	**Funding source** The Health Care Quality Improvement Program initiated by the Centers for Medicare and Medicaid

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A: 63% **B:** 67% **C:** 80% **D:** 83% **Overall:** 73%	pneumococcal immunizations. Prevention of communicable disease(s) **Target Disease Group(s)** Vaccine preventable diseases and Invasive bacterial infections **Target disease(s)** Invasive pneumococcal disease **Theory/model** Stages of Change (Transtheoretical) Model	**Sample characteristics** Only those deemed high priority included. Primary care providers, with cumulative polyvalent pneumococcal vaccine immunisation rate of less than or equal to 40% of their eligible Medicare patients. Physicians must have either seen 200 eligible patients in 1999 (High Volume) or seen at least 30 eligible African American patients which comprised greater than or equal to 20% of their Medicare practice (African American servicing). **Main outcome measures** Relevant primary outcomes Vaccination rate change 1999-2000 **Follow-up period** A year: change in vaccination rates from 1999 to 2000 calculated. **Analysis method** The mean baseline rates and change in cumulative pneumococcal vaccination rates were compared between study groups using t-tests for independent samples. The proportions of physicians that reached at least 5% and 10% improvement were compared using chi-square tests of independence.	'However, the intervention group did have a statistically significant greater percentage of practices that reached at least 10% improvement (17.8% vs. 7.0%, p = .018).' 'Overall, the intervention group had a greater percentage of practices obtaining at least 5% improvement (25.0% vs. 21.8%, p = .010).' The results of the stratified analysis indicate that most of this difference is accounted for by differences among practices that started with a lower baseline rate. In that sub-group, the intervention practices were over two and a half times as likely to have at least 5% improvement (29.0% vs. 11.1%, p = .002). In addition, their percentage point difference (3.86 vs. 2.21) was statistically significant (p = .007).	Services.
Reynolds (2008) American Journal of Medical Quality USA **A:** 17% **B:** 100% **C:** 80% **D:** 67% **Overall:** 62%	**Intervention's aim** Quality improvement programme to improve immunisation rates, primarily for influenza. Physicians invited to attend 1-day training sessions. Prevention of communicable disease(s) **Intervention's Setting** Invitational training session in Philadelphia **Intervention's target population** Physician practices: 'Physicians attended the training session accompanied by an office staff member, who was ideally considered the practice's 'immunisation champion'. **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and Invasive bacterial infections **Target disease(s)** Influenza	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 55 practices received training. Intervention/post-test sample size: 11 (20%) practices had submitted follow-up data at time of reporting **Sample characteristics** Practices were primarily based in north-eastern and southern regions of the USA (46% and 31%, respectively), and physician attendees were primarily male (69%). 51% were based in suburban setting, with 26% in urban and 23% in rural settings. Of the 39 that provided baseline data, 54% were private practices, 31% hospital based, 8% residence clinics, 5% university hospitals and 3% HMOs (Health Maintenance Organisations). **Main outcome measures** Relevant primary outcomes Practice immunisation rates **Follow-up period**	**Main primary outcome measures results** Behavioural primary outcomes Overall immunisation rate increase: 64% to 68% Greatest improvements were in patients with private insurance (41% to 59%) and patients aged 50 to 64 years (35% to 48%). Smaller improvements in patients on Medicare and Medicaid, patients aged 65 plus, and patients with diabetes and heart disease. Improvements for male and female are equivalent. White Hispanic immunisation rate declined, from 55% at baseline to 45% at follow-up. White and Black patient groups' immunisation increased slightly (from 11 (20%) practices that submitted follow-up data)	 **Notes** The shortage of vaccines during one season may have affected the baseline

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	Target Behaviour(s) for change Introduce a new system in to organise immunisation at practice level: train to practices to implement quality improvement plans for next influenza season. 'Plans varied depending on participants' experience with quality improvement but generally included improving documentation in patient chart, improving vaccine ordering, targeting the population aged 50 to 64 years and/or patients with private insurance, implementing standing orders, involving ancillary staff at check-in and other points of contact, and reviewing charts for eligible patients, either the day of or the day before the patient visit.' **Theory/model** Social Cognitive Theory (Social Learning Theory) Other: Team-based learning theory	Immunisation data collected continuously after training for duration of programme (3 years) **Analysis method** No method specified. Compared baseline and follow-up immunisation rates.		measures to such an extent that the results are unreliable.
Rosen (2009) Health Education Research Israel **A:** 71% **B:** 71% **C:** 100% **D:** 79% **Overall:** 79%	**Intervention's aim** Intervention trial designed to change hand washing behaviour and so decrease illness absenteeism among pre-schoolers. Prevention of communicable disease(s) **Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses Respiratory tract infections **Target disease(s)** Diarrhoea and lower respiratory infection **Theory/model** Health Belief Model Theory of Planned Behavior	**Study design:** Randomised controlled trial **Sample size** Total sample size: 1029, Intervention/Post-test sample size 489, Control/Pre-test sample size: 540. **Sample characteristics** All state-run pre-schools for 3-4 year olds. Mix of secular and religious. Also, 'Preschool teachers likely to comply with the trial protocol were recommended by Ministry of Education officials and were invited to join the project.' **Main outcome measures** Relevant primary outcomes Rates of hand washing and illness absenteeism. Relevant secondary outcomes Educator beliefs about outcomes if children wash hands; attitudes about children washing before lunch and after bathroom use; knowledge; and self-efficacy: I can get children to wash hands before and after lunch. **Follow-up period** Measurement pre-intervention visit month (baseline) and the 3 consecutive months after.	**Main primary outcome measures results** Behavioural primary outcomes The intervention had a significant effect on both the medium and longer term behaviour. For hand washing after lunch, the medium-term adjusted relative risk (adjusted RR) was 2.77 (CI:[1.70,7.46], P < 0.01), while the long-term adjusted RR was 2.93 (CI:[1.86,6.97], P < 0.01). For hand washing after bathroom use, the medium-term adjusted RR was 2.90 (CI:[1.69,10.06], P < 0.01), while the long-term adjusted RR was 3.30 (CI:[1.83,16.67] P < 0.01). Average daily percentages of overall and illness absenteeism: There was no evidence of an intervention effect on absenteeism (adjusted RR = 1.00, CI: [0.90,1.14], P = 0.97) or illness absenteeism (adjusted RR = 1.00, CI: [0.81,1.32], P = 0.97). **Main secondary outcome measures results** Behavioural secondary outcomes Educator effects: only significant effect detect	**Funding source** Chief Scientist's Office, Israel Ministry of Health; Health Promotion Granting Unit, Associate Director General, Ministry of Health; National Institute for Health Services Research Doctoral Stipend (m-2-02); Grant for outstanding doctoral work from Municipality of Jerusalem.

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		Analysis method Baseline hand washing rates, environmental conditions, socio-demographic characteristics, and absenteeism rates were compared between the study groups using analysis of variance, the mixed linear model, Fisher's Exact Test, or generalized estimating equations analysis	on knowledge: Knowledge was high on all items in both groups. The most positive response in the intervention group was to the item about transmissibility of infectious disease via shared cups (intervention: mean = 6.69, SD = 0.75; control: mean = 5.76, SD = 2.03). The highest response in the control group was to the item about whether it is possible for human beings to affect illness (intervention: mean = 6.17, SD = 1.68; control: mean = 6.46, SD = 1.38). The intervention group scored better than the control group on five out of six items. The score for the knowledge scale was 6.24 for the intervention group (SD = 0.73) and 5.81 for the control group (SD = 0.79). The Cronbach's alpha for this scale was 0.60, indicating a moderate level of internal consistency. Knowledge was significantly higher in the intervention group (LS Means intervention group: 6.22, LS Means control group: 5.66, P = 0.0343).	
Samore (2005) Journal of the American Medical Association USA **A:** 71% **B:** 100% **C:** 80% **D:** 80% **Overall:** 80%	**Intervention's aim** The study aimed to investigate the effects of a clinical decision support system (CDSS) coupled with a community intervention on reducing the inappropriate prescribing of antimicrobial drugs for acute RV infections. Control of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Acute RV infections (Common cold, influenza) **Theory/model** Health Belief Model Social Cognitive Theory (Social Learning Theory)	**Study design:** Randomised controlled trial **Sample size** Total sample size: 40 7460 residents 334 primary care clinicians in 12 communities plus 6 communities as a control group. Intervention/Post-test sample size CDSS plus Community Intervention: 32490 Community Intervention Alone: 35420 Control/Pre-test sample size Control: 19310 **Sample characteristics** Intervention sample characteristics CDSS & Community Intervention (n=6) Population in 2000, mean (SD) 32490 (2555) Women % (range) 51 (49-51) Adults% (range) 72 (66-77) Household size, mean No. (range) 2.7 (2.3-3.2) Household income, media (range), $ 36260 (33070-52910) Non-Hispanic white race, % (range) 89 (88-93) Educational level, college, % (range) 58 (44-78)	**Main primary outcome measures results** Behavioural primary outcomes Within the six communities receiving the CDSS and community, 71% of primary care clinicians participated in the use of CDSS. The prescribing rate in these communities decreased from 84.1 to 75.3 per 100 person years in the CDSS arm vs. 84.3 to 85.2 in community intervention alone, and remained stable in the other 2 groups of communities (P=.03). 13 081 acute RV infection visits were abstracted. The relative decrease in antimicrobial prescribing for visits in the antibiotics 'never-indicated' category post-test was 32% in CDSS communities and 5%in community intervention alone communities (P=.03). Use of macrolides decreased significantly in CDSS communities but not in community intervention–alone communities.	**Funding source** The US Centers for Disease Control and Prevention #CCU323245-02

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		Medical & pharmaceutical care in 2003: No. of clinicians per 10,000 residents, median Total primary care 6 No. of hospital beds, mean 77 No. of retail pharmacies, mean 6.5 Community Intervention Only (n=6) Population in 2000, mean (SD) 35420 (30960) Women % (range) 50 (49-53) Adults% (range) 69 (62-75) Household size, mean No. (range) 3.0 (2.7-3.7) Household income, media (range), $ 36580 (31760-38300) Non-Hispanic white race, % (range) 93 (80-96) Educational level, college, % (range) 56 (49-66) Medical & pharmaceutical care in 2003: No. of clinicians per 10,000 residents, median Total primary care 7 No. of hospital beds, mean 103 No. of retail pharmacies, mean 5.5 Control sample characteristics Control (n=6) Population in 2000, mean (SD) 19310 (13950) Women % (range) 49 (41-51) Adults% (range) 70 (67-73) Household size, mean No. (range) 2.9 (2.6-3.2) Household income, media (range), $ 33300 (32100-35070) Non-Hispanic white race, % (range) 85 (75-92) Educational level, college, % (range) 50 (42-67) Medical & pharmaceutical care in 2003: No. of clinicians per 10,000 residents, median Total primary care 9 No. of hospital beds, mean 42 No. of retail pharmacies, mean 3.8 **Main outcome measures** Relevant primary outcomes: Community wide anti-microbial use using retail pharmacy data **Follow-up period:** Approximately 1 year **Analysis method:** Multilevel regression		
Schensul (2009) American Journal of Community Psychology	**Intervention's aim** The intervention aimed to provide support, advocate for resident activities, and improved communication, to increase	**Study design:** Randomised controlled trial **Sample size** Total sample size: N = 180 Intervention/Post-test sample size: N = 107 Control/Pre-test sample size: N = 73	**Main primary outcome measures results** Behavioural primary outcomes The vaccination rate increased from 30.4 to 71% of respondents in the intervention building, meeting the target of 70% plus A significant difference	**Funding source** Institute for Community Research.

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USA **A:** 63% **B:** 71% **C:** 100% **D:** 67% **Overall:** 73%	vaccination access and uptake among the target population. Prevention of communicable disease(s) **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza **Theory/model** Social Ecological model	**Sample characteristics** Intervention Building (N=107) Mean age: 57 years Sex: female 35; male 65 Ethnicity: Latino 51%; African American 33%; West Indian 9; White 7. Education (less than 8th grade) 38% Income (less than $800/month) 84% Length of time in Hartford (mean years) 25.6 Length of time in building (mean years) 4.5 Language preferences (English/Spanish) 73%/27% Control Building (N=73) Mean age: 62 years Sex: female 44; male 56 Ethnicity: Latino 56%; African American 18%; West Indian 1; White 15. Education (less than 8th grade) 48% Income (less than $800/month) 77% Length of time in Hartford (mean years) 27.5 Length of time in building (mean years) 4.6 Language preferences (English/Spanish) 40%/60% **Main outcome measures** Relevant primary outcomes Influenza vaccination rates Relevant secondary outcomes Improvements in pro-vaccination knowledge, beliefs, and understanding of health consequences. **Follow-up period:** After the end of flu season (May to July 2006) **Analysis method:** SEM path analysis	between the increase in vaccination in the control building (18%) and the Intervention building was identified (41%) (p = .010). SEM path analysis confirmed the significant difference between vaccination rate increases in the intervention versus the control groups (standardized direct path of .18, p = .023). A significant increase in vaccination rates in the intervention versus the control building was found (b = 1.066, /p/** = .022). This translates into an increase of odds of getting the flu vaccine at post-test from 1.92 to 5.59 due to the intervention variable (change in probability from .66 to .85). Attitudinal/Belief primary outcomes It was found that the intervention had a positive impact on beliefs about influenza, increasing correct beliefs and reducing incorrect beliefs (b = -.13; p = 063). The effect on perceived consequences of the flu was significant, (b = -.19; p = .009) in that the intervention increased negative perception of consequences of influenza vaccination in the intervention group. Also, worry about the consequences of the flu decreased as a consequence of the intervention (b = -.18; p = .030) The perception that influential people are getting vaccinated and instructing respondents to be vaccinated increased significantly at post-test in the whole sample. Participants in the intervention group were significantly more likely to perceive that more people around them either vaccinate or tell them to vaccinate (path of +.30 found in a SEM model with two dimensional social influence latent measures).	
Slaunwhite (2009) Canadian Journal of Infection Control Canada **A:** 25% **B:** 33% **C:** 80%	**Intervention's aim** Key members (a.k.a. 'champions') within specific work units were provided with a brief training session designed to increase awareness of the benefits associated with influenza vaccination. Both prevention & control of communicable disease(s) **Target Disease Group(s)**	**Study design** Randomised controlled trial **Sample size** Total sample size: 46 work units Intervention/Post-test sample size: 23 work units Control/Pre-test sample size: 23 work units **Sample characteristics** In 2005, work units within an acute care facility were matched on previous year's influenza vaccination rates,	**Main primary outcome measures results** Behavioural primary outcomes Group comparisons revealed that the percentage of individuals who received an influenza vaccine in the champion absent condition was 41% whereas in the champion present group, compliance was significantly higher at 52%.	**Funding source** The department of Occupational Health, Capital District Health Authority, Halifax, Nova Scotia; the Nova Scotia Health Research Foundation; and the Canadian

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D: 75% **Overall:** 50%	Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza **Theory/model** Diffusion of Innovations	physical size and primary function (e.g., support services, surgical unit), creating a final sample of 46 work groups (or 23 pairs). The rationale for matching units was to have equal representation of champions throughout the entire hospital facility and to remove possible sampling errors associated with the aforementioned variables (e.g., previous year's immunization rate, primary function). **Main outcome measures** Relevant primary outcomes Percentage of individuals who received an influenza vaccine. **Follow-up period:** Unclear **Analysis method:** Independent samples t-test, paired sample t-tests		Institutes of Health Research.
Taylor (2011) Journal of Community Health Canada **A:** 86% **B:** 50% **C:** 100% **D:** 80% **Overall:** 78%	**Intervention's aim** Hepatitis B English as Second Language curriculum to improve HBV-related knowledge and motivate students to be tested. Control of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Hepatitis B. **Theory/model** Health Belief Model Theory of Reasoned Action Theory of Planned Behavior PRECEDE-PROCEED New: Health Behaviour Framework informed by existing theories/models	**Study design** Randomised controlled trial **Sample size** Total sample size: 180 Intervention/Post-test sample size: 80 Control/Pre-test sample size: 100 **Sample characteristics** Participants were originally from: China 90 (51%); India 30 (17%); Iran 23 (13%); Other 35 (19%). Years since immigration: <2 years 81 (45%); ≥ 2 years 99 (55%). Gender: male 57 (32%); female 123 (68%). Age: <40 years 82 (46%); ≥40 years (96, 54%).Years of education: <16 years 117 (65%); ≥ 16 years 63 (35%). Marital status: married 154 (86%); not married 26 (14%). Intervention sample characteristics Intervention and control groups were closely representative of the total sample. Control sample characteristics Intervention and control groups were closely representative of the total sample. **Main outcome measures** Relevant primary outcomes HBV knowledge scores; HBV testing rate. **Follow-up period:** 6 months. **Analysis method:** Chi-square tests, Fisher's exact tests, and unpaired t-tests for descriptive statistical analyses. And Generalized Estimating Equations (GEE) for the evaluation.	**Main primary outcome measures results** Behavioural primary outcomes Nine (11%) of experimental group and 6 (6%) of control group reported they had received HBV testing in the 6 months since (p=0.28). Health provider records verified testing for 5 (6%) of experimental group and 0 (0%) of the control group (p=0.02). Attitudinal/Belief primary outcomes The mean knowledge score (in unadjusted analyses) were 3.68 (SD:-1.12) among all experimental group students and 2.87 (SD:-1.38) among control group students (p<0.001). Differences remained highly significant after adjustment for other variables.	**Funding source** Supported with grant from US National Cancer Institute.

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Trepka (2008) Journal of the American Dietetic Association USA **A:** 75% **B:** 66% **C:** 100% **D:** 80% **Overall:** 79%	**Intervention's aim** To determine if interactive multimedia is a more effective method than pamphlets for delivering food safety education to Special Supplemental Nutrition Program. Prevention of communicable disease(s) **Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses **Target disease(s)** Foodborne pathogenic infection **Theory/model** Health Belief Model	**Study design** Randomised controlled trial **Sample size** Total sample size: 394 Intervention/Post-test sample size: 195 Control/Pre-test sample size: 199 **Sample characteristics** There were no statistically significant differences in the distribution of the demographic characteristics between participants in the two groups. **Main outcome measures** Relevant primary outcomes Changes in food handling practices. **Follow-up period:** 2 months following enrolment. **Analysis method** A mean food safety score was determined for each participant for the pre- and post-intervention questionnaires. The scores were used in a two group repeated measures analysis of variance.	**Main primary outcome measures results** Behavioural primary outcomes Although there was a statistically significant improvement for all subjects regardless of group assignment there was not a statistically significant interaction of pre-post measures with group assignment. When the age of the subject was considered, there was a statistically significant greater increase among those in the interactive multimedia group than among those in the pamphlet group.	**Funding source** The National Integrated Food Safety Initiative of the Cooperative State Research, Education and Extension Service, of the United States Department of Agriculture No. 2004-51110-02166
Turnbull (2001) Bulletin of the World Health Organization Australia **A:** 100% **B:** 100% **C:** 100% **D:** 60% **Overall:** 89%	**Intervention's aim** The intervention aimed to improve levels of immunization coverage among children aged 1-12 years, and in the longer term to prevent measles epidemics. Prevention of communicable disease(s) **Target Disease Group(s)** Vaccine preventable diseases and Invasive bacterial infections **Target disease(s)** Measles **Theory/model** Health Belief Model	**Study design:** Before-and-after study (with same sample after intervention) **Sample size** Total sample size Parents of 4800 students (20 students each from 240 schools, 30 in each state or territory of Australia). 1601 parents of pre-school children. Intervention/Post-test sample size 1844 parents of students 910 parents of pre-school children **Sample characteristics:** N/A **Main outcome measures** Relevant primary outcomes Incidence of measles. Vaccination against measles. **Follow-up period:** Six months **Analysis method:** Univariate analysis: Pearson's w2 test, Student's t test and Wilcoxon's test	**Main primary outcome measures results** Behavioural primary outcomes In excess of 1.33 million children aged 5–12 years were vaccinated at school. Serological monitoring indicated that 94% of school children were protected after the intervention. Prior to the campaign this figures was only 84%. Among preschool children aged 1–3.5 years, the corresponding levels of protection were 89% and 82%. During the six months after the intervention, there was a noticeable (but not significant) reduction in the number of measles cases among children in targeted age groups.	**Funding source** Assistance from the Commonwealth Department of Health and Aged Care, the Health Insurance Commission; the State and Territory authorities and the Departments of Education of New South Wales and Victoria; and the Hunter Valley Research Foundation (unclear if "assistance" includes funding)
Updegraff (2011) Health Psychology USA **A:** 50% **B:** 100% **C:** 100%	**Intervention's aim** The intervention aimed to encourage and improve hand hygiene to help prevent influenza through the location of point of use reminder signs adjacent to hand sanitizers in buildings on a university campus, informed by behavioural theory. Prevention of communicable disease(s)	**Study design:** Randomised controlled trial **Sample size** Total sample size: No human participants. Hand sanitizer usage was calculated per gram of sanitizer. Intervention/Post-test sample size: N/A Control/Pre-test sample size: N/A **Sample characteristics:** N/A **Main outcome measures**	**Main primary outcome measures results** Behavioural primary outcomes All signs were associated with increased sanitizer usage compared to no sign. The gain-framed sign was associated with greatest level of usage (66% over no sign). Signs emphasizing susceptibility to H1N1 were associated with the lowest level of usage (41% over no sign).	**Funding source** Kent State University, Kent, OH.

STUDY Journal title Country/Countries Validity Scores	INTERVENTION Aim Setting Target population Target Disease Group(s) Target disease(s) Target Behaviour(s) for change Theory/model used	EVALUATION DESIGN Study design Sample size Sample characteristics Main outcome measures Follow-up period Analysis method	EVALUATION RESULTS Main primary outcome measures results Main secondary outcome measures results	NOTES Funding source
D: 100% **Overall:** 83%	**Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza **Theory/model** Health Belief Model Theory of Planned Behavior	Relevant primary outcomes Hand sanitizer use (grams of sanitizer used) **Follow-up period:** N/A. Study ran for six months **Analysis method:** Generalized estimating equations were used to model sanitizer usage across time as a function of baseline usage and sign condition.		
Vet (2011) Health Education Research Netherlands **A:** 57% **B:** 80% **C:** 100% **D:** 80% **Overall:** 76%	**Intervention's aim** To assess the effects of the use of role models in persuasion messages relating to risks and social norms to increase motivation to obtain vaccine against Hepatitis B among homosexual males. Prevention of communicable disease(s) **Target Disease Group(s)** Blood-borne diseases and STIs **Target disease(s)** Hepatitis B **Theory/model** Social Cognitive Theory (Social Learning Theory)	**Study design** Randomised controlled trial **Sample size** Total sample size: 168 Intervention/post-test sample size: 37 to risk communication condition, 37 to social norms communication condition, 46 to combined communications condition, control/pre-test sample size 48 to control condition **Sample characteristics** N= 168 Mean age: 33.8 years (SD=11.2) Ethnicity: 95% Dutch/5% ethnic minority Relationship status: 37.5% in stable relationship with another man Education: 44% with bachelor degree Average No. of casual sex partners in last 6 months: 4 (range 0-35) Intervention sample characteristics: N/A Control sample characteristics: N/A **Main outcome measures** Relevant primary outcomes Motivation to obtain Hepatitis B vaccine. **Follow-up period:** Not specified but apparently immediately after intervention **Analysis method:** Mediation analysis using multivariate regression	**Main primary outcome measures results** Behavioural primary outcomes Results relating to intention to obtain vaccination showed a significant effect of the coding risk communication (b =0.24, P < 0.007), a significant effect of the social norms communication (b = 0.29, P < 0.001) and a significant effect of the combined communication (b = 0.20, P < 0.03). Attitudinal/Belief primary outcomes The results found that perceived risk showed significant effects associated with the risk communication (b = 0.21, P < 0.02), the social norms communication (b = 0.34, P < 0.00) and coding the combined communication (b =0.23, P < 0.01). The analysis for perceived social norms showed a significant effect of the social norms communication (b = 0.32, P < 0.00).	**Funding source** The Netherlands Organization for Health Research and Development
White (2001) Journal of School Nursing USA **A:** 63% **B:** 43%	**Intervention's aim** To assess whether an alcohol- free, instant hand sanitizer could reduce illness absenteeism in a population of elementary school children and serve as an effective alternative when regular soap and water hand washing was not readily available. Prevention of communicable disease(s)	**Study design** Randomised controlled trial **Sample size** Total sample size: 769 Intervention/Post-test sample size: 381 Control/Pre-test sample size: 388 **Sample characteristics** Children in kindergarten through 6th grade classes (5 to 12	**Main primary outcome measures results** Behavioural primary outcomes Of the total absences in the 5 weeks of the study for the sanitizer-using group, 29.4% were due to gastrointestinal illness and 70.6% were caused by respiratory illness. This distribution was comparable to the control group where 30.2% were caused by gastrointestinal illness and 69.8% were related to	**Funding source** Orange County School Nurses Organization Health Promotion Grant.

STUDY Journal title Country/Countries Validity Scores	INTERVENTION Aim Setting Target population Target Disease Group(s) Target disease(s) Target Behaviour(s) for change Theory/model used	EVALUATION DESIGN Study design Sample size Sample characteristics Main outcome measures Follow-up period Analysis method	EVALUATION RESULTS Main primary outcome measures results Main secondary outcome measures results	NOTES Funding source
C: 80% **D:** 80% **Overall:** 64%	**Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses Respiratory tract infections **Target disease(s)** Microbial infections of the respiratory and gastrointestinal tract. **Theory/model** Health Belief Model	years old) were included in the study. Each classroom had an enrolment of 20 to 30 students. Exclusions Children with known allergies to any of the ingredients in the SAB sanitizer were excluded from the study. **Main outcome measures** Relevant primary outcomes Attendance and reason for absence **Follow-up period:** 5 week period. **Analysis method:** Relative risk of absences (RRA) represented the normalized risk of illness-related absenteeism in the study group compared with the control group. Statistically significant differences between the test groups were determined by chi-square analysis.	respiratory illness. The total number of days of illness-absence was significantly lower in the study group than in the placebo group.	
White (2005) Journal of American College Health USA **A:** 63% **B:** 67% **C:** 100% **D:** 100% **Overall:** 79%	**Intervention's aim** To determine whether a message campaign about hand hygiene and the availability of gel hand sanitizer could decrease cold and flu illness and school and work absenteeism. Prevention of communicable disease(s) **Intervention's Setting** University campus residence halls (n=4) **Intervention's target population** College students. **Target Disease Group(s)** Respiratory tract infections **Target disease(s)** Upper Respiratory Illnesses (URIs). **Target Behaviour(s) for change** Improving hand hygiene. **Theory/model** Diffusion of Innovations	**Study design** Non-randomised controlled study **Sample size** Total sample size: 430 initially enrolled; 391 meet data submission requirements to be analysed. Intervention/Post-test sample size: 188 Control/Pre-test sample size: 203 **Sample characteristics** College freshmen: 85.6%; more female (61.9%); mainly White (88%), vs. African American (1.7%), Hispanic or Latino (4.2%), Asian or Pacific Islander (2.8%), or Native or Alaskan American (.3%), no race reported (3%). **Main outcome measures** Relevant primary outcomes From Pre and Post-intervention survey: Knowledge about hand hygiene; Hand-washing attitude; Sanitizer attitude; Perceived behaviour. From weekly internet surveys during intervention: Hand washing and sanitizer use (rates/hour); absenteeism from upper respiratory symptoms. Relevant secondary outcomes Weekly survey: whether student had encountered campaign, which aspects they found, and their perceptions of the campaign. **Follow-up period:** pre- and post-survey at beginning at end of 8 week study period, and weekly survey throughout. **Analysis method:** ANOVA between two groups.	**Main primary outcome measures results** Behavioural primary outcomes Weekly survey: Hand washing and sanitiser use (rates/hour): Experimental group had significantly better hand hygiene than did the control group. Hand washing: .48 (experimental) .43 (control). Sanitizer use: .26 (experimental) .03 (control). -A difference in both hand-washing behaviour, $t(330) = 2.06$, $p< .02$, and hand-sanitizer use between experimental and control halls, $t(367) = 12.92$, $p<.0001$. [Only experimental halls were issued with free hand sanitizer in their rooms and in travel packs]. Illness rates: 'Significantly more participants in the control group reported missing at least 1 day of school or work because of illness (9.5%), compared with the product-use group (5.7%), $\chi^2=13.39$, $p<.0001$; this reflects 40% fewer absences in the experimental group compared with the control group.' Pre- and post- survey: 'Perceived behaviour': Experimental group: Before: M=2.87, SD=0.4; After: M=2.80, SD=0.5. Control group: Before: M=2.81, SD=0.4; After: M=2.83, SD=0.5. Attitudinal/Belief primary outcomes Knowledge about hand hygiene increased in the experimental group but not in the control group,	**Funding source** This study was partially funded by Gojo Industries (a manufacturer of hand hygiene and skin care products.)

STUDY Journal title Country/Countries Validity Scores	INTERVENTION Aim Setting Target population Target Disease Group(s) Target disease(s) Target Behaviour(s) for change Theory/model used	EVALUATION DESIGN Study design Sample size Sample characteristics Main outcome measures Follow-up period Analysis method	EVALUATION RESULTS Main primary outcome measures results Main secondary outcome measures results	NOTES Funding source
			$F_{(1,334)}=11.25$, p<.001. Attitudes toward hand washing increased over time in both the experimental and control groups, $F_{(1,342)}=19.76$, p<.001. **Main secondary outcome measures results** Attitudinal/Beliefs secondary outcomes Majority of students in experimental group (76%) indicated that they had encountered a message in their residence about hand washing. Bathrooms messages were most visible (96% of students had encountered them). Bulletin boards in residence hall floors and in common areas were seen by many (56% and 54%, respectively). Students saw messages as containing accurate, interesting, and useful information. Also seen as good reminders. And 32% of respondents had talked with someone in their residence about hand washing during the last month.	
York (2009) Journal of the American Dietetic Association USA **A:** 50% **B:** 71% **C:** 60% **D:** 60% **Overall:** 61%	**Intervention's aim** The study aimed to assess the effectiveness of traditional food-safety training compared to a Theory of Planned Behavior intervention program targeting employees' perceived barriers and attitudes toward important food-safety behaviours. Prevention of communicable disease(s) **Target Disease Group(s)** Foodborne & Waterborne diseases & Zoonoses **Target disease(s)** Foodborne illnesses **Theory/model** Theory of Planned Behavior	**Study design** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 247 employees from 31 restaurants. Intervention/Post-test sample size: 33 employees from 16 restaurants. **Sample characteristics** N/A for overall contacted sample who started study Intervention sample characteristics Sex: male: 20; Female 13. Average age: 32 years (range 18-55 years) Employment in food service industry: 9.5 years (range 0.5-30 years) Control sample characteristics: N/A **Main outcome measures** Relevant primary outcomes Behavioural Compliance: Hand washing overall, hand washing using appropriate technique, thermometer usage, proper handling of work surfaces Knowledge: Knowledge of hand washing, Knowledge of thermometer use, Knowledge of proper handling of work surfaces, Overall knowledge of food safety **Follow-up period:** 1 year **Analysis method:** Repeated- measures analyses of	**Main primary outcome measures results** Behavioural primary outcomes For overall behavioural compliance (combined behaviours of hand washing, thermometer use and proper handling of work surfaces) overall scores at post-intervention were significantly higher than at baseline (P=0.01) and post-training (P=0.05) (power=0.95). For hand washing overall, compliance was better post-test than baseline (P<0.001) (power=0.88). Compliance with hand washing at appropriate times was better after the intervention (P=0.001), and after raining (P=0.01) (power=0.98). No significant differences in behavioural compliance scores were found for hand washing using appropriate technique (power=0.23), thermometer usage (power=0.10), or proper handling of work surfaces (power=0.46). Attitudinal/Belief primary outcomes Analysis found that knowledge of hand washing was significantly higher at post-training (P=0.01) and post-intervention (P=0.05) (power =0.79). No significant differences were observed for knowledge of thermometer usage (power=0.42), proper handling of work surfaces (power=0.16), or overall knowledge (power=0.09).	

STUDY Journal title Country/Countries Validity Scores	INTERVENTION Aim Setting Target population Target Disease Group(s) Target disease(s) Target Behaviour(s) for change Theory/model used	EVALUATION DESIGN Study design Sample size Sample characteristics Main outcome measures Follow-up period Analysis method	EVALUATION RESULTS Main primary outcome measures results Main secondary outcome measures results	NOTES Funding source
		variance evaluated the effectiveness of the training and intervention.		
Zerr (2005) The Pediatric Infectious Disease Journal USA **A:** 50% **B:** 50% **C:** 100% **D:** 80% **Overall:** 70%	**Intervention's aim** Hand hygiene programme to decrease to improve hand hygiene and decrease hospital-associated rotavirus infection rates. Control of communicable disease(s) **Target Disease Group(s)** Antimicrobial resistance & Healthcare-associated infections **Target disease(s)** Rotavirus infection **Theory/model** Social Cognitive Theory (Social Learning Theory)	**Study design:** Before-and-after study (with different sample after intervention) **Sample size** Total sample size: 9 multi-bed rooms in 2 wards. **Main outcome measures** Relevant primary outcomes Number of times hand hygiene was practiced when opportunities were observed to occur. Rates of hospital-associated rotavirus. **Follow-up period** 5 waves over 14 months. Baseline: October through December; period 2: February through March; period 3: August through October; period 4: December through March; period 5: September through December.	**Main primary outcome measures results** Behavioural primary outcomes Hand hygiene increased from 62% in period 1 to >80% in periods 4 and 5. Hospital-associated rotavirus decreased: 30 in 5118 cases (5.9 episodes per 1000 discharged patients) in 2001 vs. 7 of 3203 cases (2.2 per 1000 discharged patients in 2004.	**Funding source** Not stated

STUDY Journal title Country/Countries Validity Scores	INTERVENTION Aim Setting Target population Target Disease Group(s) Target disease(s) Target Behaviour(s) for change Theory/model used	EVALUATION DESIGN Study design Sample size Sample characteristics Main outcome measures Follow-up period Analysis method	EVALUATION RESULTS Main primary outcome measures results Main secondary outcome measures results	NOTES Funding source
Zimmerman (2003) American Journal of Public Health USA **A:** 50% **B:** 63% **C:** 100% **D:** 67% **Overall:** 67%	**Intervention's aim** Multi-modal interventions to increase adult immunizations within inner-city health centres. Interventions included reminders, standing orders, and walk-in 'flu shot clinics.' **Target Disease Group(s)** Respiratory tract infections Vaccine preventable diseases and invasive bacterial infections **Target disease(s)** Influenza **Theory/model** Theory of Reasoned Action	**Study design:** Before-and-after study (with same sample after intervention) **Sample size** Total sample size: 2 (health centres). 154 (patient survey) **Sample characteristics** Demographic characteristics, with the exception of race, among patients who completed the survey did not vary by site. Health Center A had a significantly higher proportion of Black respondents than did Health Center B (57% vs. 34%; P<.001). Demographic characteristics differed by age for marital status, annual household income, highest level of education completed, and employment status. Compared with patients aged 50 to 64 years (n=185), patients aged 65 years and older (n=190) were more frequently widowed (46% vs. 15%) and less frequently single (8% vs. 17%), married (28% vs. 32%), or separated/divorced (18% vs. 36%) (P<.001). Furthermore, patients aged 65 years and older reported annual household incomes less than \$20000 (75% vs. 56%; p=.009), fewer years of education (up to high school graduate, or technical or vocational school) (75% vs. 53%; P<.001), and unemployed work status (88% vs. 46%; P<.001). **Main outcome measures** Relevant primary outcomes Self-reported immunisation status. Relevant secondary outcomes Number of influenza vaccine doses administered. Rates of Influenza Vaccination From EMRs. **Follow-up period:** After flu season **Analysis method:** Chi-square tests. McNemar test. Logistic regression analyses.	**Main primary outcome measures results** Behavioural primary outcomes Self-reported immunisation rates did not change significantly between baseline and post-intervention. They did not differ over time by site. Patients aged 50-64 years showed an increasing trend in immunisation rates (40% in 2000-2001, 47% in 2001-2002, p=.08). **Main secondary outcome measures results** Behavioural secondary outcomes Number of influenza vaccine doses administered: According to vaccination log data on all patients reported by sites, the number of influenza vaccinations administered at Health Center A increased 34%, from 797 doses in 2000–2001 to 1071 in 2001–2002. At Health Center B, the doses administered increased 114%, from 350 doses in 2000–2001 to 750 in 2001–2002. Rates of Influenza Vaccination From EMRs: According to data from patient EMRs, vaccination rates at Health Center A increased from 24% in 2000–2001 to 30% in 2001–2002 among patients aged 50 to 64 years (P<.001) and from 45% in 2000–2001 to 53% in 2001–2002 among patients aged 65 years and older (P<.001).	**Funding source** The Agency for Healthcare Research and Quality.

Appendix 7. Descriptions of the health behaviour change models/theories identified in the review

Health Belief Model

The Health Belief Model [1] is a psychological model used to predict health behaviour and is one of the most widely used behavioural models within the extant literature. The model is based on four constructs of the core beliefs of individuals with regard to health behaviour and conditions, according to their perceptions.

- Perceived susceptibility – a person's view of their risk of getting the condition.
- Perceived severity – a person's view of the seriousness of the condition and the consequences.
- Perceived barriers – a person's view of the factors that facilitate or discourage adopting the promoted behaviour.
- Perceived benefits – a person's view of the positive consequences of adopting the behaviour.

In addition, constructs of mediating factors can also be added to the model including: demographics (age, gender, ethnicity), socio-psychological variables (socio-economic status, personality), perceived efficacy (ability to successfully adopt the behaviour), cues to action (external influences such as persuasive communications and personal experiences), health motivation, perceived control and perceived threat. The prediction power of the model concerns the likelihood that the person concerned will undertake the recommended health behaviour. The model has been used in youth substance misuse interventions to encourage health behaviour [2].

Theory of Reasoned Action

The Theory of Reasoned Action deals with the relationship between four main constructs: beliefs, attitudes, intentions and behaviour [3]. It assumes that to change a given behaviour requires changing the cognitive structure that underlies the behaviour. The theory has four main hypotheses:

- At the first level it is assumed that a person's behaviour is the result of their intention to perform the behaviour.
- Intention is a function of a personal factor (the person's attitude to the behaviour) and a social factor (the norm associated with the behaviour). The norm is the person's perception of what others think about the behaviour.
- Underlying the personal factor is a combination of beliefs about whether the behaviour will result in certain outcomes.
- Underlying the social factor is a complex range of beliefs about what individuals or groups think about the behaviour and the person's motivation to comply with the perceived norm.

Theory of Planned Behavior

The Theory of Planned Behavior is a psychology theory developed by Icek Ajzen as a refinement of the Theory of Reasoned Action. The Theory of Planned Behavior explores the link between attitudes and behaviour with the additional construct of perceived control. According to this theory, human behaviour is governed by three kinds of consideration: behavioural beliefs, normative beliefs and control beliefs. Consequently, behavioural beliefs produce a positive or negative attitude towards a behaviour, normative beliefs result in subjective norm, and control beliefs give rise to perceived behavioural control. A combination of attitude toward the behaviour, subjective norm, and perceived behavioural control leads to the formation of a behavioural intention [4]. Perceived behavioural control is presumed to impact behaviour directly and indirectly through behavioural intention. The more favourable a person's attitude towards a behaviour and a subjective norm, and the greater the perceived behavioural control, the greater the likelihood that the person will perform the behaviour. Given a degree of control over their behaviour, people are expected to carry out their intentions when the opportunity arises.

Integrated Behavioral Model

The Integrated Behavioral Model was developed to create a theoretical framework that combined and recognised the similarities between and the complementary nature of the key constructs making up commonly used behavioural theories applied to health. These theories include the Theory of Reasoned Action, Theory of Planned Behavior, Social Cognitive Theory, the Health Belief Model and The Transtheoretical Model [5]. The USA's National Institute of Mental Health sponsored a workshop with the primary architects of several of these theories to aid this process, and research in this area led to the eventual proposal of the Integrated Behavioral Model [6-7]. The Integrated Behavioral Model can largely be described as an extension to the Theory of Reasoned Action and the Theory of Planned Behavior. In the Integrated Behavioral Model, intention to perform the behaviour remains the most important determinant. To perform a behaviour, a person requires skills and knowledge and should experience little or no constraints from their surroundings. The behaviour should be salient to the person, and experience performing the behaviour may make it habitual. The Integrated Behavioral Model builds on previous models, by proposing differentiations within the variables relating to normative beliefs (others' expectations and others' behaviour), perceived behavioural control or personal agency (control beliefs and efficacy beliefs), perceived norms (injunctive norm and descriptive norm), and attitudes (experiential attitude and instrumental attitude). Importantly, the Integrated Behavioral Model conceptualises that these constructs are influenced by specific underlying beliefs. The Integrated Behavioral Model has been used in a number of applications such as the large, multi-site AIDS Community Demonstration Projects [8].

Transtheoretical Model/Stages of Change

According to this model behavioural change can be explained as progressing through a six-step process. These six steps or stages of change must be negotiated when trying to promote new health behaviour. The model has its roots within the health psychology discipline. The six stages of change are as follows:

- Pre-contemplation – a person is not intending to take action for the foreseeable future
- Contemplation – a person is intending to take action in the next six months
- Preparation – a person is intending to take action in the immediate future
- Action – a person has made changes to their lifestyles in the past six months
- Maintenance – a person is trying to prevent relapse to previous behaviour(s)
- Termination – a person has fully adopted the new behaviour and will not return to the old behaviour.

The concept of relapse in which people may return to an earlier stage has also been acknowledged in later iterations of the model [9].

Precaution Adoption Process Model

The Precaution Adoption Process Model is a stage theory that is designed to integrate the series of changes that can occur in relation to the factors that influence health behaviour. Advocates of stage theories have pointed out that many theories of health behaviour assume that focus on perceived costs and benefits of action apply only when an individual has been engaged by the threat and has formed beliefs about potential responses. Such theories also tend to focus on a single prediction equation. However, in real life these circumstances are not always in place. Consider the case of HIV/AIDS. Health behaviour change agents would expect to engage with people about their thoughts and experiences relating to HIV/AIDS, such as their perceived risk of coming into contact with an infected person, the effectiveness of various precautions, the social consequences of taking these precautions, what others think about the risk of HIV/AIDS, and so on. Assessing these beliefs would facilitate the understanding of why an individual is or is not engaging in risky behaviour. However, if it were 1987 when HIV/AIDS was only just emerging as a public health issue, then many people would not yet have formed firm beliefs about the issue. Given that there are different phases to people's beliefs about health and health behaviours, stage theory attempts to understand these changes by identifying the relevant variables and the way in which they combine in each stage. The Precaution Adoption Process Model is one such model that attempts to explain how a person comes to the decision to take a new precaution or ceases a risky behaviour through deliberate action. Therefore, the model applies to these types of action rather than to the gradual development of habitual patterns of behaviour, such as exercise or diet. The Precaution Adoption Process Model focuses on the psychological processes within individuals that drive people to take action. Weinstein and Sandman [10] propose the Precaution Adoption Process Model having seven stages through which an individual will go through when taking action:

- Unaware of issue
- Unengaged by issue
- Deciding about acting
- Decided not to act, or
- Decided to act
- Acting
- Maintenance.

Common Sense Model

The Common Sense Model, also known as the Illness Representations Model, the Self-Regulatory Model, the Parallel Process Model or Levanthal's Model after its founder, is a system of conscious health management. Although health professionals may offer a patient medical or health advice, the theory states that only with self-regulation will the patient properly implement that advice. Levanthal began researching how fear messages in acute situations might lead to people taking health promotion action, such as wearing seatbelts or giving up smoking [11]. He found that different forms of information were required to influence attitudes and actions relative to a perceived threat to health and wellbeing, and that these only lasted for short periods of time. Levanthal and colleagues proposed a model of an adaptive system containing three key constructs: (i) representation of the illness experience that might guide, (ii) action planning or coping responses and performance of these, and (iii) appraisal or monitoring of the success/failure of coping efforts [12]. The Common Sense Model has similarities with other theories of problem-solving behaviour such as the transactional model, discussed later on. However, an original feature of the Common Sense Model is the delineation of both how people regulate their responses to the threat of illness, and the person's regulation of emotional control over the situation. An important construct within the Common Sense Model is the concept of illness representations or beliefs about illness. These representations interact with pre-existing normative beliefs that people hold, enabling them to interpret their symptoms and guide their coping actions. In the Common Sense Model there are five constituents of these illness representations:

- Identity: Name given to a health condition and the apparent symptoms.
- Cause: Ideas about the perceived cause of the health condition, whether medically accurate or not.
- Time-line: Predictive belief about how long the health condition may last, and whether it is going to be acute or chronic.
- Consequences: Person's beliefs about the consequences of the health condition and how this will affect a person physically and socially.
- Curability/controllability: beliefs about whether the health condition can be cured or controlled and the degree to which a person plays a role in achieving this [13].

Extended Parallel Process Model

The Extended Parallel Process Model is a model of how attitudes are formed and altered when fear is used as a factor of persuasion. 'Fear appeals' have been used extensively in the public health field to attempt to frighten people into performing a desired health behaviour [14]. This is done by describing the negative outcomes if they do not obey the message. The model provides guidance on how to make fear-based appeals most effective as an attitude/behaviour change approach when an individual cares about the issue or situation. It also states that fear appeals are most effective when an individual has and knows that he/she has the ability to deal with the issue or situation in question.

When an individual is exposed to a fear appeal stimulus or message, they can seek two difference courses of action: danger control or fear control. Danger control is a process in which the individual seeks to reduce the risk presented through direct action and adaptive changes. It is outer-focused and oriented towards finding a solution. Protection motivation and response efficacy (the perception that an effective response is available) drives this process. Fear control is a process that focuses on the perception, susceptibility, and severity of risk. It is inner focused, and not oriented towards finding a solution. Instead, a maladaptive or counterproductive behaviour is invoked. This process is caused by protection motivation and self-efficacy (the perception that the individual is capable of utilising this response).

Social Cognitive Theory/Social Learning Theory

Social Cognitive Theory posits that a person's acquisition of knowledge can be related to their observation of others within the context of social interactions, experiences and outside media influences. Psychologist Albert Bandura presented Social Cognitive Theory [15] as a development of the earlier Social Learning Theory. The theory proposes that people learn by watching what others do, with environment, behaviour and cognition as key factors in influencing development. These factors are not mutually exclusive or static. According to Social Cognitive Theory, witnessing behaviour can change a person's way of thinking, the environment in which a person is brought up can influence their behaviour, and a parent's mind-set (cognition) can determine the environment in which their children are raised. Human functioning is viewed as the product of the interplay of these personal, behavioural and environmental influences. Therefore focus is placed on the reciprocal interaction between these factors. Self-efficacy theory (perceived ability to perform a behaviour) is also an important contributor to Social Cognitive Theory [16].

Transactional Model of Stress and Coping

The Transactional Model of Stress and Coping offers a framework for evaluating the processes of coping with stressful events or experiences [17]. Stressful experiences are interpreted as person-environment transactions in which the effect of an external stressor or demand is mediated by the individual's assessment of the stressor and the psychological, social and cultural resources at their disposal [18-19]. The Model proposes that when an individual is faced with a stressor, they evaluate the potential threat (primary appraisal), as well as their own ability to change the situation and manage negative emotional reactions (secondary appraisal). Actual coping efforts to manage the problem and emotional regulation give rise to the eventual outcomes of the coping process (e.g. psychological wellbeing, functional status, adherence). Recent adaptations of coping theory propose that positive psychological states should also be taken into account. Wenzel et al. [19] summarise the key concepts and definitions of the Transactional Model of Stress and Coping as follows:

- Primary appraisal: evaluation of the significance of a stressor or threatening event.
- Secondary appraisal: evaluation of the controllability of the stressor and a person's coping resources.
- Coping efforts: actual strategies used to mediate primary and secondary appraisals.
- Problem management: strategies directed at changing a stressful situation.
- Emotional regulation: strategies aimed at changing the way a person thinks or feels about a stressful situation.
- Meaning-based coping: coping processes that provoke positive emotion, which in turn supports the coping process by permitting re-enactment of problem- or emotion-focused coping.
- Outcomes of coping (adaptation): emotional well-being, functional status, health behaviour.
- Dispositional coping styles: general ways of behaving that can influence a person's emotional or functional reaction to a stressor. These are comparatively stable across time and situations.
- Optimism: tendency to have generalized positive outcome expectancies.
- Information seeking: attention styles that are vigilant (monitoring) versus those that involve avoidance (blunting).

Community Organisation

Although a gamut of new approaches and change models have been developed and adapted by health behaviour change professionals in recent years, the principles and practices loosely referred to as Community Organisation remain an important focus. Community Organisation can be defined as the process through which community groups are assisted to identify common problems or goals, mobilise resources and develop and implement strategies for achieving these goals. An important construct in Community Organisation is empowerment, explained by Rappaport [20] as an enabling process through which individuals or communities grasp control of their lives and their environment. The founder of community organising practice Murray Ross stated that Community Organisation could not be considered to have taken place unless community competence or problem-solving ability had increased during the process [21]. Key concepts in Community Organisation include:

- Empowerment: social action process for people to take control over their lives and the lives of their communities.
- Critical consciousness: a consciousness involving reflection on and action for change.
- Community capacity: community features affecting its ability to identify, mobilise, and tackle problems.
- Issue selection: identifying achievable and specific targets for change that unite and strengthen a community.
- Participation and relevance: Community Organisation that begins by focusing on where people are and engages community members as equals in the chance process (based on Minkler & Wallerstein [22]).

Diffusion of Innovations

Diffusion of Innovations is a theory of that seeks to explain the spread of new ideas; the how, why and at what rate innovations (an idea, practice, or object that is perceived as new by an individual or other unit of adoption) spread throughout societies. The concept was first examined by sociologists and anthropologists around the turn of the 20th century [23-24]. Rogers [25-26] proposed four main elements that influence the spread of a new idea: the innovation, communication channels, time and a social system. Under this model, diffusion can be described as the process by which an innovation is communicated through certain channels over a period of time among the members of a social system. Rogers identified a five-step adoption process: knowledge, persuasion, decision, implementation and confirmation. Rates at which an innovation is adopted are influenced by an individual's adopter category. Within the adoption process there is a point at which an innovation reaches critical mass, meaning that enough people have adopted it to make it self-sustaining. The characteristics of an innovation also influence the adoption process. The relative advantage offered by an innovation over previous generations, the level of compatibility offered by an innovation to ensure that it fits into someone's lifestyle, and how complex, testable and observable an innovation is can all influence an individual's decision as to whether to adopt or reject it.

PRECEDE—PROCEED

Rather than representing a theory or model in itself, PRECEDE-PROCEED is a planning tool to help guide the process of designing, implementing and evaluating health behaviour change interventions [27]. PRECEDE-PROCEED does not set out to predict or explain the relationships between factors that are associated with behavioural outcomes. Rather, it provides a framework for applying theories so that the most suitable intervention strategies can be identified and implemented. As Gielen and McDonald [28] explain, the PRECEDE-PROCEED model 'can be thought of as a road map and behaviour change theories as the specific directions to a destination'. Although originally developed for service programmes delivered in practice settings, the framework may be as useful to researchers and practitioners delivering health behaviour change programmes. Green et al. [29] first introduced the PRECEDE model, which stands for Predisposing, Reinforcing, and Enabling Constructs in Educational/Environmental Diagnosis and Evaluation. It is based upon the premise that, just as in medicine, a diagnosis precedes a treatment plan, educational diagnosis precedes an intervention plan. The model addressed some concerns that health education focused too little on the design of interventions [30]. In the early 1990s, PROCEED, which stands for Policy, Regulatory, and Organisational Constructs in Educational and Environmental Development, was added to the framework in recognition of the influence that environmental factors can have on health and health behaviour. Green and Kreuter [27] explained the PRECEDE-PROCEED model as having nine key steps as follows:

- Social assessment
- Epidemiological assessment
- Behavioural and environmental assessment
- Educational and ecological assessment
- Administrative and policy assessment
- Implementation
- Process evaluation
- Impact evaluation
- Outcome evaluation.

A key component of the PRECEDE-PROCEED model is the active participation of the intended audience in identifying their problems, goals and objectives, and in the development and implementation of solutions.

Social Ecological Model

The Social Ecological Model is a framework that examines the multiple effects and correlations of social elements in an environment. It can provide a theoretical framework to analyse various contexts and in multiple research applications – most commonly qualitative research. The most utilised version of the Social Ecological Model was developed by Bronfenbrenner [31-32], who proposed four types of nested environmental systems of influence:

- Microsystem: immediate environments (family, school, peer group neighbourhood).
- Mesosystem: a system of connections between immediate environments (such as a child's home or school).
- Exosystem: external environmental settings which only indirectly affect development (e.g. a parent's workplace).
- Macrosystem: the wider cultural context (East vs. West, national economy, political culture, sub-culture).

Later a fifth system was added:

- Chronosystem: patterns of environmental events and transitions over the course of life.

Each system of influence contains roles, norms and rules that shape psychological development. USA's Centers for Disease Control and Prevention use a four-level Social Ecological Model to identify areas for prevention activities: societal, community, relationship and individual. Each of the levels has obvious synergies with social marketing which can act in each arena [33]. The model has been used in interventions on adolescent physical activity using social marketing [34].

Behavioral Ecological Model

The Behavioral Ecological Model [35] is an extension of previous behaviour models that focus on the role and influence of selectionist and environmental factors on behaviour, such as the ecological model of health behaviour proposed by McLeroy et al [36]. The model features the integration of public health and behavioural science and places precedence on the function of behaviour, such as the consequences produced by a particular behaviour, over the type or topography of behaviour. The Behavioral Ecological Model also places emphasis on environmental influences on behaviour. The model aims to extend our understanding of populations' behaviour and culture by reliance on a hierarchy of interrelating reinforcement contingencies. These can include:

- at the social/cultural level nationality and culture-specific variables
- at the community level policy, laws and the media
- at the local level clinical services and the built and social environment, and
- at the individual level norms and physical characteristics.

The Behavioral Ecological Model assumes an interaction between physical and social contingencies to explain and control health behaviour.

SLR to examine evidence for effective interventions using theories of behaviour change to prevent communicable diseases   **TECHNICAL** REPORT

106

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