Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults


Authors' objectives
To examine the effectiveness, applicability, other effects, economic impact, and barriers to use of selected population-based interventions intended to improve vaccination coverage.

Searching
Studies published in the English language between 1980 and 1997 were sought from the following sources: MEDLINE; EMBASE; PsycLIT; CAB Health; and Sociological Abstracts. Reference lists in articles were reviewed and immunization experts were consulted. Studies that had been recommended by one or more experts as having potential to change a preliminary assessment of effectiveness were also included.

Study selection
Study designs of evaluations included in the review
Studies that compared a group of persons who had been exposed to the intervention with a group who had not been exposed or who had been less exposed were eligible if studies met the Evidence Review and Guide Chapter Development Team's definition of the interventions (see Other Publications of Related Interest no.1). Studies had to be primary studies rather than guidelines or reviews. Included studies were of the following designs: randomised controlled trials (RCTs); non randomised trials; time series; retrospective cohort studies; and before-after studies. Studies with the least suitable designs for two interventions (provider reminder/recall and client reminder/recall where the literature was most extensive) were excluded. Studies with limited execution did not qualify for the review.

Specific interventions included in the review
Studies of interventions intended to improve routine delivery of universally recommended vaccinations were eligible. Strategies that reduced exposure to vaccine-preventable disease (quarantine or outbreak control) and treatment of vaccine-preventable disease were excluded.

The following interventions were included: increasing community demand for vaccination (client reminder/recall, multicomponent interventions that include education, vaccination requirements for child care, school or college attendance, community-wide education, clinic-based education, client or family incentives, and client held medical records); enhancing access to vaccination services (reducing out-of-pocket costs, expanding access to health care settings, vaccination programmes in the Special Supplemental Nutritional Program for Women, Infants and Children Settings (WIC), home visits, and vaccination programmes in schools and child care centres); and provider-based interventions (provider reminder/recall, assessment and feedback for vaccination providers, standing orders, and provider education only). Single-component and multiple-interventions in industrialised countries were included. Recommended vaccinations included the following: measles, mumps, rubella, diphtheria-tetanus, pertussis, poliomyelitis, Haemophilus influenza type B (Hib), hepatitis B, varicella, influenza, and pneumococcal.

Participants included in the review
Adults, adolescents, and children in industrialised countries were eligible. Young children, previously unvaccinated or partially vaccinated adolescents, and adults, including those aged 65 years or older were studied. Persons with specific medical conditions or people who were at higher than usual risk of exposure to vaccine preventable diseases were excluded.

Outcomes assessed in the review
The major outcomes included attendance in health care systems, delivery of vaccinations, and vaccine-preventable disease occurrence. In children, outcomes measures were chosen among children closest to 2 years. Evidence of potential harms from interventions was sought including drop-outs. Positive and negative effects of the vaccines were
How were decisions on the relevance of primary studies made?
Methods used for selection of primary studies were described in Briss et al (see Other Publications of Related Interest no.1). The number of authors was not stated.

Assessment of study quality
Study execution was systematically assessed according to the following eight criteria: definition and selection of study and comparison population; definition and measurement of exposure and intervention; assessment of outcomes; follow-up and completion rates; bias; data analysis; confounding; and miscellaneous criteria (e.g. lack of statistical power). Studies were characterised as good (zero or one limitations), fair (two to four limitations), or limited (five or more limitations). Validity criteria were assessed using a data abstraction form and methods described in Briss et al (see Other Publications of Related Interest no.1). The number of authors who performed the assessment was not stated.

Data extraction
Two reviewers extracted the following data onto a standardised form: author and year of publication; design, category and execution; study location, setting type, population and description; interventions, comparisons and sample size; and outcomes and effect measures. Disagreements were resolved by consensus among the development team members.

Where possible, results of each study were represented as point estimate for change in vaccination coverage attributable to the intervention. Percentage point changes and baselines were calculated (formula stated). When a study presented more than one vaccination result an equally weighted average of percentage point changes was used. Studies without coverage outcomes, or for which percentage point changes were not calculable, were not included in descriptive statistics. Where possible, measures adjusted for potential confounders in multivariate analysis were used in preference to crude effect measures. In studies with multiple comparisons, each intervention group was compared with the group that received no intervention or the least intensive intervention. Further details of some studies were reported on the Internet. (See URL field below).

Methods of synthesis
How were the studies combined?
Studies of similar interventions were grouped and combined in a narrative review. Interventions were grouped according to the review authors’ definitions.

Results from individual studies were displayed in tables and figures and median and range of effect measures were reported.

How were differences between studies investigated?
The studies were grouped according to validity.

Results of the review
One hundred and eight-three qualifying studies were included.

Increasing community demand for vaccination.

1. Client reminder/recall (42 studies): strong evidence supports the effectiveness of client reminder/recall in increasing vaccination rates. Median percentage point change (31 single and 23 multicomponent intervention arms) = 12% (range -8% to -47%). Client reminder/recall only = 8% (range -7% to -31%). Part of multicomponent intervention = 16% (range -8% to -47%).

2. Multicomponent interventions that include education (17 studies): strong evidence supports the use of multicomponent interventions that include education in increasing vaccination rates. Median percentage point change (15 studies) = 16% (range -4% to 29%). Positive effects were found in clinical (median = 16%, range -4% to -25%) and
community settings (median = 12%, range 5% to -29%).

3. Vaccination requirements for child care, school or college attendance (9 studies): sufficient evidence exists to support the use vaccination requirements is effective in improving vaccination coverage and/or in reducing rates of disease. Six studies found reductions in disease rates (including measles, mumps, and Hib). Vaccination coverage (3 studies): median percentage point change = 15% (range 5% to -35%).

4. Community-wide education (one time series): there was insufficient evidence (study had limitations in design and conduct).

5. Clinic-based education only (3 studies): There was insufficient evidence.

6. Client or family incentives (3 studies): there was insufficient evidence (small number of studies, variability in interventions, inconsistent results).

7. Client held medical records (4 studies): there was insufficient evidence (small number of studies, variability in interventions, inconsistent results).

Enhancing access to vaccination services.

1. Reducing out-of-pocket costs (19 studies): strong evidence supports the effectiveness of reducing out-of-pocket expenses in increasing vaccination rates. Median percentage point change (13 studies)= 15% (range -8% to 47%). Single component interventions (5 studies): median change = 10% (range -1% to 29%). Part of multicomponent intervention (8 studies): median change = 16% (range -8% to 47%).

2. Expanding access to health care settings (16 studies): strong evidence supports expanding access, as part of a multicomponent intervention, to improve vaccination coverage among children and adults. Insufficient evidence exists on expanding access as a sole intervention. Overall median percentage change = 10% (range -8% to 35%). Expanded access only (2 intervention arms): median change (3% and 7%); only one reached statistical significance). Expanding access as part of multicomponent intervention (12 intervention arms): median change = 13% (range -8% to 35%).

3. Vaccination programmes in the Special Supplemental Nutritional Program for Women Infants and Children (WIC) Settings (4 studies): sufficient evidence exists to support interventions in WIC settings. Studies among WIC clients (3 studies): interventions of varying intensities reported improvements or significant improvement in vaccine coverage (range 4% to 34%).

4. Home visits (7 studies): sufficient evidence exists to support home-visiting interventions in improving vaccination coverage.

Overall median percentage point change = 10% (range -1% to 49%). Home-visiting only (2 studies) median change was -1% and 10%. Part of multicomponent intervention (5 studies) median change = 13% (range 2% to 20%).

5. Vaccination programmes in schools (one study): a multiple component intervention used to increase delivery of hepatitis B vaccinations to adolescents reported significant improvements in client knowledge regarding hepatitis, faster return of consent forms when incentives were used, and 66% coverage with three doses of hepatitis B vaccine after the intervention (no comparative data were available).

6. Vaccination programmes in childcare centers (no studies).

Provider-based interventions.

1. Provider reminder/recall (29 studies): strong evidence supports the effectiveness of provider reminders/recall interventions in increasing vaccination rates. Overall median percentage point change (17 single and 12 multicomponent intervention arms) = 17% (range 1% to 67%). Provider reminder/recall only = 17% (range 1% to 67%). Part of multicomponent intervention = 14% (range 1% to 36%).

2. Assessment and feedback for vaccination providers (14 studies): strong evidence supports the effectiveness
assessment and feedback in increasing vaccination rates. Generally assessment and feedback components were not described in detail. Overall median percentage point change (5 single and 8 multicomponent intervention arms)= 16% (range 1% to 43%). Assessment and feedback only: median change = 16% (range 9% to 41%). Part of multicomponent intervention = 17% (range 1% to 43%).

3. Standing orders (11 studies): Strong evidence supports the use of standing orders in improving vaccination rates in adults. Median percentage change (8 studies in adults) = 28% (range 6% to 81%). Standing orders alone: median change = 51% (range 30% to 81%). Part of multicomponent strategy: median change = 16% (range 6% to 26%).

There was insufficient evidence to assess the effectiveness of standing orders in children: only one study, which was limited in design and execution and reported effects that were not substantially greater than zero.

4. Provider education only (4 studies): there was insufficient evidence (small number of studies, limitations in designs and conduct, small effect sizes).

Cost information
An economic evaluation of effective interventions formed part of the review. Details were given of inclusion criteria.

Increasing community demand for vaccination.

1. Client reminder/recall (9 studies): adjusted cost-effectiveness ratios for single-component interventions ranged from $3 to $46 per additional vaccine (median $9) and for multicomponent interventions costs per additional vaccine included $4 (client and provider reminders), $51 (reminders and lottery-type incentive), $43 (mailed reminders and free vaccinations). Adjusted average costs (2 studies): were $0.65 and $5.75 per child.

2. Multicomponent interventions including education (two studies): adjusted estimate of average program costs was $23 per child vaccinated in one study and $7.35 in the other study.

Enhancing access to vaccination services.

1. Reducing out-of-pocket costs (one economic evaluation of free or discounted vaccinations): adjusted cost-effectiveness of multicomponent intervention compared to no intervention was $43 per additional vaccination.

2. Expanding access to health care settings (one evaluation of a multicomponent intervention): adjusted average costs was $7.65 per vaccination delivered.

3. Vaccination programmes in the Special Supplemental Nutritional Program for Women, Infants and Children Settings (two studies): adjusted average ratios ranged from $34 to $84 per fully vaccinated child, $2.65 per assessment using an on-site nurse, and $1.28 per assessment for other strategies. (WIC).

4. Home visits (4 studies): adjusted average costs in two studies were $22 per child vaccinated and $130 per vaccination. Adjusted cost-effectiveness ratios ranged from $513 to $13,020 per additional vaccination.

Provider-based interventions.

1. Provider reminder/recall (3 studies): adjusted cost-effectiveness ratios per additional vaccination were $0.70 (provider reminder only) to $4 (client and provider reminders), and $300 per fully vaccinated child (assessment of vaccination status of hospitalized child, and provider reminder).

Authors' conclusions
Taken from "Recommendations Regarding Interventions to Improve Vaccination Coverage in Children Adolescents and Adults" (see Other Publications of Related Interest no.2).

Increasing community demand for vaccination.
1. Client reminder/recall interventions are strongly recommended on the basis of strong scientific evidence that they improve vaccination coverage: in children and adults; in a range of settings and populations; when applied at different levels of scale from individual practice to entire communities; across a range of intervention characteristics; and whether used alone or as part of a multicomponent intervention.

2. Multicomponent interventions that included education are strongly recommended on the basis of strong scientific evidence that they improve vaccination coverage: in children and adults; in community-wide and clinic based settings; in a range of contexts; and have incorporated education with a variety of other activities.

3. Vaccination requirements for childcare, school, and college attendance are recommended on the basis of sufficient scientific evidence that: these requirements are effective in reducing vaccine-preventable disease and/or improving vaccination coverage; and are effective in all relevant populations.

4. Community-wide, education-only interventions: available studies provide insufficient evidence.

5. Clinic-based, education-only interventions: available studies provide insufficient evidence.

6. Client or family incentives: available studies provide insufficient evidence.

7. Client-held medical records: available studies provide insufficient evidence.

Enhancing access to vaccination services.

8. Reducing out-of-pocket costs are strongly recommended on the basis that they improve vaccination coverage: in children and adults; in a range of settings and populations; when applied at different levels of scale from individual clinical settings to national efforts; and whether used alone or as part of a multicomponent intervention.

9. Expanding access in health care settings: as part of multicomponent interventions expanding access is strongly recommended on the basis that it improves vaccination coverage in children and adults in a range of contexts. Insufficient evidence exists on the effectiveness of expanded access alone.

10. Vaccination programmes in women, infants, and children settings are recommended on the basis that they improve vaccination coverage in children whether used alone or as part of a multicomponent intervention.

11. Home visits are recommended on the basis that they improve vaccination coverage. When applied only to improve vaccination coverage, home-visiting can be highly resource intensive relative to other options.


Provider-based interventions.

14. Provider reminder/recall are strongly recommended on the basis that they improve vaccination coverage: in children, adolescents, and adults; across a range of intervention characteristics; in a range of settings and populations; and whether used alone or as part of a multicomponent intervention.

15. Assessment and feedback for vaccination providers are strongly recommended on the basis that they improve vaccination coverage: in children and adults; in a range of settings and populations; and whether used alone or as part of a multicomponent intervention.

16. Standing orders to vaccinate adults are strongly recommended on the basis that they improve vaccination coverage whether used alone or as part of a multicomponent intervention and are effective in such settings as hospitals, clinics, and nursing homes. Insufficient evidence exists regarding the effectiveness of standing orders in children.

17. Provider education only: insufficient evidence exists.
CRD commentary
The aims were stated and inclusion criteria defined in terms of study design and quality, intervention, participants, and outcome. Studies were identified from several sources and attempts were made to locate unpublished studies. By limiting included studies to those published in the English language, some other relevant studies may have been omitted. Methods used to select studies, though not described in the review itself, were described in another article for which the reference was given. A formal assessment of validity was undertaken and only higher quality studies included. Relevant details of the included studies were presented in tabular format and on a website and methods used to extract data were described. Given the heterogeneity among data, a narrative review with median and ranges of results was appropriate. Each intervention was discussed under the following headings: background and actual interventions studied; review of effectiveness evidence; review of applicability of the evidence (settings, population, and vaccinations); other positive or negative effects of the intervention; review of economic evidence; barriers to intervention implementation; and conclusion. In addition, research issues following on from a review of the evidence were discussed for each broad intervention under the following headings: applicability; other positive or negative effects; economic evaluation; and barriers.

The evidence supports the authors’ conclusions.

Implications of the review for practice and research
Practice: The authors made the following recommendations.

1. Increasing community demand for vaccination.

Client reminder/recall interventions are strongly recommended in children and adults; in a range of settings and populations; when applied at different levels of scale from individual practice to entire communities; across a range of intervention characteristics; and whether used alone or as part of a multicomponent intervention. Multicomponent interventions that include education are strongly recommended in children and adults; in community-wide and clinic based settings; in a range of contexts; and have incorporated education with a variety of other activities.

Vaccination requirements for childcare, school and college attendance are effective in reducing vaccine-preventable disease and/or improving vaccination coverage, and are effective in all relevant populations.

2. Enhancing access to vaccination services.

Reducing out-of-pocket costs are strongly recommended in children and adults; in a range of settings and populations; when applied at different levels of scale from individual clinical settings to national efforts; and whether used alone or as part of a multicomponent intervention.

Expanding access in health care settings is recommended when part of multicomponent interventions in children and adults in a range of contexts.

Vaccination programmes in women, infants and children settings are recommended in children, whether used alone or as part of a multicomponent intervention.

Home visits are recommended but are resource intensive.

3. Provider-based interventions.

Provider reminder/recall are strongly recommended in children, adolescents and adults; across a range of intervention characteristics; in a range of settings and populations; and whether used alone or as part of a multicomponent intervention.

Assessment and feedback for vaccination providers are strongly recommended in children and adults; in a range of settings and populations; and whether used alone or as part of a multicomponent intervention.

Standing orders to vaccinate adults are strongly recommended on the basis that they improve vaccination coverage.
whether used alone or as part of a multicomponent intervention, and are effective in such settings as hospitals, clinics and nursing homes.

Research: The authors report the following implications for research.

1. Increasing community demand for vaccination.

For recommended interventions (multicomponent interventions that include education, client reminder/recall and vaccination requirements) research is required into: the particular characteristics of interventions that increase demand; the contribution of the content, specificity and method of delivery, and frequency of delivery of reminder/recall interventions; the influence of cultural characteristics of clients; the relative effectiveness of reminder and recall systems; the least and most effective combinations of components in multicomponent interventions; the influence of the variability in specific requirements and enforcement in vaccinations requirements; and the part registries play in interventions.

Basic research is required into community-wide education, clinic-based education-only interventions, client or family incentives, and client held medical records.

Investigation is required into the applicability of interventions in settings and populations other than those studied (vaccination in adolescents, and different levels of scale).

Research is required into other positive or negative effects of the interventions and considerable research is required into economic evaluations of interventions.

2. Enhancing access to vaccination services.

For recommended interventions (reducing out-of-pocket expenses, expanding access in health care settings as part of multicomponent interventions, home visits and vaccination in WIC settings) research is required into factors that increase or reduce effectiveness (level of economic disadvantage; use of staged intensity of home visits; effectiveness of combinations of services in various health care settings; and the influence of the accuracy of vaccination data in WIC programmes).

Basic research is required into the effectiveness of vaccination programmes in child care centres, vaccination programmes in schools, and single-component interventions to increase access to vaccination.

Investigation is required into the applicability of interventions in settings and populations other than those studied (vaccination in adolescents and WIC interventions in rural areas).

Research is required into other positive or negative effects of the interventions and considerable research is required into economic evaluations of interventions.

3. Provider-based interventions.

For recommended interventions (provider reminder/recall, provider assessment and feedback, and standing orders) research is required into factors that increase or reduce effectiveness (characteristics of interventions that contribute to effectiveness; influence of content and delivery of provider reminder/recall; which components contribute most to effectiveness; effect of different practice settings and organisation; intermediate outcomes that contribute to effectiveness; least and most effective combinations of services; place of registries; adaptation of provider reminder systems to other services; and the relative effectiveness of reminders focused on immunizations versus reminders that rotate from one clinical preventive service to another).

Basic research is required into the effectiveness of provider education-only. Investigation is required into the applicability of interventions in settings and populations other than those studied (vaccination in adolescents, and level of scale).

Research is required into other positive or negative effects of the interventions and considerable research is required.
into economic evaluations of interventions.

**Bibliographic details**

**PubMedID**
10806982

**Other publications of related interest**

**Indexing Status**
Subject indexing assigned by NLM

**MeSH**
Adolescent; Adult; Aged; Child; Child, Preschool; Evidence-Based Medicine; Female; Humans; Immunization Programs /organization & administration; Infant; Organizational Objectives; Practice Guidelines as Topic; United States; Vaccination /utilization

**AccessionNumber**
12000000358

**Date bibliographic record published**
31/07/2001

**Date abstract record published**
31/07/2001

**Record Status**
This is a critical abstract of a systematic review that meets the criteria for inclusion on DARE. Each critical abstract contains a brief summary of the review methods, results and conclusions followed by a detailed critical assessment on the reliability of the review and the conclusions drawn.