
Methods for Conducting Systematic Reviews of Targeted Vaccination Strategies for *The Guide to Community Preventive Services*

Serigne M. Ndiaye, PhD, David P. Hopkins, MD, MPH, S. Jay Smith, PhD, Alan R. Hinman, MD, MPH, Peter A. Briss, MD, MPH, Task Force on Community Preventive Services

Overview

This paper describes the qualitative methods adopted by the Task Force on Community Preventive Services (Task Force) to evaluate the evidence on effectiveness of interventions to improve targeted vaccine coverage. The Task Force used the same three conceptual categories as in their earlier review of interventions to increase universally recommended vaccine coverage (increasing community demand, enhancing access, and provider- or system-based interventions). In the current review, the Task Force found that (1) few studies described the effects of individual interventions implemented alone, (2) most studies evaluated interventions implemented in combination, and (3) most combinations involved more than one conceptual approach. The Task Force examined the evidence of effectiveness for all possible combinations across categories. This qualitative process provided the Task Force with sufficient evidence to support a recommendation for the use of intervention combinations.

Introduction

Three vaccine-preventable diseases—influenza, pneumococcal polysaccharide infections, and hepatitis B—continue to cause a significant amount of morbidity and mortality in the United States. Objectives to improve vaccination coverage among populations at high risk are included in *Healthy People 2010*, the prevention agenda for the United States.¹ These include the goals of increasing to 60% both influenza and pneumococcal polysac-

charide vaccination coverage rates among high-risk adults, and objectives for increasing hepatitis B vaccine coverage among high-risk groups including hemodialysis patients (to 90%), men who have sex with men (to 60%), and occupationally exposed workers (to 98%). These targeted vaccination objectives are also priorities for the National Immunization Program (NIP) of the Centers for Disease Control and Prevention (CDC).

In an earlier systematic review of interventions to improve universally recommended vaccination coverage among children, adolescents, and adults,² the Task Force provided evidence-based recommendations for the use of these interventions.³ The original review, conducted for *The Guide to Community Preventive Services (Community Guide)*, included studies (published in the 1980–1997 period) of efforts to increase vaccine coverage for hepatitis B among children and adolescents, and studies of interventions to increase coverage for influenza, pneumococcal polysaccharide vaccines, or both, for adults aged ≥ 65 .

NIP initiated an expansion of the original *Community Guide* review to investigate the evidence on effectiveness of interventions to increase targeted vaccination coverage among high-risk populations. This expanded systematic review adopted the methods developed for the *Community Guide*.² The Task Force conducted the final review of the evidence and issued recommendations based on established criteria.

The *Community Guide's* methods for conducting systematic reviews and for linking evidence to recommendations have been described elsewhere.⁴ This report briefly describes the methods adopted for the *Community Guide* review of targeted vaccination strategies. In addition, it details the process developed by the Task Force for translating the identified evidence on effectiveness of multicomponent interventions into a menu format recommendation.

Process

This systematic review of interventions to increase targeted vaccination coverage adhered to the estab-

From the National Immunization Program, Centers for Disease Control and Prevention (Ndiaye), and Division of Prevention Research and Analytic Methods, Epidemiology Program Office (Hopkins, Briss, Smith), Centers for Disease Control and Prevention, Atlanta, Georgia; and Task Force for Child Survival and Development (Hinman), Atlanta, Georgia

The names and affiliations of the Task Force members are listed at the front of this supplement and at www.thecommunityguide.org.

Address correspondence and reprint requests to: David P. Hopkins, Community Guide Branch, Centers for Disease Control and Prevention, 4770 Buford Highway, MS K-95, Chamblee, GA 30341. E-mail: DHopkins@cdc.gov.

lished format for *Community Guide* reviews.² In brief, the process of this review involved:

- Recruiting a panel of experts to participate in the development of the chapter contents
- Adopting the original conceptual approach to the topic
- Selecting the interventions (same as those in the review of universally recommended vaccinations)
- Searching for and retrieving published evidence
- Assessing the quality and summarizing the body of evidence on effectiveness
- Translating the body of evidence on effectiveness into conclusions
- Evaluating the data on applicability, other positive and negative effects, economic efficiency, and barriers to implementation
- Identifying and summarizing research gaps

The following sections provide a brief description of the specific methods employed in the reviews of selected targeted vaccination strategies.

Systematic Review Development Team

Three groups of experts served on the systematic review development team (the team).

The coordination team consisted of the primary investigators representing NIP, the *Community Guide* researchers, and selected members of the Task Force. The coordination team organized the systematic review and presented the review findings to the full Task Force.

The consultation team included experts in vaccine-preventable diseases and vaccination programs from academic and research organizations, federal agencies, and state and local public health departments. Consultants provided comments and feedback on the goals and conduct of the systematic review and on the summary conclusions.

The abstraction team collected and recorded data from studies identified in the systematic search and screening process. Each study was evaluated by at least two abstractors. For this review, the abstraction team included members of the coordination team.

Conceptual Approach

For our review we adopted the same conceptual approach and logic framework used in the initial vaccine-preventable disease (VPD) review by the *Community Guide*, published in 2000.² The logic framework is provided in the accompanying evidence review.⁵ As in the initial review, we focused on three categories of interventions:

- Interventions to increase community or client demand for vaccination

- Interventions to enhance access to vaccine and to vaccination services
- Interventions directed at healthcare providers and healthcare systems (provider- or system-based interventions)

As detailed below, these three conceptual categories of interventions provided a framework for evaluating the evidence on effectiveness identified in this review.

Interventions Selected for Review

The team decided to review the same interventions selected for the earlier review of strategies to increase coverage for universally recommended vaccines. In the course of this review, the team identified three additional strategies relevant or potentially relevant to targeted vaccination efforts. These strategies are described here for informational purposes, but the team did not conduct a formal systematic review of the following:

The use of a designated staff person to administer vaccinations to people in the target populations (e.g., assigning infection control nurses to conduct annual influenza vaccination programs for hospital staff). In this review, assigning designated staff was considered one option for implementing the standing orders intervention.

Vaccination requirements for employment. Our review included a search for evidence on effectiveness of vaccination laws and vaccination requirements (laws and policies) for child care, school, and college attendance. In the United States, current Occupational Safety and Health Administration (OSHA) standards mandate that employers offer, at no cost to the employee, the hepatitis B vaccination series to any employee for whom exposure to blood or other potentially infectious materials might be reasonably anticipated.⁶ Employees may opt to decline. We elected not to evaluate the evidence on effectiveness of the current OSHA policy, although historical evidence suggests that this policy (along with recommendations for vaccination) has been an effective component of an overall effort to reduce hepatitis B transmission among healthcare workers.⁷

Vaccination in non-healthcare settings. Vaccinations delivered outside of medical or public health clinical settings were considered in the review of interventions to increase coverage for universally recommended vaccines. The settings (Special Supplemental Nutrition Program for Women, Infants, and Children [WIC] settings, home visits, schools, child care centers), however, were less relevant to targeted vaccination efforts for adults. Although the team considered interventions in non-healthcare settings (e.g., street- or shelter-based vaccination programs for hepatitis B), we identified no studies of these interventions in our search.

Search for Evidence

We used several search strategies to identify published studies of interventions. These strategies included a systematic search of multiple databases, reviews of reference lists of published studies, and consultation with experts. Our search of 12 computerized databases (MEDLINE, EMBASE, PsychLit, Sociological Abstracts, CABHealth, HealthSTAR, AIDSLINE, Occupational Safety and Health Database, Educational Research Index [ERIC], PsycINFO, Dissertation Abstracts, and Conference Papers Index) yielded 2461 titles and abstracts for screening.

Studies were eligible for inclusion if they were published between 1980 and August of 2001; were primary studies, not guidelines or reviews; included a comparison to an unexposed or less-exposed population; were conducted in an established market economy^a; were written in English; measured differences or changes in vaccination coverage; were studies of influenza, pneumococcal polysaccharide, or hepatitis B vaccines; and were studies of populations that either focused on or included individuals aged <65 years and at high risk for infection, morbidity, or mortality.

Evaluating and Summarizing the Studies

Effectiveness. Two abstractors using a standardized abstraction form (available at: www.thecommunityguide.org/methods/abstractionform.pdf) evaluated every eligible study. Information was abstracted, and each study was assessed on the basis of the suitability of design and threats to validity (quality of execution). Differences between reviewers were resolved by consensus of the team. On the basis of the number of threats to validity, studies were characterized as having good, fair, or limited quality of execution. Studies with limited quality of execution were not included in the summary of the effect of the intervention. For this review, studies of least-suitable design (simple before-and-after comparisons, cross-sectional surveys, and post-only designs) were also excluded from further analysis. The remaining studies (i.e., those with greatest or moderate design suitability and a good or fair quality of execution) were considered “qualifying studies.” Qualifying studies were included in the body of evidence for the subsequent assessment and summary of effectiveness of the intervention.

For this review, effectiveness of an intervention was based primarily on the reported measurements of differences or changes in vaccination coverage. In

studies with a concurrent comparison group(s), the overall change in vaccination coverage was calculated using the difference between the changes in vaccination coverage observed in the intervention and comparison groups. In time series studies, the absolute percentage point change over time was derived instead.

For studies with before-and-after measurements and concurrent comparison groups, where baseline = I_{pre} :

$$(I_{post} - I_{pre}) - (C_{post} - C_{pre})$$

For studies with post-only coverage measurements and concurrent comparison groups, where baseline = C_{post} :

$$I_{post} - C_{post}$$

For studies with before-and-after measurements but no concurrent comparison, where baseline = I_{pre} :

$$I_{post} - I_{pre}$$

These variables are defined as follows:

I_{post} = last reported coverage in the intervention group after the intervention.

I_{pre} = reported coverage in the intervention group immediately before the intervention.

C_{post} = last reported coverage in the comparison group after the intervention.

C_{pre} = reported coverage in the comparison group immediately before the intervention.

Once measures of effectiveness were confirmed or determined for individual studies, an overall median was calculated across the qualifying body of evidence as the summary effect measure for the vaccination coverage outcome.

Bodies of evidence of effectiveness were characterized as strong, sufficient, or insufficient on the basis of the number of studies, suitability of study designs for evaluating effectiveness, quality of study execution, consistency of results, and determination of a sufficient median effect size.²

Applicability. Information is provided on the applicability to various populations of each recommended intervention on the basis of the range of settings, providers, and target populations identified in the qualifying studies. Conclusions about applicability of an intervention require both an assessment of gaps (if any) in the qualifying studies and general agreement within the team and the Task Force.

Other positive and negative effects. The team collected additional information on other health or non-health effects of interventions. We summarized any evidence of additional potential benefits or harms of the interventions reviewed. In some cases, other potential effects of the intervention were described in literature not reporting intervention studies or in discussions among the members of the team. Information on other

^aEstablished market economies as defined by the World Bank are Andorra, Australia, Austria, Belgium, Bermuda, Canada, Channel Islands, Denmark, Faeroe Islands, Finland, France, Germany, Gibraltar, Greece, Greenland, Holy See, Iceland, Ireland, Isle of Man, Italy, Japan, Liechtenstein, Luxembourg, Monaco, the Netherlands, New Zealand, Norway, Portugal, San Marino, Spain, St. Pierre and Miquelon, Sweden, Switzerland, the United Kingdom, and the United States.

Table 1. Intervention combinations evaluated in studies qualifying for review of multicomponent strategies to increase targeted vaccination coverage ($n = 26$ study arms from 23 studies)

Study (year) ^{ref}	Interventions to increase demand			Provider- or system-based interventions				Interventions to enhance access	
	Client education	Client reminders	Client incentives	Standing orders	Provider reminders	Provider feedback	Provider education	Expanded access in healthcare settings	Reducing out-of-pocket costs
Baker (1998) ¹²	X	X						X	
Barton (1990) ¹⁹		X			X	X			
Becker (1989) ¹⁰		X			X				
Brimberry (1988) ²⁰		X						X	
Carter (1986) ¹³	X	X						X	
Coyne (2000) ²¹	X					X	X		
Fedson (1996) ²²				X				X	X
Harbarth (1998) ¹⁴	X	X						X	X
Hogg (1998) ²⁹ (two arms)	X				X				X
Jans (2000) ¹⁷		X			X				X
Klein (1986) ³⁰	X			X			X	X	
Landis (1995) ²³				X					X
Larson (1982) ¹⁸	X	X							
Moran (1996) ¹⁵ (three arms)	X	X	X					X	X
	X	X	X					X	X
Nichol (1990) ³¹	X	X		X	X			X	
Nichol (1998) ³²	X			X				X	
Overhage (1996) ²⁴					X			X	
Sellors (1997) ²⁵		X							X
Spaulding (1991) ²⁶		X						X	X
Thomas (1993) ²⁷	X							X	X
Turner (1990) ¹¹		X			X				
van Essen (1997) ²⁸	X					X	X		
Yassi (1993) ¹⁶	X	X						X	X
Totals (arms)	14	16	2	5	7	4	4	15	12

effects identified in the original vaccine review² was duplicated in this review.

Economic efficiency. Methods for conducting economic evaluations for the *Community Guide* have been described in detail in print⁸ and are available at the website www.thecommunityguide.org/methods/default.htm. For this review, the team identified no qualifying studies on the recommended interventions or intervention combinations that provided economic data.

Barriers to intervention implementation. Although information about barriers to intervention implementation did not affect conclusions on the evidence on effectiveness, our reports provide information identified in the review or in discussions among members of the team. Information on barriers presented in the original VPD report² was duplicated in this review for the appropriate interventions.

Translating Strength of Evidence into Recommendations

The Task Force recommendations presented in the accompanying article⁹ are based on the strength of the evidence of effectiveness as determined by the systematic review. For example, an intervention was recommended when sufficient or strong evidence of effectiveness was found. A finding of insufficient evidence to determine effectiveness indicates that not enough evidence was available to determine whether or not an intervention works; it should not be seen as evidence of ineffectiveness. A finding of insufficient evidence is important for identifying areas of uncertainty that require additional research.

Summarizing Research Gaps

In addition to providing scientific information on which to base public health decisions about implementing inter-

Table 2. Strength of evidence on effectiveness for multicomponent interventions to increase targeted vaccination coverage, organized by intervention review ($n = 28$ measurements from 26 study arms from 23 qualifying studies)

Category	Multicomponent intervention (all combinations including named intervention)	Study arms (measurements)	Median difference in vaccination coverage (range)	Conclusion: evidence on effectiveness
Interventions to increase client or community demand	Client education plus other interventions	14 (15)	+14 pct points (−5.9, +67)	Strong
	Client reminders plus other interventions	16 (18)	+14 pct points (−2, +28.9)	Strong
	Client incentives plus other interventions	2 (2)	+15.5 pct points (+14, +17)	Insufficient evidence to determine effectiveness
	Community-wide education plus other interventions	0	NA	Insufficient evidence to determine effectiveness
Provider- or system-based interventions	Standing orders plus other interventions	5 (6)	+29.7 pct points (+17.2, +67)	Strong
	Provider reminders plus other interventions, stratified by vaccine type:	7 (9)	+2.6 pct points (−5.9, +28.9)	
	Influenza	(6)	+16.1 pct points (−0.5, +28.9)	Sufficient (influenza)
	Pneumococcal	(3)	−0.5 pct points (−2, +0.8)	Insufficient (pneumococcal)
	Provider assessment and feedback plus other interventions	4 (4)	+7.3 pct points (+1.1, +28.9)	Sufficient
	Provider education plus other interventions	4 (4)	+3.7 pct points (+1.1, +11)	Insufficient evidence to determine effectiveness
Interventions to enhance access	Expanded access in healthcare settings plus other interventions	15 (16)	+16.1 pct points (−0.5, +67)	Strong
	Reducing out-of-pocket costs to client plus other interventions	12 (12)	+16.5 pct points (−5.9, +46)	Strong

Note: Individual multicomponent studies contributed to two or more intervention reviews and conclusions on effectiveness. NA, not applicable; pct, percentage.

ventions, an important benefit of systematic reviews is to identify areas in which information is lacking or of poor quality. To summarize these research gaps, remaining research questions for each intervention were identified.

Methods for Assessment of Interventions Implemented in Combination

Systematic reviews conducted for the *Community Guide* attempt to distinguish between the evidence on effectiveness of an intervention when implemented alone (single-component interventions) and the evidence on effectiveness of the intervention when implemented in combination with other interventions (multicomponent interventions). The following section and accompanying tables describe the qualitative methods developed by the team in an effort to translate the multicomponent body of

evidence on effectiveness into recommendations from the Task Force.

A total of 35 studies qualified for inclusion in the assessment of effectiveness. Twelve studies evaluated the effectiveness of any intervention when implemented alone. Only one single-component intervention—provider reminder systems—had sufficient evidence to support a Task Force conclusion on effectiveness and recommendation for use. Most of the qualifying studies (23 of 35 studies) evaluated the effectiveness of interventions when implemented in combination.

Table 1 summarizes the interventions and the intervention combinations evaluated in the 23 qualifying multicomponent studies. The median number of interventions combined in the qualifying studies was three (range, two to five interventions). The most common interventions implemented in combination were clinic-

Table 3. Combinations across conceptual categories of interventions evaluated in qualifying multicomponent studies

Study (year) ^{ref}	Interventions to increase client or community demand (client education, client reminders)	Provider- or system-based interventions (standing orders, provider reminders, provider feedback, provider education)	Interventions to enhance access (expanded access, reducing out-of-pocket costs)	Total categories
Baker (1998) ¹²	2		1	2
Barton (1990) ¹⁹	1	2		2
Becker (1989) ¹⁰	1	1		2
Brimberry (1988) ²⁰	1		1	2
Carter (1986) ¹³	2		1	2
Coyne (2000) ²¹	1	2		2
Fedson (1996) ²²		1	2	2
Harbarth (1998) ¹⁴	2		2	2
Hogg (1998) ²⁹	1	1	1	3
(two arms)	1	1	1	3
Jans (2000) ¹⁷		2		1
Klein (1986) ³⁰	1	2	1	3
Landis (1995) ²³		1	1	2
Larson (1982) ¹⁸	2			1
Moran (1996) ¹⁵	2		2	2
(three arms)	2		2	2
	3		2	2
Nichol (1990) ³¹	2	2	1	3
Nichol (1998) ³²	1	1	1	3
Overhage (1996) ²⁴		1	1	2
Sellors (1997) ²⁵	1		1	2
Spaulding (1991) ²⁶	1		2	2
Thomas (1993) ²⁷	1		2	2
Turner (1990) ¹¹	1	1		2
van Essen (1997) ²⁸	1	2		2
Yassi (1993) ¹⁶	2		2	2
Study totals	19	13	16	

based client education (13 arms from 12 studies); client reminders (16 arms from 14 studies); and expanded access in healthcare settings (15 arms from 13 studies).

Of the 23 qualifying studies, 16 evaluated unique combinations of interventions and 7 studies evaluated one of three specific combinations. Two studies evaluated the combination of client reminders and provider reminders.^{10,11} Two studies evaluated the combination of clinic-based client education, client reminders, and expanded access in healthcare settings.^{12,13} Three studies evaluated a four-intervention combination of clinic-based client education, client reminders, expanded access in healthcare settings, and reduced client out-of-pocket cost.^{14–16} Overall, the qualifying studies of multicomponent interventions consisted of unique but overlapping combinations of interventions; subsets of specific combinations accounted for only a small portion of the available evidence. Because of this large body of evidence of various intervention combinations, we wanted to adopt an approach that best reflected published evidence on effectiveness. We therefore developed a way of organizing the evidence by categorizing the studies across broader categories.

Table 2 summarizes the body of evidence in the format adopted for the previous review of interventions to increase coverage for universally recommended vaccines. Each multicomponent intervention is evaluated

separately using all of the available evidence. For example, the body of evidence for client reminders when implemented with any other intervention(s) consisted of 16 study arms with a median difference in vaccination coverage of +14 percentage points (range, –2 to +28.9). Organized for assessment in this format, the evidence on effectiveness would be considered strong, thereby supporting a recommendation for use from the Task Force.

The team expressed two concerns about using the format presented in Table 2 for the review of interventions to increase targeted vaccination coverage. First, the overlapping combinations of interventions evaluated in the qualifying studies suggest a larger body of evidence on effectiveness than is the case because individual study arms contribute to more than one (a median of three) multicomponent intervention conclusions. More importantly, the team observed that effective intervention combinations described in the qualifying studies were combined not randomly but across conceptual approaches to vaccination delivery. To capture these conceptual combinations in the final assessment on effectiveness, the team conducted some additional analyses of the body of evidence.

Table 3 presents the second step in our review of the qualifying multicomponent studies. In this table, individual interventions are organized into three concep-

tual categories of vaccination delivery (interventions to increase client or community demand, provider- or system-based interventions, and interventions to enhance access). Both the conceptual categories and the interventions in each category were established in the review of interventions to increase coverage for universally recommended vaccines.² A total of 19 studies, for example, evaluated a multicomponent intervention that included at least one intervention to increase client or community demand; 13 studies included at least one provider- or system-based intervention; and 16 studies included at least one intervention to enhance access.

Table 3 also demonstrates that virtually all studies within the body of evidence considered combinations of interventions across conceptual categories. Only 2 of 23 qualifying studies evaluated interventions combined within a single category^{17,18}; 17 studies evaluated interventions combined across two of the three conceptual categories;^{10–16,19–28} and 4 studies evaluated interventions combined across all three categories.^{29–32}

Table 4 presents the qualifying studies rearranged into common combinations across categories. For example, five studies evaluated interventions combined across the categories of increasing client or community demand and provider- or system-based interventions.^{10,11,19,21,28} These five studies (evaluating a median of three interventions) reported a median improvement in vaccination coverage of 3.7 percentage points (range, –2 to +28.9). Nine studies with 11 study arms evaluated interventions (median of three) combined across the categories of client or community demand and enhancing access with a median improvement in vaccination coverage of 14 percentage points (range, 3.1 to 46).^{12–16,20,25–27} Three studies evaluated interventions combined across the categories of provider- or system-based interventions and enhancing access with a median difference in vaccination coverage of +27.8 percentage points (range, –0.5 to +31).^{22–24} Finally, four studies with five study arms evaluated interventions (median of 3.5) combined across all three categories,^{29–32} showing a median improvement in vaccination coverage of 22.8 percentage points (range, –5.9 to +67).

Translation: A Menu Format Recommendation

Translating the multicomponent evidence on effectiveness into specific recommendations for use involved some additional methods discussions and decisions by the team and the Task Force. These methods decisions included determining the evidence basis for a category-based conclusion and the inclusion criteria for intervention options within a menu format recommendation.

As described in the accompanying article,⁵ conclusions were based on the evidence of effectiveness

reported in the 16 multicomponent studies (with 19 study arms) that included one or more interventions to enhance access to vaccination services. The evidence was considered insufficient for determining the effectiveness of interventions combined within a single category due to the small number of studies ($n=2$). Evidence was also considered insufficient for an assessment of interventions combined across the client or community demand and provider- or system-based categories due to inconsistent and small magnitudes of effect reported in the five qualifying studies. The Task Force recommendation supports the combination of interventions across two or three categories including one or two interventions to enhance access to vaccination services.

The category-based conclusions capture the evidence on effectiveness of combining interventions from one category of vaccination delivery with those from one or both of the other two categories. The menu presented in Table 5 provides a useful format for creating specific intervention combinations across the categories.

In developing the menu format, the team and the Task Force relied in part on the organization of evidence on effectiveness of multicomponent interventions as conducted in the initial review² and presented in Table 2. Specific interventions that were components of effective intervention combinations (those with sufficient or strong evidence of effectiveness) were included as category options in the menu-format recommendations as presented in Table 5. Interventions with insufficient evidence to determine effectiveness as organized in Table 2 (i.e., client incentives, community-wide education, provider education) were not included as category options in the menu format recommendations.

The Task Force included provider reminder systems as an intervention option within the menu format despite inconsistent evidence on effectiveness because (1) there was strong evidence on effectiveness of provider reminders when implemented alone;⁵ and (2) although effectiveness varied by vaccination type, evidence on effectiveness was sufficient for increasing targeted vaccination coverage for influenza.

Strengths and Limitations in a Category-Based Review and Menu Format Recommendation

The qualitative methods adopted for the *Community Guide* review of multicomponent interventions to increase targeted vaccination coverage have both limitations and strengths. Adoption of these methods and decision steps was precipitated by the small number of qualifying studies providing evidence on effectiveness of single-component interventions (interventions when implemented alone). Studies evaluating the effectiveness of each of these interventions, both alone and as part of multicomponent interventions, would provide a

Table 4. Combinations of intervention categories and differences in targeted vaccination coverage observed in qualifying studies

Study (year) ^{ref}	Interventions to increase client or community demand	Provider- or system-based interventions	Interventions to enhance access	Interventions across all categories	Percentage point difference in vaccination coverage (vaccine)	Median change (percentage points)
Studies evaluating interventions combined within a single category: community demand						
Larson (1982) ¹⁸	2			2	+13.6 (I)	+13.6
Studies evaluating interventions combined within a single category: provider- or system-based						
Jans (2000) ¹⁷		2		2	+11 (I)	+11
Studies evaluating interventions combined across two conceptual categories: community demand + provider- or system-based						
Barton (1990) ¹⁹	1	2		3	+28.9 (I)	
Becker (1989) ¹⁰	1	1		2	+16.1 (I)	
					+0.8 (P)	+3.7 (range: -2, +28.9)
Coyne (2000) ²¹	1	2		3	+3.7 (HB)	
Turner (1990) ¹¹	1	1		2	+18 (I)	
					-2 (P)	
van Essen (1997) ²⁸	1	2		3	+1.1 (I)	
Studies evaluating interventions combined across two conceptual categories: client or community demand + enhanced access						
Baker (1998) ¹²	2		1	3	+3.1 (I)	
Brimberry (1998) ²⁰	1		1	2	+5.5 (I)	
Carter (1986) ¹³	2		1	3	+13 (I)	
Harbarth (1998) ¹⁴	2		2	4	+10 (I)	+14 (range: +3.1, +46)
Moran (1996) ¹⁵	2		2	4	+14 (I)	
(three arms)	2			4	+14 (I)	
	3			5	+17 (I)	
Sellors (1997) ²⁵	1		1	2	+23 (HB)	
Spaulding (1991) ²⁶	1		2	3	+16.1 (I)	
Thomas (1993) ²⁷	1		2	3	+46 (I)	
Yassi (1993) ¹⁶	2		2	4	+19.6 (HB)	
Studies evaluating interventions combined across two conceptual categories: provider- or system-based + enhanced access						
Fedson (1996) ²²		1	2	3	+31 (I)	
Landis (1995) ²³		1	1	2	+27.8 (P)	+27.8 (range: -0.5, +31)
Overhage (1996) ²⁴		1	1	2	-0.5 (P)	
Studies evaluating interventions combined across three conceptual categories: client or community demand + provider- or system-based + enhanced access						
Nichol (1990) ³¹	2	2	1	5	+28.4 (I)	
Nichol (1998) ³²	1	1	1	3	+17.2 (I)	
					+32.1 (P)	+22.8 (range: -5.9, +67)
Hogg (1998) ²⁹	1	1	1	3	-5.9 (I)	
(two arms)	1	1	1	3	+2.6 (I)	
Klein (1986) ³⁰	1	2	1	4	+67 (P)	

HB, hepatitis B; I, influenza; P, pneumococcal polysaccharide.

Table 5. Menu format of intervention combinations recommended for use by Task Force on Community Preventive Services. The Task Force recommends one or more interventions to enhance access to vaccination services combined or coordinated with one or more provider- or system-based interventions and/or one or more interventions to increase client or community demand for vaccination services on the basis of strong evidence of effectiveness in increasing targeted vaccination coverage.

Interventions to enhance access to vaccination services	Provider- or system-based interventions	Interventions to increase client or community demand for vaccination services
Expanded access in healthcare settings	Standing orders	Client reminder systems
Reducing client out-of-pocket costs	Provider reminder systems	Client education
	Provider assessment and feedback	

more complete assessment of their effectiveness, including their relative contributions in a combined effort.

Several limitations are worth noting. First, the conclusions of this review did not explicitly control for the total number of interventions implemented. The information summarized in Table 6 suggests that, in general, the magnitude of the effect size for intervention combinations increased with the total number of interventions. Because few multicomponent studies evaluated combinations of interventions within a single category, the available evidence was inadequate to distinguish whether increases in magnitude of effect were due solely to the number of interventions or to combination across conceptual categories. Since *Community Guide* reviews only evaluate and describe available evidence, these Task Force conclusions appropriately reflect the predominance of studies evaluating interventions combined across conceptual categories. In addition, *Community Guide* reviews, in general, do not distinguish between differences in the magnitude of effect beyond determining an effect size sufficient to support a conclusion on effectiveness.

Second, our conclusions reflect both the available evidence (studies) and our decisions about the assignment of specific interventions to conceptual categories. Although we adopted the same organization of interventions into categories as described in the original *Community Guide* review,² some interventions, arguably, could have been assigned differently. Standing orders, for example, is evaluated in this review within the

conceptual category of provider-based interventions, although it might also be considered an intervention to enhance access to vaccination services. In addition, the conceptual categories include some fundamentally different interventions. The category of enhancing access to vaccination services, for example, includes two very different approaches (reducing client out-of-pocket costs and expanding access in healthcare settings). In this review, the evidence was organized to permit an evaluation of the contribution of interventions to enhance access (in general) to an effective multicomponent effort, but we do not draw a distinction between these two specific intervention options.

Third, the menu format provides recommendations in support of potential intervention combinations not evaluated in the qualifying studies. The total number of intervention combinations described in the qualifying multicomponent studies was 22 (19 unique combinations plus three combinations with more than one qualifying study). The menu format potentially provides a recommendation in support of a total of 92 possible combinations (two to seven interventions across two to three categories, including at least one intervention to enhance access). In the absence of sufficient information on the effectiveness of the intervention options when implemented alone, the menu format recommendations represent the exercise of some judgment from the Task Force. Rather than creating combinations from the menu, readers can opt to duplicate the specific intervention combinations described in the qualifying studies (summarized in Table 1 and in the accompanying reviews).⁵

The methods developed for this review also include a number of strengths. First, as noted above, the conclusions from this review capture the evidence on effectiveness of interventions combined across conceptual categories. Second, individual studies were considered only once in the overall assessment. Third, Task Force conclusions represent the findings of the majority of the qualifying evidence on the effectiveness of intervention combinations. Finally, recommendations in a menu format provide a flexible list of intervention options for local consideration and application.

The methods developed for this review also expand the options available to the Task Force for translating conclusions on effectiveness into recommendations for

Table 6. Total number of interventions and median difference in vaccination coverage for qualifying multicomponent studies ($n = 28$ measurements from 26 study arms from 23 studies)

Total interventions (all combinations)	Study arms	Median difference in vaccination coverage (range)
2	10	+12.3 percentage points (-2, +27.7)
3	12	+14.6 percentage points (-5.9, +46)
4	5	+14 percentage points (+10, +67)
5	2	+22.7 percentage points (+17, +28.4)

use. Evidence on effectiveness for a number of other *Community Guide* reviews is similarly dominated by studies evaluating multicomponent interventions. The additional qualitative methods developed in this summary may assist future reviewers in representing the conceptual organization and application of interventions when implemented in combination to address a variety of public health and health promotion efforts.

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