

## Chapter 6

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# Vaccine-Preventable Diseases

In this chapter, we report on the effectiveness of interventions to increase the use of both *universally recommended* and *targeted* vaccines. As the name implies, universally recommended vaccines are those that should be administered to all people in a given age group, whereas targeted vaccines are those given to specific groups because of factors that make those groups particularly susceptible to a disease. Note that it is not actually the vaccines themselves that change, but rather their indicated use. For example, the influenza vaccine is *universally recommended* for all people over 50 years of age and is also *targeted* to people under 50 who have specific health problems. Interventions and policies to promote targeted vaccines are likely to be much more complex than similar interventions to promote universally recommended vaccines. For example, programs to improve coverage with universally recommended vaccines might need no more information about the target population than age, whereas programs to promote targeted vaccines might require information on age, risk factors, and vaccination history. Therefore, although the distinction between universally recommended and targeted vaccines is not clear, we have discussed these issues separately in Sections I and II, respectively. (The term *vaccination coverage* refers to the proportion of people who have received a particular vaccination.)

### SECTION I: UNIVERSALLY RECOMMENDED VACCINATIONS

#### Increasing Community Demand for Vaccinations

##### RECOMMENDED INTERVENTIONS

*Client Reminder and Recall Systems* 231

*Multicomponent Interventions That Include Education* 233

*Vaccination Requirements for Child Care, School, and College Attendance* 236

The Task Force approved the recommendations in this chapter for universally recommended vaccines in 1997–1998. The research on which the findings are based was conducted from 1980 to 1997. The recommendations in Section I of this chapter have been previously published in the *American Journal of Preventive Medicine* [2000;18(1S):92–96 and 97–140] and the *MMWR Recommendations and Reports* series [1999; 48(No. RR-8):1–15].

In 2001, based on seven additional studies published between 1995 and 2000, the Task Force updated the finding for vaccination programs in schools from “Insufficient evidence to determine effectiveness” to “Recommended with sufficient evidence of effectiveness.”

Some of the background information included in the chapter has been updated since the original publications.

## INSUFFICIENT EVIDENCE TO DETERMINE EFFECTIVENESS OF THE INTERVENTION\*

*Community-Wide Education When Used Alone* 238*Clinic-Based Education When Used Alone* 239*Client or Family Incentives* 240*Client-Held Medical Records* 241

## Enhancing Access to Vaccination Services

## RECOMMENDED INTERVENTIONS

*Reducing Out-of-Pocket Costs* 242*Expanding Access in Healthcare Settings  
as Part of a Multicomponent Intervention* 244*Vaccination Programs in Women, Infants, and Children (WIC) Settings* 247*Vaccination Programs in Schools* 249*Home Visits* 252

## INSUFFICIENT EVIDENCE TO DETERMINE EFFECTIVENESS OF THE INTERVENTION\*

*Expanding Access in Healthcare Settings When Used Alone* 244*Vaccination Programs in Child Care Centers* 251

## Provider- or System-Based Interventions

## RECOMMENDED INTERVENTIONS

*Provider Reminder and Recall Systems* 254*Assessment Plus Feedback for Vaccination Providers* 256*Standing Orders for Adults* 259

## INSUFFICIENT EVIDENCE TO DETERMINE EFFECTIVENESS OF THE INTERVENTION\*

*Provider Education Only* 258*Standing Orders for Children* 259**SECTION II: TARGETED VACCINES: IMPROVING TARGETED  
INFLUENZA, PNEUMOCOCCAL POLYSACCHARIDE, AND  
HEPATITIS B VACCINATION COVERAGE AMONG HIGH-RISK ADULTS**

## Increasing Community Demand for Targeted Vaccinations

## INSUFFICIENT EVIDENCE TO DETERMINE EFFECTIVENESS OF THE INTERVENTION\*

*Clinic-Based Client Education When Used Alone* 266*Client Reminder Systems When Used Alone<sup>†</sup>* 267*Community-Wide Education When Used Alone* 268

\*Insufficient evidence means that we were not able to determine whether or not the intervention works.

<sup>†</sup>This intervention is recommended to increase coverage with universally recommended vaccines. See Section I of this chapter for complete information.

The Task Force approved the recommendations in this chapter for targeted vaccines in 2002. The research on which the findings are based was conducted from 1980 to 2001. This information is being prepared for publication, and more information will be available at [www.thecommunityguide.org](http://www.thecommunityguide.org) as it becomes available.

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<i>Plus</i>	
<i>At Least One Provider- or System-Based Intervention and/or</i>	
<i>At Least One Intervention to Increase Community Demand for Vaccination Services</i>	

In the first section of this chapter we review approaches to increasing coverage of universally recommended vaccines (those that should be administered to all people in a given age group). In the second section, we look at targeted vaccinations, those given to specific groups with factors that make them particularly susceptible to a disease (*at-risk* or *high-risk* populations). We present these separately because interventions and policies to improve targeted vaccination coverage may be more complex than similar interventions and policies for universally recommended vaccines for a number of reasons. For example, it may be more difficult to identify the people who should receive targeted vaccines and to determine whether they have been previously vaccinated.

Vaccine-preventable diseases are still major causes of illness and death for people of all ages in the United States.<sup>1</sup> Despite great successes in the use of vaccines to prevent childhood disease—over the past 50 years the occurrence of the vaccine-preventable diseases of childhood has decreased by more than 95%—more than 400,000 children and adults in the United States become ill (Centers for Disease Control and Prevention, unpublished data) and approxi-

mately 50,000 still die each year from preventable diseases.<sup>2</sup> Influenza and pneumonia in the elderly account for most of the mortality.

Vaccines are available to prevent many diseases in people of all ages. The primary vaccine-preventable diseases of childhood are diphtheria, invasive diseases caused by the *Haemophilus influenzae* type b (Hib) bacterium, measles, poliomyelitis (polio), rubella (“German” measles), tetanus, mumps, varicella (chickenpox), and pertussis (whooping cough). The primary vaccine-preventable diseases of adulthood are influenza, diseases caused by the *Streptococcus pneumoniae* bacterium, and hepatitis B. The distinctions between diseases of childhood and those of adulthood, however, have become less clear in recent years. Several diseases formerly considered childhood diseases (e.g., measles and pertussis) are now being found among adults, and hepatitis B vaccinations are now routinely recommended for infants and adolescents.

These preventable diseases are still much too common in the United States. Each year, more than 50,000 children contract varicella, the most common vaccine-preventable disease of childhood.<sup>3</sup> Influenza, pneumococcal infections, and hepatitis B affect hundreds of thousands of adults annually.<sup>4</sup> Each year approximately 500 people die of childhood vaccine-preventable diseases and more than 40,000 adults die of influenza, pneumococcal infections, and hepatitis B.<sup>1,5</sup> Influenza is the leading killer among these diseases,<sup>5</sup> with most deaths occurring among people age 65 or older.

Vaccination not only protects individuals but also limits the spread of disease in the general population. Therefore, the more people who receive a vaccination, the better the protection for everyone, including those who have not been vaccinated.

## **OBJECTIVES AND RECOMMENDATIONS FROM OTHER ADVISORY GROUPS**

The interventions recommended in this chapter can be used to reach objectives set out in *Healthy People 2010*<sup>6</sup> (Table 6–1). In addition, the recommendations complement information from other advisory groups, including the following:

### ***Recommendations for Childhood Vaccinations***

These recommendations are issued regularly by the Advisory Committee on Immunization Practices (ACIP) of the U.S. Department of Health and Human Services (DHHS)/Centers for Disease Control and Prevention (CDC),<sup>7</sup> the American Academy of Pediatrics (AAP),<sup>8</sup> and the American Academy of Family Physicians (AAFP).<sup>9</sup> The AAP, AAFP, and ACIP work together to develop a common childhood vaccination schedule.

**Table 6-1. Healthy People 2010<sup>6</sup> Objectives for Improving Vaccination Coverage and Reducing the Incidence of Vaccine-Preventable Diseases**

<i>Objective</i>	<i>Population</i>	<i>Baseline</i>	<i>2010 Objective</i>
<i>Improving Vaccination Coverage</i>			
Achieve and maintain effective vaccination coverage levels for universally recommended vaccines among young children (Objective 14-22)	Young children	Varies by vaccine regimen	90%
Maintain vaccination coverage levels for children in licensed day care facilities and children in kindergarten through first grade (14-23)	Children	Varies by vaccine	95%
Increase the proportion of young children and adolescents who receive all vaccines that have been recommended for universal administration for at least five years (four DTaP, three polio, one MMR, three Hib, three hepatitis B):			
• Among children aged 19-35 months (14-24a)	Young children	73% (1998)	80%
• Among adolescents aged 13-15 years (14-24b)	Adolescents	Developmental	
Increase the proportion of providers who have measured the vaccination coverage levels among children in their practice population within the past two years:			
• Public health providers (14-25a)	Children	66% (1997)	90%
• Private providers (14-25b)		6% (1997)	90%
Increase the proportion of children who participate in fully operational population-based immunization registries (14-26)	Children under 6 years	32% (1999)	95%
Increase routine vaccination coverage levels for adolescents aged 13-15 years (14-27)	Adolescents	Varies by vaccine	90%
Increase hepatitis B vaccine coverage among high-risk groups:			
• Dialysis patients (14-28a)	High-risk groups	35% (1995)	90%
• Men having sex with men (14-28b)		9% (1995)	60%
• Occupationally exposed workers (14-28c)		71% (1995)	98%

*continued next page*

**Table 6–1.** *Continued*

<i>Objective</i>	<i>Population</i>	<i>Baseline</i>	<i>2010 Objective</i>
<i>Improving Vaccination Coverage (continued)</i>			
Increase the proportion of adults who are vaccinated annually against influenza and ever vaccinated against pneumococcal disease (14–29)	Adults	Varies by vaccine and population	Varies by vaccine and population
<i>Reducing the Incidence of Vaccine-Preventable Diseases</i>			
Reduce or eliminate indigenous cases of vaccine-preventable diseases (14–1)	All	Varies by disease	Varies by disease
Reduce chronic hepatitis B virus infections in infants and young children (perinatal infections) (14–2)	Infants/young children	1682 (1995)	400
Reduce hepatitis B cases per 100,000 population (14–3)	All	Varies by population	Varies by population
Reduce bacterial meningitis cases per 100,000 young children (14–4)	Young children (1–23 months)	13.0 (1998)	8.6
Reduce invasive pneumococcal infections (14–5)	All	Varies by age of population	Varies by population

### ***Recommendations for Adolescent and Adult Vaccinations***

These recommendations are published by ACIP,<sup>10,11</sup> the American College of Physicians,<sup>12</sup> Infectious Disease Society of America,<sup>12,13</sup> AAFP,<sup>9</sup> and the American College of Obstetricians and Gynecologists.<sup>14</sup> Vaccination recommendations for adolescents are now coordinated among ACIP, AAP, AAFP, and the American Medical Association.

### ***Recommendations for Interventions to Improve Vaccination Coverage***

These recommendations have been developed by the Canadian Community Health Practice Guidelines Working Group,<sup>15,16</sup> ACIP,<sup>17,18</sup> and the National Vaccine Advisory Committee.<sup>19</sup>

## **METHODS**

Methods used for the reviews are summarized in Chapter 10. Specific methods used in the systematic reviews for universally recommended vaccinations have been described elsewhere<sup>20</sup> and are available at [www.thecommunityguide](http://www.thecommunityguide)

.org/vaccine. The logic framework depicting the conceptual approach used in reviews of both universally recommended and targeted vaccines is presented in Figure 6-1.

For purposes of our reviews, we did not consider certain activities that might improve vaccination coverage to be interventions. Activities that provide useful information for public health action (e.g., immunization registries) may incorporate or lead to such interventions as client reminders and recalls, provider reminders and recalls, and assessment plus feedback for vaccination providers. Consequently, we considered registries to represent part of the public health infrastructure rather than being interventions themselves. Similarly, improving vaccines (e.g., developing vaccines that are less likely to cause adverse reactions or increasing the number of antigens contained in a vaccine, thus reducing the number of injections required) can lead to improvements in vaccination coverage. However, improvements are made primarily for other reasons (e.g., reducing potential harm or allowing administration of more antigens than would otherwise be feasible) and therefore, for purposes of our systematic reviews, we did not consider them to be interventions.

## **ECONOMIC EFFICIENCY**

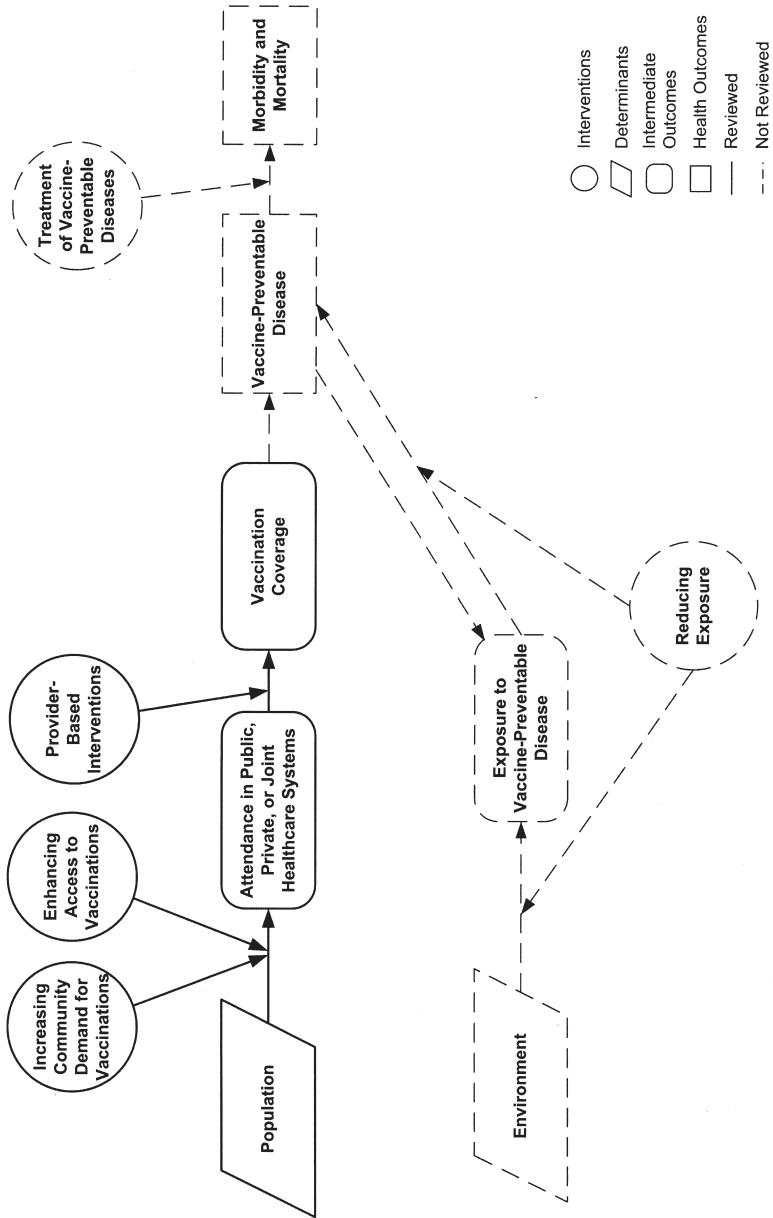
A systematic review of available economic evaluations was conducted for all recommended interventions, and a summary of each review is presented with the related intervention. The methods used to conduct these economics reviews are summarized in Chapter 11.

## **RECOMMENDATIONS AND FINDINGS**

This section presents a summary of the findings of the systematic reviews conducted to determine the effectiveness of interventions to increase coverage with universally recommended vaccines. Interventions are grouped into three categories: increasing community demand for vaccinations, enhancing access to vaccination services, and provider- or system-based interventions.

### ***Universally Recommended Vaccines: Increasing Community Demand for Vaccinations***

Interventions to increase community demand for vaccinations are designed to work in several ways: they can educate communities about the importance of vaccinations and about which vaccinations are appropriate and at what ages; remind families directly when vaccinations are due; make vaccinations



**Figure 6-1.** Logic framework illustrating the conceptual approach used in the systematic reviews of interventions to increase vaccination coverage. (Reprinted from Am J Prev Med, Vol. 18, No. 1S, Briss PA et al., Reviews of evidence regarding interventions to improve vaccination coverage in children, adolescents, and adults, p. 99, Copyright 2000, with permission from American Journal of Preventive Medicine.)

a requirement for child care, school, and college attendance; and provide families with take-home vaccination records and schedules. We reviewed client reminder and recall systems; vaccination requirements for child care, school, and college attendance; community-wide education and clinic-based education as single-component interventions; multicomponent interventions that include education; client or family incentives; and client-held medical records.

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***Client Reminder and Recall Systems to Increase Coverage with Universally Recommended Vaccines: Recommended (Strong Evidence of Effectiveness)***

*(See also Client Reminder Systems When Used Alone to Increase Targeted Vaccines Coverage: Insufficient Evidence to Determine Effectiveness, in Section II of this chapter.)*

Community organizations, providers, and healthcare systems can help clients remember to come in for vaccinations through reminders (if it's time for the vaccination) and recalls (if the vaccination is overdue). These messages—delivered by telephone, letter, post card, or e-mail—can be either specific (i.e., telling the client to come in by a certain date to receive a specific vaccination) or general (i.e., telling the client to get in touch with the provider or healthcare system to make an appointment for needed vaccinations). Providers and systems that must reach a large number of clients may choose to use an autodialing system to help deliver phone messages.

(Client reminder and recall systems are also used in conjunction with home visits. See the review of Home Visits in this section for more information about this use.)

***Effectiveness***

- Client reminder and recall systems alone are effective in increasing coverage for universally recommended vaccines by approximately 8 percentage points.
- Client reminder and recall systems combined with other activities are effective in increasing coverage for universally recommended vaccines by approximately 16 percentage points.

***Applicability***

- These findings should be applicable to most adults and children in the United States for whom universally recommended vaccines are appropriate where improvements in coverage are needed.

The findings of our systematic review of client reminder and recall systems are based on 42 studies that evaluated the effectiveness of these systems.<sup>21–62</sup> An additional 18 studies were identified but did not meet our quality criteria and were excluded from the review.<sup>63–80</sup> Nine additional reports provided in-

formation on studies already included in the review.<sup>81-89</sup> We examined the use of reminders and recalls alone, as well as reminder and recall systems combined with one or more of the following activities: expanding access in healthcare settings; provider reminders; provider education; assessment plus feedback for vaccination providers; clinic-based education; community-wide education; client incentives; client-held medical records; reducing out-of-pocket costs; women, infants, and children (WIC) programs; home visits; or standing orders.

Most studies evaluated the effectiveness of reminders; some evaluated either recalls only or a combination of reminders and recalls. Telephone, post card, and letter reminders were evaluated; e-mail reminders would have been included, but we identified no studies of the use of these reminders. Two studies compared mailed and telephone reminders and found no difference between them. More intensive or more specific reminders were found to generate greater increases in vaccination coverage (e.g., more vs. fewer reminders, specific vs. general, personalized vs. generic, and letters signed by a physician) in five of six studies.

Client reminder and recall systems used alone showed an overall median difference of 8 percentage points (range, -7 to +31; 31 intervention arms). When used in conjunction with other activities, the median difference was 16 percentage points (range, -8 to +47; 23 intervention arms). Therefore, whether used alone or in combination with other interventions, and across a range of intervention content and delivery, client reminder and recall systems are effective in increasing vaccination coverage.

These findings should be applicable to most adults and children in the United States for whom universally recommended vaccines are appropriate where improvements in coverage are needed. Studies were conducted among white, African-American, and Hispanic people, poor and non-poor, in cities, suburbs, or rural areas. The findings are also applicable in a variety of settings: private practice, managed care, pharmacies, academic clinics, and community-wide. We also found effectiveness in increasing delivery of a broad range of vaccinations: measles, mumps, and rubella (MMR); diphtheria, tetanus, pertussis (DTP); oral poliovirus (OPV); *Haemophilus influenzae* type B Hib; influenza; pneumococcal polysaccharide; and the adult formulation of diphtheria and tetanus toxoids (Td).

No studies in this review of universally recommended vaccines examined the use of reminders and recalls to increase delivery of vaccinations to adolescents or specific delivery of hepatitis B vaccinations.

We did not look for or find any other positive or negative effects of client reminders and recalls.

The findings of our systematic review of economic evaluations are based on 11 studies of client reminder and recall interventions.<sup>28,33,38,44,46,65,88,90–93</sup> Median adjusted cost per additional vaccination for single-component interventions was \$9 (range, \$3 to \$46). Adjusted cost per additional vaccination for multicomponent interventions was \$4 for a combination of client and provider reminders; \$51 for a combination of reminders and a lottery-type incentive; and \$43 for a combination of mailed reminders and free vaccinations. Adjusted average costs varied from \$0.65 to \$5.75 per child.

The burden placed on providers or healthcare systems, or the lack of an information infrastructure (e.g., computerized records), can present a barrier to implementation of client reminders and recalls.

In conclusion, the Task Force recommends client reminders and recalls on the basis of strong evidence of effectiveness in increasing vaccination coverage, whether used alone or combined with other activities. The findings of this review should be applicable to most children and adults in the United States for whom universally recommended vaccines are appropriate where improvements in coverage are needed.

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***Multicomponent Interventions That Include Education to Increase Coverage with Universally Recommended Vaccines: Recommended (Strong Evidence of Effectiveness)***

*(Multicomponent interventions implemented in combination, which are related to but not identical to this intervention, are recommended to increase coverage with targeted vaccines. See Section II of this chapter.)*

Education of clients or providers, when combined with other activities, can be very effective in increasing vaccination coverage. This education can be combined with one or more of the following: client reminders; provider reminders; longer hours of operation or improved access to clinics; reducing out-of-pocket costs; client-held vaccination records; providing information, incentives, or vaccinations to clients receiving WIC benefits; medical and psychosocial assessments; nutrition services; or home visits.

***Effectiveness***

- These interventions are effective in increasing coverage with universally recommended vaccines by approximately 16 percentage points in clinical settings.
- The interventions are also effective in increasing vaccination coverage with universally recommended vaccines by approximately 12 percentage points in community settings.
- It was not possible to separate the independent effects of specific intervention components.

*Applicability*

- These findings should be applicable to most adults and children in the United States for whom universally recommended vaccines are appropriate where improvements in coverage are needed.

*Other Effects*

- Multicomponent interventions that include education may also improve delivery of other preventive or clinical care.

The findings of our systematic review of multicomponent interventions that include education are based on 17 studies.<sup>27,36,39,48–50,52,53,61,70,94–100</sup> An additional 17 studies were identified but did not meet our quality criteria and were excluded from the review.<sup>64–66,101–114</sup> Three additional reports provided information on studies already included in the review.<sup>81–83</sup> All studies evaluated community or client education, along with other activities: client reminders; provider reminders; provider education; longer hours of operation or improved access to clinics; reducing out-of-pocket costs; client-held vaccination records; providing information, incentives, or vaccinations to clients receiving WIC benefits; medical and psychosocial assessments; nutrition services; or home visits.

These interventions make community members and clients in clinics aware of available vaccination services and the usefulness and relevance of these services, and provide information about how to access and use them. In the reviewed studies, information was provided in many ways, including mailed reminders, community outreach activities, media reports, posters in waiting rooms, other print materials in waiting rooms (e.g., flyers, brochures), educational sessions led by nursing staff, home visits, and client questionnaires that were reviewed by providers. Fifteen studies with follow-up periods of up to five years found a median difference in vaccination coverage of 16 percentage points (range, –4 to +29). The median difference in clinics was 16 percentage points (range, –4 to +25) and in community settings it was 12 percentage points (range, 5 to 29). In both clinic and community settings, these multicomponent approaches were effective in increasing vaccination coverage.

Although we could not attribute incremental improvements to the specific components, it appears that combined activities improve vaccination coverage. Why is there more solid evidence of the effectiveness of multicomponent approaches than of education alone? It could be because:

- the combined activities reinforce one another (e.g., education alone might not be enough to increase acceptance of vaccinations, but it could make clients more receptive to other components);

- multicomponent interventions are delivered more intensively than single-component interventions;
- more studies have been done of multicomponent interventions than of single-component interventions; or
- multicomponent interventions might increase the likelihood of a client's exposure to at least one component.

These results should be applicable to adults and children of any socioeconomic status for whom universally recommended vaccines are appropriate where improvements in coverage are needed. The reviewed studies were conducted among white, African-American, and Hispanic populations. The findings are also applicable in a variety of settings: academic clinics, private practice, public health clinics, and managed care. These interventions increased delivery of a broad range of vaccinations: influenza; pneumococcal polysaccharide; the adult formulation of diphtheria and tetanus toxoids (Td); diphtheria, tetanus, pertussis (DTP); oral poliovirus (OPV); measles, mumps, and rubella (MMR); and *Haemophilus influenzae* type B (Hib).

No studies in this review of universally recommended vaccines examined the use of multicomponent interventions that include education to increase delivery of vaccinations to adolescents or specific delivery of hepatitis B vaccinations.

An additional benefit of these multicomponent interventions may be improved delivery of other preventive or clinical care through reduction of client-, access-, provider-, or system-related barriers to such care.

The findings of our systematic review of economic evaluations of these multicomponent interventions are based on two studies,<sup>109,115</sup> both cost analyses. One study evaluated the costs of an intervention that included assembling a community task force, undertaking a media campaign, and implementing a school-based program that assessed students' immunization status and delivered vaccinations. The adjusted program costs for that study were \$23 per child vaccinated. Another study estimated the costs of an intervention that included expanding access to vaccination services, multiple education and health promotion activities, and evaluation of the functioning of the clinics established as part of the intervention. The adjusted estimate of program costs for that study was \$7.65 per vaccination delivered. Children in the first study could have received more than one vaccination, so the estimates might be more similar than they appear.

The difficulties of coordinating activities among several programs or administrative systems could present a barrier to the implementation of these multicomponent interventions.

In conclusion, the Task Force recommends multicomponent interventions that include education on the basis of strong evidence of effectiveness in increasing vaccination coverage in both clinical and community settings. The findings of this review should be applicable to most children and adults in the United States for whom universally recommended vaccines are appropriate where improvements in coverage are needed. These interventions may also improve delivery of other preventive or clinical care.

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***Vaccination Requirements for Child Care, School, and College Attendance to Increase Coverage with Universally Recommended Vaccines: Recommended (Sufficient Evidence of Effectiveness)***

*(See also Vaccination Requirements When Used Alone to Increase Targeted Vaccines Coverage: Insufficient Evidence to Determine Effectiveness in Section II of this chapter.)*

Preschools and day care centers, elementary and high schools, and colleges and universities often require proof that incoming attendees or students have had certain vaccinations. In the 1970s–1980s, most primary and secondary schools began requiring vaccination of students. This led to consistent vaccination of more than 95% of students. For preschoolers and college-age students, laws and enforcement are more recent and vary greatly from state to state.

*Effectiveness*

- Vaccination requirements for child care, school, and college attendance are effective in increasing coverage with universally recommended vaccines by approximately 15 percentage points.

*Applicability*

- These findings should be applicable to most children and young adults in the United States for whom universally recommended vaccines are appropriate where improvements in coverage are needed.

The findings of our systematic review are based on 9 studies.<sup>116–124</sup> One additional study was identified but did not meet our quality criteria and was excluded from the review.<sup>125</sup> Another report provided information on a study already included in the review.<sup>126</sup> Six studies examined how effective these requirements were in reducing disease. Of these, three national studies found that the incidence of measles and mumps was lower in states that required school-age children to be vaccinated against these diseases; one of these also showed that officials in low-incidence areas are more likely to enforce the laws by excluding unvaccinated students from school attendance. Three additional studies measured diverse characteristics of laws and enforcement and generally found lower rates of disease. In jurisdictions where the inci-

dence of measles was lower, laws banning unvaccinated children from entering school were more likely to be enforced. During an outbreak of mumps in New Jersey, children in schools that required vaccination were much less likely to have the disease than were other children. In New York State, the decline in Hib was greater for children in day care centers that required Hib vaccinations (even without any provision for enforcement) than for the state overall. We did not attempt a quantitative combination of these disparate outcomes and effect measures, but consider the pattern of results to be consistent with a conclusion that these requirements are effective in increasing coverage with universally recommended vaccines and decreasing rates of disease.

Three studies (one of which also measured disease rates) looked for changes in vaccination coverage and found a median difference of 15 percentage points (range, 5 to 35).

These findings should be applicable to most children and young adults in the United States who attend child care, school, or college, for whom universally recommended vaccines are appropriate and where improvements in coverage are needed. Studies were conducted in all 50 states, mostly in primary and high schools, but also in two- and four-year colleges as well as statewide in New York and California. Although no studies provided specific race and ethnicity data, studies in these large, diverse state populations should include, and apply to, diverse populations including racial and ethnic minorities.

Studies assessed the effectiveness of these laws in improving delivery of vaccinations against measles, mumps, and rubella (MMR), in reducing the occurrence of measles and mumps and the incidence of *Haemophilus influenzae* type B (Hib) and in increasing coverage of diphtheria, tetanus (DT), diphtheria, tetanus, pertussis (DTP), and oral poliovirus (OPV) vaccinations. No studies in this review of universally recommended vaccines examined the effectiveness of these laws in improving delivery of hepatitis B vaccinations.

We did not look for or find any other positive or negative effects of vaccination requirements for day care, school, and college attendance. We also did not find any economic evaluations of the effects of these laws. The difficulties of passing laws, and then of administering them and coordinating among various programs, can present barriers to implementation.

In conclusion, the Task Force recommends vaccination requirements for day care, school, and college attendance on the basis of sufficient evidence of effectiveness in increasing vaccination coverage. These results should be applicable to most children and young adults in the United States for whom universally recommended vaccines are appropriate where improvements in coverage are needed.

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***Community-Wide Education When Used Alone to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness***

*(See also Community-wide Education When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness in Section II of this chapter.)*

The goal of community-wide education about vaccinations is to help people within a specified geographic area learn more about vaccinations in the hope that they (and their children) will get the vaccinations they need. Health-care providers can often be additional targets of these education programs. Community-wide education efforts can use one or more approaches, including mail, radio, television, newspaper, and posters.

Community-wide education can be one component in a multicomponent intervention. A number of the interventions reviewed in this section include community-wide education (see Client Reminder and Recall Systems; Multicomponent Interventions That Include Education; Vaccination Programs in Women, Infants, and Children (WIC) Settings; and Provider Reminder and Recall Systems).

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of community-wide education, when used alone, to increase vaccination coverage.
- Evidence was insufficient because the only qualifying study had limitations in its design and execution and showed inconsistent results in different subpopulations.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

We found only one study that qualified for the systematic review of this intervention.<sup>52</sup> An additional five studies were identified but did not meet our quality criteria and were excluded from the review.<sup>71,78,127–129</sup> The reviewed study showed inconsistent results, with improvements in measles vaccination coverage among 6-year-olds but not among 14- to 18-month-olds. The evidence is therefore insufficient to determine the effectiveness of community-wide education alone to increase vaccination coverage. We did not look for other harms or benefits of education-only programs.

Because we could not establish the effectiveness of these programs, we did not examine situations in which the programs would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, although educational components can be part of effective multicomponent interventions, the Task Force found insufficient evidence to determine the effectiveness of community-wide education, when used alone, to increase vaccination coverage. Only a single qualifying study was identified,

which had limitations in its design and execution and showed inconsistent results in different subpopulations.

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***Clinic-Based Education When Used Alone to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness***

*(See also Clinic-based Client Education When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness in Section II of this chapter.)*

Clinic-based education about vaccinations is directed to clients coming to medical or public health clinics to let them know about services and recommended vaccinations available at the clinic. Educational materials often take the form of standardized “Vaccine Information Statements,” which are available to all vaccination providers for distribution to clients (and can be found at [www.cdc.gov/nip/publications/VIS/default.htm](http://www.cdc.gov/nip/publications/VIS/default.htm)). These statements include both information and consent forms for vaccinations.

Clinic-based education can be one component in a multicomponent intervention. A number of the multicomponent interventions reviewed in this section include clinic-based education (see Client Reminder and Recall Systems; Multicomponent Interventions That Include Education; and Provider Reminder and Recall Systems).

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of clinic-based education, when used alone, to increase vaccination coverage.
- Evidence was insufficient because the small number of studies showed no consistent effect on vaccine coverage or knowledge and attitudes.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

The findings of our systematic review are based on three studies.<sup>98,130,131</sup> An additional two studies were identified but did not meet our quality criteria and were excluded from the review.<sup>132,133</sup> In a randomized trial, provider education plus clinic-based education produced no significant increases in receipt of influenza and pneumococcal vaccines compared with provider education alone. Two before-and-after studies looked at the effects of Vaccine Information Statements on parents’ knowledge about and attitudes toward vaccinations: one found a significant increase in both parental knowledge and willingness to have children vaccinated, but the other found no significant difference in either knowledge or attitude. We did not look for other harms or benefits of clinic-based education programs. The small number of studies and the inconsistent results in those studies provide insufficient evidence to determine the effectiveness of clinic-based education, by itself, in increasing vaccination coverage.

Because we could not establish the effectiveness of these programs, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of clinic-based education, when used alone, to increase vaccination coverage because of the small numbers of studies and lack of consistent demonstration of an effect.

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***Client or Family Incentives to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness***

*(See also Client or Family Incentives When Used Alone to Increase Targeted Vaccines Coverage: Insufficient evidence to Determine Effectiveness in Section II of this chapter.)*

One approach to getting clients to agree to be vaccinated or to have their children vaccinated is to offer either positive or negative incentives (e.g., money, baby toys, discount coupons for retailers, or exclusion from a particular program).

Some programs that focus on other approaches to increasing coverage of universally recommended vaccines also include incentives. For the results of these reviews see Vaccination Requirements for Child Care, School, and College Attendance and Vaccination Programs in Women, Infants, and Children (WIC) Settings.

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of client or family incentives in increasing vaccination coverage.
- Evidence was insufficient because the small number of studies showed no consistent effect.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

The findings of our systematic review of client or family incentives are based on three studies.<sup>27,44,62</sup> One additional report provided information on a study already included in the review.<sup>84</sup> All the studies in our review included the use of both positive incentives (e.g., gift certificates or lotteries for cash prizes) and other activities (e.g., client and provider reminders, home visits, or transportation assistance). In one study, one intervention arm evaluated incentives alone. No studies of negative incentives were evaluated.

These studies all showed an increase in vaccine coverage in response to offers of gift certificates or cash prizes, but some changes were small and many were not statistically significant. The small number of studies, with inconsistent effects, provided insufficient evidence to determine the effectiveness of incentives in increasing coverage. (We also found insufficient evidence to

determine whether or not client or family incentives are effective in increasing hepatitis B vaccine coverage. See Section II of this chapter.)

Because we could not establish the effectiveness of these programs, we did not examine situations in which they would be applicable or information about economic efficiency.

A possible barrier to implementation of such programs would be ethical concerns about whether incentives constitute coercion.

We did not look for other harms or benefits of client or family incentives.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of incentives in increasing receipt of vaccinations because the small number of studies showed no consistent effect.

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***Client-Held Medical Records to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness***

The idea behind encouraging clients to keep a record of their vaccinations is that they will be more aware of when their vaccinations are due or overdue and may request the vaccinations themselves. And when a client can bring a copy of his or her vaccination record to a healthcare provider, the provider may be prompted to deliver a vaccination that might otherwise be missed. Some state and local health departments and private provider offices have distributed medical records to clients.

*Effectiveness*

- We found insufficient evidence to determine the effectiveness of client-held medical records in increasing vaccination coverage.
- Evidence was insufficient because of the small number of studies, the variability in the programs evaluated, and the lack of statistical significance in the results of some studies.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

The findings of our systematic review are based on four studies.<sup>48,94,134,135</sup> An additional four studies were identified but did not meet our quality criteria and were excluded from the review.<sup>108,136-138</sup> One study compared a combination of client-held medical records and provider reminders with provider reminders alone. Other studies evaluated client-held medical records combined with clinic-based education, client reminders, or multiple approaches. Although three studies reported median increases in coverage of 5 to 15 percentage points, not all of these were statistically significant improvements. Therefore, the small number of studies, the variety of evaluated programs, the

small effect sizes, and the lack of statistical significance in some of the findings provide insufficient evidence to determine the effectiveness of client-held medical records in increasing vaccination coverage.

Because we could not establish effectiveness of these programs, we did not examine situations in which such programs would be applicable or information about economic efficiency.

A possible barrier to implementation could be the burden placed on providers. In one survey, 80% of providers had positive reactions to client-held medical records, but 17% felt that such records had a negative effect on clinic efficiency.

In conclusion, although four studies were reviewed, the differences among the evaluated programs and the fact that several of the results were neither substantial nor significantly different from zero provide insufficient evidence to determine the effectiveness of client-held medical records in increasing vaccination coverage.

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### ***Universally Recommended Vaccines: Enhancing Access to Vaccination Services***

Even if community demand for vaccinations can be increased through the interventions reviewed above, other barriers to vaccination may still remain. Costs that are too high for clients to pay, or inconvenient locations or hours for vaccination, are typical barriers. The strategy reviewed here, enhancing access to vaccination services, focuses on reducing such barriers by making it as easy as possible for individuals and families to get the vaccinations they need. Interventions that enhance access to vaccination services work by reducing the cost of vaccinations or by making vaccinations very easy to obtain. We reviewed interventions that reduce the price consumers pay for vaccinations; expand availability of vaccinations in healthcare settings; and provide vaccinations in nonmedical settings, including women, infants, and children (WIC) programs, home visits, schools, and child care centers.

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### ***Reducing Out-of-Pocket Costs to Increase Coverage with Universally Recommended Vaccines: Recommended (Strong Evidence of Effectiveness)***

*(See also Reducing Client Out-of-Pocket Costs to Increase Coverage with Targeted Vaccines: Recommended as Part of a Combination Approach, as well as Reducing Client Out-of-Pocket Costs When Used Alone, to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness in Section II of this chapter.)*

The cost of vaccinations often stops clients and their family members from being vaccinated. Covering the cost of the vaccines or their administration ei-

ther directly or through insurance coverage, or reducing clients' co-payments for vaccinations, can increase the number of clients who get appropriate vaccinations. Programs to reduce costs and increase vaccine coverage have been used by the federal government (e.g., the Vaccines for Children Program), state governments (e.g., providing free vaccinations), and managed care organizations (e.g., reducing co-payments).

#### *Effectiveness*

- Reducing out-of-pocket costs alone is effective in increasing coverage with universally recommended vaccines by approximately 10 percentage points.
- Reducing out-of-pocket costs combined with other activities is effective in increasing coverage with universally recommended vaccines by approximately 16 percentage points.

#### *Applicability*

- These findings should be applicable in a broad range of settings, among populations for whom universally recommended vaccines are appropriate, where improvements in coverage are needed.

The findings of our systematic review are based on 19 studies.<sup>42,46,48,50,54,70,97,139-150</sup> An additional seven studies were identified but did not meet our quality criteria and were excluded from the review.<sup>71,101,103,107,110,151,152</sup> Two additional reports provided information on a study already included in the review.<sup>153,154</sup> The reviewed studies evaluated improvement in vaccination outcomes, reduction in the likelihood that providers would refer clients elsewhere to get needed vaccines, or both.

Five surveys of providers' likelihood to refer clients elsewhere for needed vaccinations (including two nationally representative surveys of pediatricians and family physicians) consistently found that limited insurance coverage (public or private) for children was a key factor in providers' decisions to refer children to other sites for vaccinations.

Efforts to improve vaccination outcomes (earlier or increased vaccination) were either single-component or multicomponent. Findings of the five single component studies that could be expressed with a percentage point improvement showed a median improvement in vaccination outcomes of 10 percentage points (range, -1 to +29). The eight multicomponent studies looked at reducing out-of-pocket costs along with client reminders and recalls, community-wide education, expanding access in healthcare settings, provider education, clinic-based education, client-held medical records, WIC interventions, or provider reminders and recalls. The median improvement in these studies was 16 percentage points (range, -8 to +47).

The evidence therefore shows that reducing clients' out-of-pocket costs is effective in increasing vaccination coverage.

These results should be applicable to adults and children of low or mixed socioeconomic status for whom universally recommended vaccines are appropriate and improvements in coverage are needed, in rural and urban settings, in hospitals, clinics, private offices, WIC settings, and emergency departments.

The findings of our systematic review of economic evaluations of interventions to reduce out-of-pocket cost for vaccinations are based on one study.<sup>46</sup> That study evaluated the cost effectiveness of a multicomponent intervention to encourage influenza vaccination, which consisted of mailed reminders and free vaccinations. The adjusted cost per additional vaccination in this intervention was \$43.

We questioned whether reducing out-of-pocket costs would have any negative effects on vaccine research and development but did not find any studies that examined this issue. We did not look for any other positive or negative effects of reducing out-of-pocket costs.

A possible barrier to reducing out-of-pocket costs could be the complexities and fragmentation of mechanisms for payment of vaccinations.

In conclusion, the Task Force recommends reducing out-of-pocket costs on the basis of strong evidence of effectiveness in increasing vaccination coverage. The components of the interventions reviewed varied considerably, yet these findings should be applicable in a variety of settings to a variety of populations for whom universally recommended vaccines are appropriate and improvements in coverage are needed.

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***Expanding Access in Healthcare Settings, to Increase Coverage with Universally Recommended Vaccines: Recommended as Part of a Multicomponent Intervention (Strong Evidence of Effectiveness) Insufficient Evidence to Determine Effectiveness When Used Alone***

*(See also Expanding Access in Healthcare Settings to Increase Coverage with Targeted Vaccines: Recommended as Part of a Combination Approach, as well as Expanding Access in Healthcare Settings When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness, in Section II of this chapter.)*

Barriers to clients seeking and obtaining vaccinations for themselves or their children are common, and include limited hours during which vaccination services are available (e.g., while most people must be at work or in school), distances to travel to vaccination locations, and difficulties in arranging for vaccinations. Financially disadvantaged families are particularly burdened by the challenges of child care and transportation. These barriers can be reduced by administering vaccines in additional locations (e.g., emergency departments, inpatient units in hospitals, or subspecialty clinics), especially if these

are closer to where clients live and work; expanding the hours of facilities that offer vaccinations; or easing the process of getting a vaccination (e.g., in a “drop-in” clinic or an “express lane” vaccination service).

#### *Effectiveness*

- Expanding access in healthcare settings is effective in increasing coverage with universally recommended vaccines by approximately 13 percentage points when used as part of a multicomponent intervention.
- We found insufficient evidence to determine the effectiveness of this intervention when used alone because the small number of studies did not show statistically significant improvement.
- Insufficient evidence means that we were not able to determine whether or not the intervention works when used alone.

#### *Applicability*

- Review findings should be applicable to adults and children for whom universally recommended vaccines are appropriate in diverse clinical and community settings where improvements in coverage are needed.

The findings of our systematic review are based on 16 studies that examined expanding access alone and expanding access combined with other activities.<sup>27,35,36,39,40,42,47,53,61,62,77,96,99,147,155,156</sup> An additional nine studies were identified but did not meet our quality criteria and were excluded from the review.<sup>65,101,103,105,107,110,113,136,157</sup> Four additional reports provided information on studies already included in the review.<sup>81,83,84,86</sup>

Approaches to expanding access were drop-in clinics; increased night and weekend hours; making vaccinations available in emergency departments; special vaccination clinics; special vaccination appointments; inpatient vaccination stations; and transportation assistance. The activities combined with expanded access were client reminder and recall, provider education, clinic-based education, standing orders, community-wide education, client incentives, vaccination programs in WIC settings, home visits, or assessment plus feedback for vaccination providers. Overall, 12 of the studies of expanded access combined with another intervention showed a median improvement of 13 percentage points (range, -8 to +35) in vaccination coverage, indicating the effectiveness of the multicomponent interventions in increasing vaccination coverage.

No statistically significant improvement was found in two studies that examined expanding access by itself, although these efforts could help to make other approaches (e.g., standing orders or client reminders) more effective. The small number of studies showing no statistically significant improvement provided insufficient evidence to determine the effectiveness of expanded access alone in increasing vaccination coverage.

Multicomponent approaches may be generally more effective because they are more intense or because the combined effects of the various components increase the overall effectiveness of each one.

These findings should be applicable to most adults and children for whom universally recommended vaccines are appropriate where improvements in coverage are needed. Studies were conducted in managed care settings, public health clinics, community clinics, private practices, Veterans Administration hospitals and clinics, academic settings, and as part of community-wide programs.

We did not look for any other positive or negative effects of expanding access in healthcare settings.

The findings of our systematic review of economic evaluations of this multicomponent intervention are based on one study.<sup>115</sup> The study, a cost analysis, estimated the costs of an intervention that included expanding access to vaccination services, multiple education and health promotion activities, and evaluation of the functioning of the clinics established as part of the intervention. The adjusted program costs were \$7.65 per vaccination delivered.

Efforts to expand access to vaccination services can encounter several barriers, presented either by clients or by the settings in which they might seek vaccinations. These barriers include the problems of coordinating between settings and of having appropriate records available, the lack of a relationship between vaccination programs and the primary purpose of the setting in which they are offered, clients' inability to remember which vaccinations they or their children have received, and contraindications to receiving vaccinations in some situations (e.g., feverish children being brought to emergency departments).

In conclusion, the Task Force recommends multicomponent interventions to expand access in healthcare settings on the basis of strong evidence of effectiveness in increasing vaccination coverage. When used alone, however, evidence was insufficient to determine the effectiveness of the intervention because of a small number of studies that showed no statistically significant improvement in coverage. The findings of this review should be applicable to adults and children for whom universally recommended vaccines are appropriate in most clinical and community settings where improvements in coverage are needed.

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Access to vaccination services can be expanded in nonmedical settings, too. Assessing immunization status and referring or vaccinating children or adults

in places where they go on a regular basis may be effective ways to increase vaccination coverage. These nonmedical settings can also offer education about, and incentives to accept, vaccinations.

The Task Force recommends expanding access to include WIC settings, home visiting, and school-based programs (based on sufficient evidence of effectiveness). Evidence was insufficient, however, to determine if expanding access in child care centers is effective. The findings of our reviews of these four settings follow.

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***Vaccination Programs in Women, Infants, and Children (WIC) Settings to Increase Coverage with Universally Recommended Vaccines: Recommended (Sufficient Evidence of Effectiveness)***

The Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) provides supplemental foods, health care referral, and nutrition education for low-income women, infants, and children who are at nutritional risk. Administered by the U.S. Department of Agriculture, this single largest point of access to health-related services for low-income preschool children reaches 45% of all U.S. infants; in some cities, up to 80% of all infants participate in WIC. Participants in the WIC programs visit program sites every 2 to 3 months for nutrition services and food vouchers, and receive comprehensive health status evaluations every 6 to 12 months. The programs are required to serve as a gateway to, and coordinator for, other health services, including vaccinations.

Programs that promote vaccinations in WIC settings require assessment of each child's immunization status. They may refer underimmunized children to a healthcare provider or provide vaccinations onsite. These programs can also include education or incentives to accept vaccinations. One such incentive is the voucher restriction or *monthly voucher pick up*, which require clients at high risk of not receiving the vaccines they need to come to the WIC site more frequently, usually monthly.

***Effectiveness***

- Vaccination programs in WIC settings used alone increased vaccination coverage by approximately 9 percentage points.
- Vaccination programs in WIC settings combined with other activities increased vaccination coverage by approximately 12 percentage points.

***Applicability***

- These findings should be applicable to WIC participants of any race for whom universally recommended vaccines are appropriate, in urban and rural settings, where improvements in coverage are needed.

*Other Effects*

- We found no evidence to support the possible harm that vaccination requirements or monthly voucher pick up increase WIC dropout rates.

The findings of our systematic review are based on four studies that examined the effectiveness of vaccination programs in WIC settings in increasing vaccination coverage.<sup>61,141,158,159</sup> An additional six studies were identified but did not meet our quality criteria and were excluded from the review.<sup>160-165</sup> One additional report provided information on a study already included in the review.<sup>166</sup> Three of the reviewed studies were conducted entirely among WIC clients. These studies (1) compared a combination of education, assessment, and referral with the same combination plus monthly voucher pick up or an escort to a vaccination clinic, resulting in small but significant increases in vaccination coverage, or (2) compared WIC programs with no program. Various combinations of education, assessment, referral, free vaccinations, monthly voucher pick up, and regular care produced a median increase of 9 percentage points (range, 4 to 34) in vaccination coverage over regular care alone. Education, assessment, monthly voucher pick up, free vaccinations, and various combinations of vaccination referrals or onsite vaccinations resulted in a median increase of 34 percentage points in vaccination coverage; the specific strategies used for vaccination or referral produced no differences in effectiveness. The fourth study looked at programs in WIC settings as part of a comprehensive multicomponent program and found that the components combined produced a median increase of 12 percentage points in vaccination coverage. The four reviewed studies provide sufficient evidence that a variety of vaccination programs, delivered in WIC settings, are effective in increasing vaccination coverage.

Although studies in this review looked at minority children in urban areas, the results should be applicable to all WIC clients, of any race, for whom universally recommended vaccines are appropriate in either rural or urban settings where improvements in coverage are needed.

Despite concerns on the part of many WIC providers that vaccination requirements or monthly voucher pick up could negatively affect WIC participation, two studies suggested that these effects may not be large. The first found that the dropout rates remained constant among those receiving the vaccine program but increased in the group receiving no such program. The second found small dropout rates ( $\sim 1$  percentage point) when comparing children who received assessment and escort, assessment and referral, or assessment and monthly voucher pick up. These findings do not suggest substantial effects of these programs on dropout rates.

The findings of our systematic review of economic evaluations of WIC interventions are based on two studies.<sup>141,166</sup> One of these reported cost per fully vaccinated child of three variations of a WIC intervention that differed primarily in the way referrals were handled and how vaccines were provided. Adjusted cost per fully vaccinated child ranged from \$34 to \$84. Adjusted cost of assessing immunization status, based on a second study, were \$2.65 per assessment for interventions using an onsite vaccination nurse and \$1.28 per assessment for interventions using other strategies to promote vaccination.

Difficulties in coordinating WIC programs with vaccination programs can present barriers to implementation of the latter, as can objections among WIC providers and managers to the concept of monthly voucher pick up requirements.

In conclusion, the Task Force recommends vaccination programs in WIC settings on the basis of sufficient evidence of effectiveness in increasing vaccination coverage. These findings should be applicable to WIC clients of any race for whom universally recommended vaccines are appropriate, in rural and urban settings, where improvements in coverage are needed. No evidence was found to support the possible harm that vaccination requirements or monthly voucher pick up increase WIC dropout rates.

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***Vaccination Programs in Schools to Increase Coverage with Universally Recommended Vaccines: Recommended (Sufficient Evidence of Effectiveness)***

The goal of school-based vaccination programs is to improve vaccination delivery to students aged 5–18 years. At this time, the only vaccination programs that would be appropriate in schools are those for newly recommended vaccines, such as hepatitis B vaccine. School-based vaccination programs offer a unique opportunity for providing vaccinations and other preventive services to young people. In the United States, for example, approximately 99% of children aged 11 and 12 years attend school. The vaccination programs we reviewed were almost always multicomponent, and included efforts to increase demand (through educating students, parents, teachers, and other school staff about vaccines and providing reminders or recalls when students were due or past due for vaccinations) and access (by providing free vaccines, incentives, and special vaccination hours and locations). Written consent from parents or guardians was usually required. The programs often involved collaboration among schools, local health departments, community clinics, and private health providers. (Vaccination requirements for school attendance are reviewed elsewhere in this section; see Vaccination Requirements for Child Care, School, and College Attendance.)

*Effectiveness*

- Vaccination programs in schools are effective in increasing immunization coverage by approximately 58 percentage points.

*Applicability*

- These findings should be applicable to adolescents for whom universally recommended vaccines are appropriate, of any socioeconomic status and race, in most schools where improvements in coverage are needed.
- These findings should also be applicable to newly recommended vaccines (e.g., hepatitis B vaccine).

The findings of our systematic review are based on nine studies (in multiple reports).<sup>167–183</sup> All of the studies except one<sup>183</sup> were conducted to assess the acceptance of hepatitis B vaccine at a time when the vast majority of students were unvaccinated. Only one of these studies had a concurrent comparison group in which vaccination was available but not promoted in a special program.<sup>172</sup> We therefore included before-and-after studies in our review as long as an assessment of the baseline vaccination coverage of the entire target student population (usually the entire school) was included. An additional 11 studies were identified (in two reports) but did not meet our quality criteria and were excluded from the review.<sup>176,184</sup>

The nine studies of school-based programs reported a median increase in vaccination coverage of 58 percentage points (range, 11 to 92). This improvement shows that vaccination programs in schools are effective in increasing coverage. Although exact dates of these programs were not always provided, follow-up was generally one school year.

These results should be applicable to adolescents of any socioeconomic status and race for whom universally recommended vaccines are appropriate and where improvements in coverage are needed. They are also applicable in a variety of types of schools. Because the studies only evaluated newly introduced or recommended (but not required) vaccines, and because coverage with vaccines already recommended for children in the United States is greater than 90% by the time children enter school, school-based programs can only be recommended for the introduction of new vaccines (e.g., hepatitis B vaccine).

One positive effect of vaccinating adolescents in schools is that they do not then need to make special visits to their providers to receive vaccinations. However, not visiting providers for vaccinations could have the unintended negative effect of reducing the provision of other recommended adolescent health services that might be offered when vaccines are delivered in a clinical setting. We did not find empirical studies of this suggested harm.

The findings of our systematic review of economic evaluations of school-based vaccination programs are based on one study.<sup>185</sup> That study included a cost analysis and a cost-effectiveness analysis of a school-based universal hepatitis B vaccination program for sixth graders in British Columbia. The adjusted program cost per fully vaccinated child (three vaccinations) was US\$47.11. Considering direct costs only, the adjusted cost per life-year saved was US\$2316 compared with the policy in place prior to the program (screening mothers and vaccinating children born to carrier mothers, in addition to vaccinating high-risk individuals).

Need for special staff, difficulties coordinating school-based health programs in each school, potential disruption of school routines, and concerns about confidentiality are potential barriers to the implementation of these programs.

In conclusion, the Task Force recommends vaccination programs in schools on the basis of sufficient evidence of effectiveness in increasing vaccination coverage. These findings should be applicable to most schools and students for whom newly recommended vaccines are indicated (e.g., hepatitis B vaccine) where improvements in coverage are needed.

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***Vaccination Programs in Child Care Centers to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness***

In 1997, approximately 32% of preschool children were cared for in child care centers.<sup>186</sup> These children, mostly under the age of five, are at increased risk of contracting communicable diseases.<sup>187</sup> Programs to encourage vaccination of children who are in child care assess a child's immunization status either when the child enrolls in the center or one or more times while the child is attending the center. The efforts can be combined with education or notification of parents, referrals to healthcare providers, and even providing needed vaccinations at the center. Some centers require proof that children have received certain vaccinations before they can be enrolled (see Vaccination Requirements for Child Care, School, and College Attendance).

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of vaccination programs in child care centers in increasing vaccination coverage.
- Evidence was insufficient because no studies met the quality standards required for review.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

We found no studies that qualified for our systematic review of vaccination programs in child care centers. One study was identified but did not meet our

quality criteria and was not included in the review.<sup>188</sup> We therefore had insufficient evidence to determine whether or not these programs are effective in increasing vaccination coverage. We did not look for other harms or benefits of these programs.

Because we could not establish the effectiveness of these programs, we did not examine situations in which such programs would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of vaccination programs in child care centers in increasing vaccination coverage because no qualifying studies were identified.

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***Home Visits to Increase Coverage with Universally Recommended Vaccines: Recommended (Sufficient Evidence of Effectiveness)***

Home visits to promote receipt of vaccinations consist of face-to-face services delivered to clients in their homes, including education, assessment of need for vaccinations, referral to a vaccination provider, or providing vaccinations in the clients' homes. Telephone or mail reminders can also be used. Home visits are usually directed to subpopulations that are difficult to reach, such as people living in public housing communities or rural areas. (Home visits are also used to address other public health issues such as violence [see Chapter 9]).

***Effectiveness***

- Home visits combined with other activities are effective in increasing vaccination coverage by approximately 13 percentage points.

***Applicability***

- These findings should be applicable to adults and children for whom universally recommended vaccines are appropriate, including those of low socioeconomic status, in urban and rural settings where improvements in coverage are needed.

***Economic Efficiency***

- Although effective in increasing vaccination coverage, home visits solely for this purpose can have very high resource costs for the benefits achieved.

The findings of our systematic review are based on seven studies that examined the effectiveness of home visits alone or combined with other activities to promote vaccinations.<sup>27,77,189-193</sup> An additional eight studies were identified but did not meet our quality criteria and were excluded from the review.<sup>194-201</sup> One additional report provided information on a study already in-

cluded in the review.<sup>84</sup> Five of the reviewed studies looked at home visiting with or without client reminders and case management, and two studies looked at home visits along with other activities, including community outreach, education, transportation assistance, or provider education with feedback (see Assessment plus Feedback for Vaccination Providers). These seven studies showed a median increase of 10 percentage points in vaccination coverage (range, -1 to +49). The generally positive changes in the reviewed studies provide sufficient evidence of the effectiveness of home visits in increasing vaccination coverage.

These findings should be applicable to most adults and children, including those of low socioeconomic status, living in urban or rural areas, for whom universally recommended vaccines are appropriate and where improvements in coverage are needed.

The findings of our systematic review of economic evaluations of home visits are based on four studies.<sup>191,193,197,202</sup> Adjusted cost per child vaccinated was \$22<sup>197</sup> and \$130.<sup>202</sup> Adjusted cost per additional vaccination was \$513<sup>191</sup> and \$13,020.<sup>193</sup>

The need to train those who will conduct home visits, and concerns about their safety, present potential barriers to use of this approach.

In conclusion, the Task Force recommends home visits on the basis of sufficient evidence of effectiveness in increasing coverage with universally recommended vaccines. These findings should be applicable to most adults and children, including those of low socioeconomic status, in both urban and rural settings where improvements in coverage are needed. Although home visits are an effective way to increase vaccination coverage, when made solely for this purpose they can have very high resource costs for the benefits achieved.

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### ***Universally Recommended Vaccines: Provider- or System-Based Interventions***

Healthcare providers and systems can also help to ensure that their clients receive recommended vaccinations. Unfortunately, they often miss such opportunities. Provider- or system-based interventions, which are implemented primarily through healthcare systems, are designed to encourage healthcare providers to actively ensure that clients get needed vaccinations. These interventions educate providers about vaccinations, remind providers when individual clients are due for vaccinations, and give feedback to providers on how well they are doing in terms of providing specific vaccinations. An additional intervention—*standing orders*—removes a potential barrier to vacci-

nation (heavy physician workload) by increasing the number of personnel in healthcare settings qualified to give vaccinations.

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***Provider Reminder and Recall Systems to Increase Coverage with Universally Recommended Vaccines: Recommended (Strong Evidence of Effectiveness)***

*(See also Provider Reminder Systems to Increase Coverage with Targeted Vaccines: Recommended as Part of a Combination Approach, as well as Provider Reminder Systems When Used Alone to Increase Coverage with Targeted Vaccines: Recommended in Section II of this chapter.)*

Through provider reminder and recall systems, providers are reminded that clients are due (reminder) or overdue (recall) for specific vaccinations. Reminders can take many forms, including notes in clients' charts, mailings, checklists, flowcharts, or computer notification. The content of the reminders varies, ranging from a simple notation that a vaccination is due or late to such a reminder combined with additional information. Providers most often receive the information during a scheduled appointment with a client, but can also receive it before or after the appointment.

Provider reminder and recall can be used alone or combined with other activities including clinic-based education, assessment plus feedback for vaccination providers, provider education, community-wide education, or expanded access to vaccination services.

(Provider reminders can also be combined with standing orders. See Standing Orders for more information about this use.)

***Effectiveness***

- Provider reminder and recall systems, when used alone, are effective in increasing vaccination coverage by approximately 17 percentage points.
- Various combinations of interventions that include provider reminder and recall systems are effective in increasing vaccination coverage by approximately 14 percentage points.

***Applicability***

- These findings should be applicable to clients of any age for whom universally recommended vaccines are appropriate, for a range of providers and healthcare settings, where improvements in coverage are needed.

***Other Effects***

- The use of provider reminder and recall systems may lead to improvements in outcomes other than vaccine coverage, such as improved delivery of other preventive services or clinical care.

The findings of our systematic review are based on 30 studies.<sup>24,25,33,36,39,41,51,52,95,100,156,191,203-220</sup> An additional 30 studies were identified but did not meet our quality criteria and were excluded from the review.<sup>56,68,75,104,106,110-112,114,</sup>

<sup>136,137,151,152,195,221-236</sup> Eight additional reports provided information on studies already included in the review.<sup>81,85,87,88,237-240</sup> Reviewed studies evaluated reminder and recall alone, in combination with other activities, or both. Provider reminder and recall systems used alone showed an overall median increase of 17 percentage points (range, 1 to 67; 17 intervention arms). When combined with other activities, the median increase was 14 percentage points (range, 1 to 36; 12 intervention arms). Whether used alone or in combination with other activities, provider reminder and recall systems were effective in increasing vaccination coverage.

These results should be applicable, where improvements in coverage are needed, to clients for whom universally recommended vaccines are appropriate and to diverse providers in a wide range of settings. The findings are applicable to several kinds of providers—residents, physicians who have completed their training, and non-physician providers of vaccinations—in academic clinics, managed care facilities, private practice, community health centers, community hospitals, and community-wide settings. Physicians who practice internal medicine, family medicine, and pediatrics were studied. Clients were either outpatients or inpatients of any age. Reminder and recall systems were effective in increasing delivery of vaccines for measles, mumps, and rubella (MMR); diphtheria, tetanus, pertussis (DTP); oral poliovirus (OPV); *Haemophilus influenzae* type B (Hib); influenza; pneumococcal disease; and the adult formulation of diphtheria and tetanus toxoids (Td). Studies of universally recommended vaccines did not examine provider reminder and recall system effectiveness in increasing delivery of hepatitis B vaccinations.

Some studies found additional benefits of provider reminder and recall systems in the form of improved delivery of other preventive services or clinical care, perhaps owing to improved performance of providers and systems in delivering preventive care. We did not look for other positive or negative effects of provider reminder and recall systems.

The findings of our systematic review of economic evaluations are based on three studies.<sup>33,88,221</sup> The first study showed that the adjusted cost per additional vaccination for provider reminders only<sup>88</sup> was \$0.70. This cost is probably an underestimate because it does not include the cost of producing reminders. The second study estimated the cost of an intervention that included both client and provider reminders.<sup>33</sup> The adjusted cost per additional child vaccinated in that study was \$4. The third study<sup>221</sup> estimated the cost of a program that assessed the immunization status of hospitalized children by contacting the children's usual physicians and by reminding hospital physicians to vaccinate the children before they were discharged. The adjusted cost per fully vaccinated child was \$300.

We found two potential barriers to implementing provider reminder and recall systems: the burden placed on administrative systems (e.g., difficulty in placing reminders in clients' charts or providers' difficulty in using the reminders) and lack of an information infrastructure (e.g., computerized records) to generate reminders and recalls.

In conclusion, the Task Force recommends provider reminder and recall systems alone or in combination with other activities on the basis of strong evidence of effectiveness in increasing vaccination coverage. These findings should apply to clients of any age, for whom universally recommended vaccines are appropriate and where improvements in coverage are needed, and should also apply to diverse providers in most settings where vaccinations are provided.

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***Assessment Plus Feedback for Vaccination Providers to Increase Coverage with Universally Recommended Vaccines: Recommended (Strong Evidence of Effectiveness)***

*(See also Assessment Plus Feedback for Vaccination Providers to Increase Coverage with Targeted Vaccines: Recommended as Part of a Combination Approach, as well as Assessment Plus Feedback for Vaccination Providers, When Used Alone, to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness, in Section II of this chapter.)*

Assessment and feedback programs for vaccination providers involve assessing the provider's performance in delivering one or more vaccinations to clients and giving information about that assessment to the provider. Goals of these programs can include changing the provider's knowledge, attitudes, and behavior and stimulating other changes in the way vaccinations are delivered (e.g., use of provider reminders [see Provider Reminder and Recall Systems] or standing orders [see Standing Orders]). Program activities can also include use of financial or other incentives (positive or negative) or benchmarking (comparing a provider's performance to a goal or standard of performance).

Assessments can be conducted for providers in private practices, group practices, managed care organizations, teaching hospitals, or other settings and may be conducted by the provider's staff, the staff of the organization that manages the setting, insurance companies, or others with an interest in improving provider and system success in delivering vaccinations. One good example of provider assessment and feedback can be found at [www.cdc.gov/nip/afix/default.htm](http://www.cdc.gov/nip/afix/default.htm).

***Effectiveness***

- Provider assessment plus feedback, when used alone, is effective in increasing vaccination coverage by approximately 16 percentage points.

- Various combinations of provider assessment plus feedback with other activities are effective in increasing vaccination coverage by approximately 17 percentage points.

#### *Applicability*

- These findings should be applicable to clients of any age, for universally recommended vaccinations delivered by most providers, in most settings where vaccinations are provided and where improvements in coverage are needed.

#### *Other Effects*

- Provider assessment plus feedback can lead to improvements other than vaccine coverage, such as improved delivery of other preventive services or clinical care.

The findings of our systematic review are based on 14 studies that evaluated the effectiveness of provider assessment plus feedback, either alone or in combination with other activities<sup>24,29,36,72,191,209,210,214,219,224,241-244</sup> (most often provider reminder and recall systems, as well as provider education, client reminders, clinic-based education, or incentives). An additional 13 studies were identified but did not meet our quality criteria and were excluded from the review.<sup>75,79,136,223,228,229,234,235,245-249</sup> Four additional reports provided information on studies already included in the review.<sup>81,89,101,250</sup> Provider feedback plus assessment was effective in increasing vaccination coverage, whether used alone (median increase of 16 percentage points; range, 9 to 41) or in combination with other activities (median increase of 17 percentage points; range, 1 to 43). Several studies showed that these improvements could be maintained or increased over several subsequent years.

These results should be applicable to clients of any age for whom universally recommended vaccines are appropriate, seen by many kinds of providers (residents; physicians in internal medicine, family medicine, and general practice; and non-physician providers) in settings where vaccinations are commonly delivered (private practice, managed care organizations, public health clinics, community health centers, and university or other teaching hospitals) and where improvements in coverage are needed. Provider assessment plus feedback was effective in increasing delivery of several vaccines: measles, mumps, and rubella (MMR); diphtheria, tetanus, pertussis (DTP); oral poliovirus (OPV); *Haemophilus influenzae* type B (Hib); influenza; pneumococcal; and the adult formulation of diphtheria and tetanus toxoids (Td). Studies of universally recommended vaccines did not examine the effectiveness of provider assessment plus feedback in increasing delivery of hepatitis B vaccinations.

Some studies looked at additional benefits of provider assessment plus feedback (e.g., improved delivery of other preventive services or clinical care) and found some improvements in these areas. We did not look for other positive or negative effects of provider assessment plus feedback.

We did not find any economic evaluations of these programs.

The lack of an adequate information infrastructure (e.g., computerized records) and the administrative burden placed on providers and systems are potential barriers to implementing provider assessment plus feedback programs.

In conclusion, the Task Force recommends assessment plus feedback for vaccination providers either alone or in combination with other activities, on the basis of strong evidence of effectiveness in increasing vaccination coverage. These findings should be applicable to clients of any age, for whom universally recommended vaccines are appropriate, for many kinds of providers, in settings where vaccines are usually delivered and where improvements in coverage are needed.

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***Provider Education Only to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness***

*(See also Provider Education When Used Alone to Increase Targeted Vaccines Coverage: Insufficient Evidence to Determine Effectiveness in Section II of this chapter.)*

Provider education seeks to increase providers' knowledge and change their attitudes about vaccinations, to get them to deliver more of the appropriate vaccinations to their clients, to stimulate them to use additional approaches to increasing vaccine coverage (e.g., client or provider reminder and recall systems or standing orders), or to improve their interactions with clients so that clients are more willing to accept vaccinations. Educational information for providers can be made available through written materials, computer software, videos, lectures, or continuing medical education programs.

(For more information on provider education programs that include other activities to increase universally recommended vaccine coverage, see Provider Reminder and Recall Systems and Assessment Plus Feedback for Vaccination Providers.)

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of provider education alone in increasing vaccination coverage or improving providers' knowledge and attitudes about vaccinations.
- Evidence was insufficient because of the small number of studies, small effect sizes, variable statistical significance, and few studies measuring outcomes other than knowledge and attitudes.

- Insufficient evidence means that we were not able to determine whether or not the intervention works.
- Provider education combined with provider reminders or provider assessment and feedback, however, can be effective in increasing coverage with universally recommended vaccines.

The findings of our systematic review are based on four studies.<sup>206,251–253</sup> An additional two studies were identified but did not meet our quality criteria and were excluded from the review.<sup>232,254</sup> One additional report provided information on a study already included in the review.<sup>240</sup> Two studies evaluated improvements in vaccination coverage among adults. One found a small and nonsignificant improvement, and the other found that provider education alone produced less improvement in vaccination coverage than did standing orders or provider reminders. The two other studies found small improvements in provider knowledge and attitudes. The programs evaluated in three of the studies were not very intensive. Overall, the evidence was insufficient to determine whether or not provider education, by itself, is effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these programs, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the small number of studies, small effect sizes, variable statistical significance, and few studies measuring outcomes other than knowledge and attitudes provided insufficient evidence for the Task Force to determine the effectiveness of provider education alone in increasing vaccination coverage or improving providers' knowledge and attitudes about vaccinations. It should be noted, though, that provider education can be effective in increasing vaccine coverage when used in combination with provider reminders or provider assessment and feedback (see Provider Reminder and Recall Systems and Assessment Plus Feedback for Vaccination Providers).

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***Standing Orders to Increase Coverage with Universally Recommended Vaccines: Recommended for Adults (Strong Evidence of Effectiveness)***  
***Insufficient Evidence to Determine Effectiveness for Children***

*(See also Standing Orders to Increase Coverage with Targeted Vaccines: Recommended as Part of a Combination Approach, as well as Standing Orders When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness in Section II of this chapter.)*

Standing orders allow professionals who are not physicians (e.g., nurses or pharmacists) to give vaccinations without direct physician involvement at the time of the vaccination. The goal of standing orders is to increase vaccination coverage by reducing missed opportunities and overcoming existing

barriers, such as requirements for a physical examination before vaccinating a client or unavailability of physicians due to other demands on their time.

We reviewed the use of standing orders in clinics, hospitals, and nursing homes. Although dedicated vaccination clinics often operate using standing orders, we did not consider this use to be a provider or system intervention and therefore did not include this setting in our review.

#### *Effectiveness*

- Standing orders, when used alone, were effective in increasing vaccine coverage of adults by approximately 51 percentage points.
- Various combinations of interventions that include standing orders are effective in increasing vaccination of adults by approximately 16 percentage points.
- We found insufficient evidence to determine the effectiveness of standing orders in increasing vaccination coverage among children: the only study included in our review found no overall improvement in vaccination coverage.
- Insufficient evidence means that we were not able to determine whether or not the intervention works to increase vaccination of children through standing orders.

#### *Applicability*

- The recommended intervention should be applicable to adults for whom universally recommended vaccines are appropriate in both inpatient and outpatient settings where improvements in coverage are needed.

The findings of our systematic review are based on 11 studies (in 12 reports) that examined standing orders either alone or combined with other activities.<sup>36,40,47,81,98,155,206,255–259</sup> An additional five studies were identified but did not meet our quality criteria and were excluded from the review.<sup>110,152,233,260,261</sup> Two additional reports provided information on a study already included in the review.<sup>86,262</sup> Used alone, standing orders increased adult vaccination coverage by a median of 51 percentage points (range, 30 to 81). Used in combination—with expanding access in healthcare settings, client reminder and recall systems, clinic-based education, provider education, provider reminder and recall systems, or provider assessment plus feedback—standing orders increased adult vaccination coverage by a median of 16 percentage points (range, 6 to 26). Most studies were less than a year long, but one found that improvement continued over a five-year period. Alone or combined with other interventions, standing orders are effective in increasing adult vaccination coverage.

We found only one study that evaluated standing orders for vaccinations for children, which showed no overall improvement in vaccination coverage.

Because vaccination protocols in children are more complex than such protocols in adults, and because the single available study showed no improvement in coverage, the evidence was insufficient to determine the effectiveness of standing orders in increasing vaccination coverage among children.

These findings should be applicable to delivery of influenza and pneumococcal polysaccharide vaccines to adults in hospitals, nursing homes, and outpatient settings including private practices, managed care organizations, Veterans' Administration clinics, and university-related clinics where improvements in coverage are needed. No studies looked at using standing orders to increase delivery of vaccines to adolescents or to increase delivery of hepatitis B vaccinations or the adult formulation of diphtheria and tetanus toxoids (Td).

We did not look for any other positive or negative effects of standing orders and did not find any economic evaluations of these programs.

The burden placed on providers and healthcare systems, difficulties in fostering inter-professional communication and sharing of responsibilities, and challenges of reconciling these programs with local legal and regulatory structures can present barriers to implementing standing orders programs.

In conclusion, the Task Force recommends standing orders to increase vaccination coverage among adults on the basis of strong evidence of effectiveness. This finding should be applicable to adults in both inpatient and outpatient settings where improvements in coverage are needed.

The Task Force, however, found insufficient evidence to determine the effectiveness of standing orders in increasing vaccination coverage among children.

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## **CONCLUSION: UNIVERSALLY RECOMMENDED VACCINES**

This first section of the chapter summarizes Task Force conclusions and recommendations on interventions to increase delivery of universally recommended vaccines for children, adolescents, and adults. To increase community demand for these vaccinations the Task Force recommends client reminder and recall systems; multicomponent interventions that include education; and vaccination requirements for child care, school, and college attendance; insufficient evidence exists at this time to determine the effectiveness of community-wide education; clinic-based education; client or family incentives; or client-held medical records. To enhance access to vaccination services, the Task Force recommends reducing client out-of-pocket costs, expanding access as part of a multicomponent intervention, vaccination pro-

grams in WIC settings, vaccination programs in schools, and home visits; insufficient evidence is available to determine the effectiveness of expanding access as a single-component intervention or of vaccination programs in child care centers. To improve the performance of providers and systems in delivering vaccines, the Task Force recommends provider reminder and recall systems, assessment plus feedback for vaccination providers, and standing orders for adults; insufficient evidence was found to determine the effectiveness of either standing orders for children or provider education by itself. Details of these reviews have been published<sup>20,263,264</sup> and these articles, along with additional information about the reviews, are available at [www.thecommunityguide.org/vaccine](http://www.thecommunityguide.org/vaccine). Updates and expansions of this chapter are in progress and will also be available at that site. Additional information about using these recommendations is available at the end of this chapter.

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## **SECTION II: TARGETED VACCINES: IMPROVING TARGETED INFLUENZA, PNEUMOCOCCAL POLYSACCHARIDE, AND HEPATITIS B VACCINATION COVERAGE AMONG HIGH-RISK ADULTS**

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*(See summary list of interventions at the beginning of this chapter.)*

Section I of this chapter considered effective approaches to increasing coverage of universally recommended vaccines (those that should be administered to all people in a given age group). Now we turn to targeted vaccines, those given to specific groups with factors that make them particularly susceptible to a disease (at-risk or high-risk populations). Note that it is not actually the vaccines themselves that change, but rather their indicated use. For example, the influenza vaccine is *universally recommended* for all people over age 50 and is also *targeted* to people under age 50 who have specific health problems. Interventions and policies to promote targeted vaccines are likely to be more complex than similar interventions to promote universally recommended vaccines. For example, interventions to improve coverage with universally recommended vaccines might need no more information about the target population than age; programs to promote targeted vaccines might require information on age, risk factors, and vaccination history.

Three vaccine-preventable diseases—influenza, pneumococcal infections, and hepatitis B—cause significant illness and premature death each year in the United States. The people most likely to develop these diseases can be identified by specific risk factors, and prevention of the diseases can be enhanced by increasing vaccine coverage in the at-risk groups.<sup>265</sup>

Annually, influenza may cause as many as 36,000 deaths in the United States<sup>5</sup> and hospitalize as many as 114,000 people.<sup>266</sup> The most vulnerable

groups are adults age 65 and older, and younger people with medical conditions such as diabetes, heart disease, or lung disease.<sup>267–269</sup>

More than 7000 people in the United States die every year as a result of invasive pneumococcal disease.<sup>270</sup> Pneumococcal infections account for more than 100,000 hospitalizations for pneumonia and more than 60,000 cases of bacteremia and other forms of invasive pneumococcal diseases annually.<sup>271–273</sup> Risk factors for complications of pneumococcal infections are similar to those for influenza, and include age and chronic illnesses such as diabetes, heart disease, and lung disease.<sup>267,268,274</sup>

As many as 1.25 million people in the United States are chronically infected with hepatitis B virus (HBV),<sup>275</sup> and 5000 die of HBV-related cirrhosis or liver cancer annually.<sup>276,277</sup> An estimated 73,000 new HBV infections occurred in 2000.<sup>278</sup> The most commonly reported risk factors for hepatitis B include heterosexual activity (39.8%), sexual activity between men (14.6%), and injection drug use (13.8%).<sup>279</sup> Infection with HBV is also an occupational risk for health, rescue, and law enforcement personnel who deliver either routine or emergency care.

Annual vaccination to prevent influenza is recommended<sup>280</sup> for people over 50 years of age and for younger people with certain chronic conditions, especially during the active flu season between October and March. Influenza coverage rates among adults under 65 years of age with high-risk conditions remain well below the *Healthy People 2010*<sup>6</sup> goal of 60%.<sup>281</sup> In 2000, vaccination coverage for adults aged 18–49 years with high-risk conditions was 24.7%, and among adults aged 50–64 with high-risk conditions, coverage rates were only 43.9%.<sup>266</sup>

Similarly, in 2000, only 12.3% of people aged 18–49 years with high-risk conditions had ever been vaccinated with the pneumococcal polysaccharide vaccine, and only 26% of those aged 50–64 with high-risk conditions had been vaccinated; in contrast, coverage among people over the age of 65 was 52.9%.<sup>282</sup> It is worth noting, however, that vaccination coverage rates among people over the age of 65 largely reflect vaccination coverage of non-Hispanic whites, 56.8% of whom have been vaccinated, whereas only 30.4% of Hispanics and 30.7% of non-Hispanic blacks have received the vaccine.

The impact of a policy to deliver hepatitis B vaccine routinely to healthcare workers can be seen in the dramatic decline of HBV infections among these workers after such vaccination became routine: from 17,000 in 1983 to only 400 in 1995.<sup>283</sup> Despite the availability of this effective vaccine, vaccination coverage rates for HBV still remain low in most targeted populations. Two small local studies showed vaccination coverage rates of only 9% of men who have sex with men in 1998<sup>284</sup> and only 6% among injection drug users in 1998–2001.<sup>285</sup>

Over the past decade, improvements in vaccination coverage for adults have also been unevenly distributed. Although coverage rates for influenza and pneumococcal polysaccharide vaccines have steadily improved among adults over 65 years of age, improvements in vaccination coverage among younger adults with risk conditions have been less dramatic and coverage rates remain low.<sup>281</sup> Similarly, significant increases in vaccination coverage for HBV among healthcare workers have not been matched in harder-to-reach populations engaging in high-risk behaviors.

## **OBJECTIVES AND RECOMMENDATIONS FROM OTHER ADVISORY GROUPS**

The interventions recommended in this chapter can be used to reach objectives set out in *Healthy People 2010*<sup>6</sup> (Table 6-1). These targeted vaccines objectives are also priorities for the National Immunization Program (NIP) of the Centers for Disease Control and Prevention (CDC). In addition, the recommendations complement information from other advisory groups, including the following:

### ***Recommendations for Adolescent and Adult Vaccinations***

These recommendations are published by the Advisory Committee on Immunization Practices (ACIP) of the U.S. Department of Health and Human Services (DHHS)/CDC,<sup>10,11</sup> the American College of Physicians,<sup>12</sup> Infectious Disease Society of America,<sup>12,13</sup> the American Academy of Family Physicians (AAFP),<sup>9</sup> and the American College of Obstetricians and Gynecologists.<sup>14</sup> Vaccination recommendations for adolescents are now coordinated among ACIP, AAFP, and the American Medical Association.

### ***Recommendations for Interventions to Improve Vaccination Coverage***

These recommendations have been developed by the Canadian Community Health Practice Guidelines Working Group,<sup>15,16</sup> ACIP,<sup>17,18</sup> and the National Vaccine Advisory Committee.<sup>19</sup>

## **METHODS**

Methods used for the reviews are summarized in Chapter 10. Specific methods used in the systematic reviews are described elsewhere<sup>286</sup> and are available at [www.thecommunityguide.org/vaccine](http://www.thecommunityguide.org/vaccine). For this review of interventions to increase targeted vaccines coverage among high-risk adults, we adopted the conceptual approach used in the reviews of evidence on effectiveness of interventions to improve universally recommended vaccines coverage, the

topic of the first section of this chapter (see also Briss et al., 2000<sup>20</sup>). The logic framework (Figure 6–1) shows the strategy and intervention options available for efforts to increase targeted vaccination coverage in populations at high risk, which is the same as that for universally recommended vaccines.

In interpreting the results of our systematic reviews of interventions to increase targeted vaccine coverage, we found that only 1 of 11 interventions, when implemented alone, provided evidence of effectiveness strong enough for the Task Force to recommend use of the intervention (Provider Reminders, described below). Among the other 10 interventions, too few studies with sufficient quality of design and execution were available to formulate a recommendation (all described below). Many of the studies in the review evaluated the use of more than one intervention (multicomponent interventions). In these published reports of multicomponent interventions, we found that the effects of the individual interventions could not be calculated separately from the overall effect. Yet, as we worked with the data on the effectiveness of the multicomponent interventions, we saw that they frequently combined interventions from at least two of our three categories: increasing client demand for vaccinations, enhancing access to vaccination services, and provider- or system-based interventions. We analyzed the various combinations used, and discovered that the effective combinations usually combined one or more interventions to enhance access with one or more provider- or system-based interventions and/or one or more interventions to increase client demand (a more complete discussion of this process can be found elsewhere<sup>286</sup>). This qualitative approach to data analysis allowed us to formulate a recommendation that encompasses the three categories and provides a “menu” of options from which users can choose (see Increasing Targeted Vaccines Coverage Through Multiple Interventions Implemented in Combination below).

### **ECONOMIC EFFICIENCY**

We found no economic evaluations of interventions recommended for increasing targeted vaccine coverage and therefore present no economic data in this section of the chapter.

### **RECOMMENDATIONS AND FINDINGS**

This section presents a summary of the findings of the systematic reviews conducted to determine the effectiveness of interventions to increase coverage with vaccinations targeted to high-risk populations. These interventions are grouped into four categories: increasing community demand for vaccinations; enhancing access to vaccination services; provider- or system-based in-

terventions; and increasing targeted vaccines coverage through multiple interventions implemented in combination.

### ***Targeted Vaccines: Increasing Community Demand for Vaccinations***

Interventions to increase demand for vaccination services provide information and advice to individual clients or to people within a community who are at risk. Within this category, we reviewed interventions that use clinic-based or community-wide client education, client reminder systems, client incentives, and vaccination requirements.

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#### ***Clinic-Based Client Education When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(See also Clinic-Based Education When Used Alone to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness in Section I of this chapter.)*

Clinic-based education interventions provide information on vaccinations to clients while they are being served in a medical or public health clinic setting. These interventions help clients to identify their risk status and determine whether they should get specific vaccines. The interventions also educate clients about the potential benefits of vaccination. Such education can reduce or remove barriers to vaccination by changing negative attitudes and beliefs. These interventions may use a variety of formats such as letters, newsletters, brochures, and posters.

#### ***Effectiveness***

- We found insufficient evidence to determine the effectiveness of clinic-based client education alone in increasing targeted vaccines coverage.
- Evidence was insufficient because of the small number of available studies.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

The findings of our systematic review are based on two studies that examined the effectiveness of clinic-based client education when used alone.<sup>287,288</sup> In both studies, brochures were used to provide education to clients. One study also evaluated two versions of health information brochures given to healthcare providers for use with their clients. The two brochure versions were associated with increases of 2 and 10 percentage points, respectively, in the proportion of clients screened or vaccinated for hepatitis B. The second study evaluated the effect on subsequent receipt of pneumococcal vaccination of an educational brochure given to clients. In this study, vaccination rates among clients with at-risk medical conditions improved by 16.1 per-

centage points compared with rates among clients who were not given the brochure. The small number of studies, however, does not provide enough evidence to determine the effectiveness of the intervention.

Because we could not establish the effectiveness of these programs, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of clinic-based client education when used alone to increase vaccination coverage among adult populations at high risk. The evidence was considered insufficient because of the small number of available studies. (Clinic-based client education when combined with additional interventions is reviewed below. See *Increasing Targeted Vaccines Coverage through Multiple Interventions Implemented in Combination*.)

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***Client Reminder Systems When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(Client reminder and recall systems are recommended for increasing coverage with universally recommended vaccines. See Section I of this chapter.)*

Client reminder systems for targeted vaccines provide information or advice directly to individual clients at high risk to encourage them to obtain appropriate vaccinations. Examples of client reminders include letters or postcards sent from a provider's office, healthcare system, or insurance carrier. In this review, we categorized as client reminders those interventions that identified and notified individual clients at high risk and included a vaccination recommendation developed for the client by his or her healthcare provider or system.

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of client reminder systems alone in increasing targeted vaccination coverage.
- Evidence was insufficient because of the small number of available studies.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

The findings of our systematic review are based on one study evaluating the effectiveness of client reminder systems when used alone.<sup>37</sup> In this study, clients identified as being at high risk for influenza received a postcard with a personal message signed by their physician. At follow-up, self-reported vaccination for influenza improved by 3.7 percentage points compared with clients who did not receive a postcard reminder. This single study, however,

provided insufficient evidence to determine whether or not client reminders, by themselves, are effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these interventions, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of client reminder systems when used alone to increase vaccination coverage among high-risk adults because of the small number of available studies. (Client reminder systems when combined with additional interventions are reviewed below. See *Increasing Targeted Vaccines Coverage through Multiple Interventions Implemented in Combination*.)

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***Community-Wide Education When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(See also Community-wide Education When Used Alone to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness in Section I of this chapter.)*

Community-wide education interventions provide information to most or all of a target group of people in a geographic area, which can include vaccination providers in addition to clients. Educational messages can be delivered by various methods (e.g., mail, radio, newspapers, television, and posters). The goal of community-wide education is to increase or improve the availability of information about vaccinations and increase people's knowledge, thereby increasing their acceptance of and demand for vaccinations and, ultimately, increasing vaccination coverage.

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of community-wide education interventions alone in increasing targeted vaccines coverage.
- Evidence was insufficient because no studies were available.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

We did not find any studies that evaluated community-wide education when used alone, and therefore had insufficient evidence to determine whether or not this intervention is effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these interventions, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of community-wide education when used alone to increase targeted vaccines coverage among high-risk adults because no studies were available.

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***Client or Family Incentives When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(See also Client or Family Incentives to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness in Section I of this chapter.)*

These interventions use financial or other incentives to motivate people at risk to accept vaccinations. Incentives may be positive (rewards) or negative (penalties). This approach is based on the idea that clients will be motivated to seek vaccinations if they receive rewards (e.g., money or discount coupons for retail establishments) or face penalties (e.g., being excluded from participation in a program).<sup>289</sup>

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of client or family incentives alone in increasing targeted vaccines coverage.
- Evidence was insufficient because of the small number of available studies.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

The findings of our systematic review are based on one study evaluating the effectiveness of client incentives when used alone.<sup>289</sup> This study evaluated the implementation of a \$10 incentive to increase hepatitis B vaccination coverage among recruited injection drug users; the incentive increased vaccinations by 35 percentage points. Although this is a relatively large increase, this single study alone did not provide enough evidence for the Task Force to determine whether or not client incentives by themselves are effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these interventions, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of client incentives when used alone to increase targeted vaccines coverage among adults at high risk because of the small number of available studies.

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***Vaccination Requirements When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(Vaccination requirements for child care, school, and college attendance are recommended to increase coverage with universally recommended vaccines. See Section I of this chapter.)*

These laws or policies require vaccinations or other documentation of immunity (or documentation of refusing a vaccination) as a condition of attendance, participation, or employment. Although some hospitals have policies requiring staff to be vaccinated against influenza, no state or federal laws in the United States require high-risk adults to receive influenza, pneumococcal polysaccharide, or hepatitis B vaccines. Current standards of the Occupational Safety and Health Administration<sup>290</sup> mandate that employers offer the hepatitis B vaccination series, at no cost, to any employee whose work is likely to include exposure to blood or other potentially infectious materials,<sup>291</sup> although employees can decline the vaccination. The impact of this policy can be seen in the dramatic decline of HBV infections among healthcare workers, from 17,000 in 1983 to only 400 in 1995.<sup>283</sup>

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of vaccination requirements, when used alone, in increasing targeted vaccines coverage.
- Evidence was insufficient because there were no qualifying studies.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

We found no studies that qualified for our systematic review, and therefore had insufficient evidence to determine whether or not vaccination requirements, by themselves, are effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these policies, we did not examine circumstances in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of vaccination requirements alone in increasing vaccination coverage among high-risk adults because no qualifying studies were identified.

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***Targeted Vaccines: Enhancing Access to Targeted Vaccination Services***

Interventions that enhance access to vaccination services are designed to reduce the cost or to increase the convenience of being vaccinated. We reviewed interventions that reduce out-of-pocket costs to the client and those that expand access to vaccination services in healthcare settings.

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***Reducing Client Out-of-Pocket Costs When Used Alone to Increase Targeted Vaccines Coverage: Insufficient Evidence to Determine Effectiveness***

*(Reducing out-of-pocket costs is recommended to increase coverage with universally recommended vaccines. See Section I of this chapter.)*

Methods to reduce out-of-pocket vaccination costs to clients include paying for vaccinations or administration, providing insurance coverage, or reducing co-payments for vaccinations at the point of service. Reducing client out-of-pocket costs can increase vaccination coverage by improving availability of vaccinations, by increasing the demand for them, or both.

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of reducing out-of-pocket vaccination costs alone in increasing targeted vaccines coverage.
- Evidence was insufficient because no studies were identified.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

We did not find any studies that evaluated reducing client out-of-pocket costs and therefore had insufficient evidence to determine whether or not these programs are effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these programs, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of reducing client out-of-pocket costs, when used alone, in increasing targeted vaccines coverage among high-risk adults, because no studies were identified. (Reducing client out-of-pocket costs when combined with additional interventions is reviewed below. See Increasing Targeted Vaccines Coverage through Multiple Interventions Implemented in Combination.)

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***Expanding Access in Healthcare Settings When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(Expanding access in healthcare settings to increase coverage with universally recommended vaccines is recommended as part of a multicomponent intervention; when used alone, we found insufficient evidence to determine effectiveness in increasing coverage with universally recommended vaccines. See Section I of this chapter.)*

Interventions that expand access focus on increasing the availability of vaccinations in medical or public health clinic settings. These interventions are designed to remove important barriers to obtaining vaccinations, including inconvenient clinic hours or locations and burdensome administrative re-

quirements. These barriers are particularly significant among clients who do not visit clinics on a regular basis or who have transportation problems or other difficulties getting to appointments. Interventions to expand access in healthcare settings do so by (1) reducing the distance from the healthcare setting to the population, (2) increasing or changing hours for vaccination services, (3) delivering vaccinations in clinical settings that did not previously provide them (e.g., emergency departments, inpatient units, or subspecialty clinics), or (4) reducing administrative barriers to obtaining vaccination services within clinics (e.g., by developing a drop-in clinic or an express lane vaccination service).

#### *Effectiveness*

- We found insufficient evidence to determine the effectiveness of expanding access in healthcare settings, when used alone, in increasing targeted vaccines coverage among high-risk clients.
- Evidence was insufficient because no studies were identified for review.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

We did not find any studies that evaluated expanding access in healthcare settings, when used alone, and therefore had insufficient evidence to determine whether or not these programs, by themselves, are effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these interventions, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of expanding access in healthcare settings, when used alone, in increasing vaccination coverage of high-risk adults because no studies were identified for review. (Expanded access in healthcare settings when combined with additional interventions is reviewed below. See *Increasing Targeted Vaccines Coverage through Multiple Interventions Implemented in Combination.*)

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#### ***Targeted Vaccines: Provider- or System-Based Interventions***

Healthcare providers can play a vital role in ensuring that high-risk adults receive appropriate vaccinations. Unfortunately, for a variety of reasons, providers often miss opportunities to vaccinate clients. Provider-based interventions, implemented primarily through healthcare systems, are designed to encourage healthcare providers to actively ensure that clients who are at risk

get needed vaccinations. We reviewed four provider- or system-based interventions used alone: provider reminder systems, provider education, assessment plus feedback for vaccination providers, and standing orders.

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***Provider Reminder Systems When Used Alone to Increase Coverage with Targeted Vaccines: Recommended (Strong Evidence of Effectiveness)***

*(Provider reminder and recall systems are also recommended to increase coverage with universally recommended vaccines. See Section I of this chapter.)*

Provider reminders to administer vaccines to high-risk clients let providers or other appropriate staff know when individual clients are due for vaccinations. Reminder techniques can include notations in clients' charts, stickers or other prompts attached to clients' charts, standardized checklists generated by clinical staff, or computer databases and registries. Reminders can be directed at the primary healthcare provider or clinic staff. All of the reminder systems we reviewed provided information to the provider at the time of the scheduled appointment.

*Effectiveness*

- When used alone, provider reminder systems are effective in increasing targeted vaccines coverage among high-risk adults by approximately 22 percentage points.

*Applicability*

- These findings should be applicable to providers and staff in most health-care settings where improvements in coverage are needed.

*Other Effects*

- Provider reminder systems can also improve delivery of other preventive services or clinical care through use of additional reminders.

The findings of our systematic review are based on seven studies that examined the effectiveness of provider reminder systems alone in increasing targeted vaccines coverage.<sup>25,203,207,211,213,237,238</sup> Several types of provider reminder systems were examined in the qualifying studies, including attachments to clients' charts generated by computer programs or clinic staff and a reminder questionnaire designed as a letter from a colleague.

Two studies measured changes in influenza vaccine coverage, and one study measured differences or changes in pneumococcal vaccine coverage. Four studies provided measurements of differences or changes in coverage for both influenza and pneumococcal vaccinations. Overall, the nine study arms in the seven qualifying studies reported a median improvement in targeted vaccines coverage of 22 percentage points (range, 8 to 72), indicating

that provider reminder systems, by themselves, are effective in increasing vaccination coverage.

These findings should be applicable to providers and staff in most healthcare settings where improvements in coverage are needed. All studies were implemented and evaluated in academic healthcare settings, including hospitals and clinics, and all evaluated the effectiveness of provider reminder systems on resident and faculty physicians and nurses. The client populations in the qualifying studies were patients with chronic illnesses. It should be noted, however, that none of the studies identified in this review evaluated outcomes of hepatitis B vaccination coverage in high-risk populations.

Provider reminder systems may provide an additional benefit in that they allow for prompts to deliver additional preventive services or clinical care. In three of the reviewed studies, provider reminder systems also included prompts for fecal occult blood tests (FOBT), Pap tests, mammography, dental exams, tetanus boosters, cancer screening, and measurements of serum cholesterol. Our review did not find any harms associated with provider reminder systems.

We did not find any economic evaluations of this intervention.

Potential barriers to the implementation of provider reminder systems include the concerns of some providers about the efficacy<sup>211,257</sup> and safety<sup>207</sup> of pneumococcal vaccination. Clients may also refuse to receive vaccinations.<sup>203,207</sup> The costs associated with implementation of reminder systems can also be a barrier.

In conclusion, the Task Force recommends provider reminder systems, when used alone, on the basis of strong evidence of effectiveness in increasing targeted vaccines coverage among high-risk adults. These findings should be applicable to providers and staff in most healthcare settings where improvements in coverage are needed. (Provider reminder systems when combined with additional interventions are also recommended. See *Increasing Targeted Vaccines Coverage through Multiple Interventions Implemented in Combination*.)

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***Provider Education When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(See also Provider Education When Used Alone to Increase Coverage with Universally Recommended Vaccines: Insufficient Evidence to Determine Effectiveness in Section I of this chapter.)*

Provider education seeks to increase providers' knowledge and change their attitudes about vaccinations, to get them to deliver more of the appropriate vaccinations to their clients or improve their interactions with clients so that

clients are more willing to accept vaccinations. Giving information to providers can result in fewer missed vaccination opportunities and a greater proportion of eligible clients receiving appropriate vaccinations. Information can be delivered through written materials, videos, lectures, continuing medical education programs, and computerized software.

#### *Effectiveness*

- We found insufficient evidence to determine the effectiveness of provider education alone in increasing targeted vaccines coverage.
- Evidence was insufficient because no studies were identified for review.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

We did not find any studies that evaluated provider education interventions when used alone, and therefore had insufficient evidence to determine whether or not these programs are effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these interventions, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of provider education, when used alone, in increasing targeted vaccines coverage among high-risk adults because no studies were identified for review.

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#### ***Standing Orders When Used Alone to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(Standing orders to increase coverage with universally recommended vaccines are recommended for adults; for children, we found insufficient evidence to determine effectiveness. See Section I of this chapter.)*

Standing orders allow professionals who are not physicians (e.g., nurses or pharmacists) to give vaccinations without direct physician involvement at the time of the vaccination. Standing orders can increase vaccination coverage by reducing missed opportunities and overcoming existing barriers, such as a requirement for a physical exam before receiving a vaccination or limited availability of physicians due to other demands.

#### *Effectiveness*

- We found insufficient evidence to determine the effectiveness of standing orders alone in increasing targeted vaccines coverage.
- Evidence was insufficient because no studies were identified for review.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

We did not find any studies that evaluated standing orders when used alone, and therefore had insufficient evidence to determine whether or not these programs are effective in increasing vaccination coverage.

Because we could not establish the effectiveness of these interventions, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of standing orders, when used alone, in increasing targeted vaccines coverage among high-risk adults, because no studies were identified in this review. (The effectiveness of standing orders when combined with additional interventions is reviewed below. See *Increasing Targeted Vaccines Coverage through Multiple Interventions Implemented in Combination.*)

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***Assessment Plus Feedback for Vaccination Providers When Used Alone, to Increase Coverage with Targeted Vaccines: Insufficient Evidence to Determine Effectiveness***

*(Assessment plus feedback for vaccination providers is recommended to increase coverage with universally recommended vaccines. See Section I of this chapter.)*

Assessment plus feedback programs for vaccination providers assess the provider's performance in delivering one or more vaccinations to clients and provide assessment results to the provider. Assessment plus feedback can result in improvements in vaccination coverage by changing provider knowledge, attitudes, and behaviors and by stimulating additional improvements in the vaccination delivery system (e.g., through reminders or standing orders).

***Effectiveness***

- We found insufficient evidence to determine the effectiveness of provider assessment plus feedback programs alone in increasing targeted vaccines coverage.
- Evidence was insufficient because only one study was identified for review, and it had limitations in the quality of execution.
- Insufficient evidence means that we were not able to determine whether or not the intervention works.

The findings of our systematic review are based on one study evaluating the effectiveness of assessment plus feedback for vaccination providers when used alone.<sup>242</sup> This study evaluated the effect on influenza and pneumococcal polysaccharide vaccine coverage of annual chart reviews and feedback to resident physicians. Vaccination coverage improved among at-risk patients by 32 percentage points for influenza vaccine and 18 percentage points for pneumococcal polysaccharide vaccine. Although the findings from this study are encouraging, they do not, in themselves, provide adequate evidence for

the Task Force to determine whether or not assessment plus feedback for providers is effective in increasing vaccination coverage when used alone, because the study had limitations in the quality of its execution.

Because we could not establish the effectiveness of these interventions, we did not examine situations in which they would be applicable, information about economic efficiency, or possible barriers to implementation.

In conclusion, the Task Force found insufficient evidence to determine the effectiveness of assessment plus feedback for vaccination providers, when used alone, in increasing targeted vaccines coverage among high-risk patients, because only one study with limitations in the quality of study execution was identified for review. (The effectiveness of assessment plus feedback for vaccination providers when combined with additional interventions is reviewed below. See Increasing Targeted Vaccines Coverage through Multiple Interventions Implemented in Combination.)

### ***Increasing Targeted Vaccines Coverage through Multiple Interventions Implemented in Combination***

#### ***Interventions to Increase Vaccine Coverage When Implemented in Combination: Recommended (Strong Evidence of Effectiveness)***

Most of the available evidence on effectiveness identified in this review comes from studies evaluating interventions implemented in combination rather than alone. The limited evidence on the effectiveness of interventions when used alone, and the variety of intervention combinations evaluated, led us to develop a “menu option” approach (discussed above under “Methods” and in greater detail in Ndiaye et al.<sup>286</sup>). The complete Task Force recommendation is written as follows, and the options themselves are shown in Table 6–2:

The Task Force recommends one or more interventions to enhance access to targeted vaccination services combined or coordinated with one or more provider- or system-based interventions and/or one or more interventions to increase community demand for targeted vaccination services, on the basis of strong evidence of effectiveness in increasing targeted vaccination coverage.

#### ***Effectiveness***

- The combinations of interventions described in Table 6–2 were consistently effective in increasing targeted vaccines coverage.

**Table 6–2.** Menu Format of Intervention Combinations Recommended by the Task Force on Community Preventive Services to Increase Targeted Vaccinations

One or both of these interventions to enhance access to vaccination services	Expanded access in healthcare settings Reducing client out-of-pocket costs
Plus	
One or more of these provider- or system-based interventions	Standing orders Provider reminder systems Provider assessment and feedback
And/Or	
One or both of these interventions to increase client demand for vaccination services	Client reminder systems Client education

- Only one of these interventions (provider reminder systems), when used alone, had sufficient evidence to determine effectiveness (see Provider Reminder Systems When Used Alone to Increase Coverage with Targeted Vaccines).

*Applicability*

- These results should be applicable in most client and provider populations and most settings where improvements in coverage are needed.

The findings of our systematic review are based on 23 studies evaluating interventions to increased targeted vaccines coverage when implemented in combination (multicomponent interventions).<sup>24 - 26,31,37,44,47,57,135,257,262,290,292 - 302</sup> Twenty-four other studies were identified but did not meet our quality criteria and were excluded from the review.<sup>112,114,137,206,224,225,232,236,256,303 - 317</sup> Two additional papers provided information on studies already included in the review.<sup>86,152</sup>

Overall, the 23 qualifying studies provided 26 study arms evaluating 22 different combinations of interventions. A total of seven study arms in seven studies evaluated one of three specific intervention combinations: two studies evaluated a combination of client reminders and provider reminders; two used a combination of client education, client reminders, and expanded access in a healthcare setting; and three used a combination of client education, client reminders, expanded access, and reduced client out-of-pocket costs. In the remaining 19 study arms, the intervention combinations evaluated were unique.

As mentioned above, we conducted additional analyses to examine the combinations of interventions described in the qualifying studies. The effectiveness of interventions combined across two or three conceptual categories of vaccination demand and delivery was evaluated in 21 of the 23 qualifying studies (24 of 26 study arms). A total of 19 study arms from 16 qualifying

studies evaluated the effectiveness of combinations that included one or more interventions to enhance access to vaccination services with one or more interventions from one or both of the other two categories. Within this subset of combined interventions, the median improvement in vaccination coverage was 16.5 percentage points (range, -5.9 to +67.0). This combined approach is recommended by the Task Force on the basis of strong evidence of effectiveness.

The reviewed studies provided insufficient evidence to determine the effectiveness of the following combinations because of the small number of qualifying studies or inconsistent effects on vaccination coverage among populations at high risk. Only two qualifying studies evaluated interventions combined *within* conceptual categories: the combination of client education and client reminders showed an improvement of 13.6 percentage points, and the combination of provider education and provider assessment plus feedback showed an improvement of 11 percentage points. In five studies, an intervention to increase client demand was combined with one or two provider- or system-based interventions. The median increase in vaccination coverage reported in these studies was 3.7 percentage points (range, -2.0 to +28.9).

In addition, the available studies provided insufficient evidence to determine the effectiveness of client incentives or community-wide education as options for interventions to increase demand for vaccination because of the small number of qualifying studies.

Finally, the available studies provided insufficient evidence to assess the effectiveness of provider education as an option for provider- or system-based interventions because the small number of qualifying studies reported results that were inconsistent and small in magnitude when compared with other intervention combinations.

Although we could not attribute incremental improvements in vaccine coverage to the specific components, we did find that combined activities improved vaccination coverage. This could reflect any of the following:

- The combined activities reinforce one another (e.g., education alone might not be enough to increase acceptance of vaccinations but could make clients more receptive to other components);
- Multicomponent interventions are delivered more intensively than single-component interventions;
- More studies have been done of multicomponent than of single-component interventions; or
- Multicomponent interventions might increase the likelihood of a client's exposure to at least one component.

These results should be applicable in most client and provider populations and most settings where improvements in coverage are needed. Interventions

were evaluated among outpatients, inpatients, healthcare workers, nurses, and faculty physicians. Evaluated healthcare settings included academic programs, outpatient clinics, hospitals, and long-term care facilities.

No additional positive or negative effects specific to the combination of interventions were identified in this review. (Positive or negative effects of single-component interventions, which may remain relevant, are examined above for each intervention.)

We found economic evaluations of the effects of these combined interventions, but none of them met our quality criteria. We did not, therefore, report results of these economic evaluations.

Barriers to the implementation of single-component interventions (described above) are likely to be relevant to combinations of interventions. Additional barriers, such as lack of infrastructure, may also be encountered in efforts to combine and coordinate two or more interventions.

In conclusion, the Task Force recommends one or more interventions to enhance access to targeted vaccination services combined or coordinated with one or more provider- or system-based interventions, and/or one or more interventions to increase community demand for targeted vaccination services, on the basis of strong evidence of effectiveness in increasing targeted vaccines coverage among adult populations at high risk. These findings should be applicable to most client populations for which targeted vaccines are indicated and where improvements in coverage are needed, and to diverse provider populations and healthcare settings.

## **CONCLUSION: TARGETED VACCINES**

The second section of this chapter summarizes Task Force conclusions and recommendations on interventions to increase delivery of targeted vaccines for adolescents and adults. The most effective interventions were provider reminders and those that combined one or more interventions to enhance access to vaccination services (expanded access in healthcare settings, reducing client out-of-pocket costs) with at least one provider- or system-based intervention (standing orders, provider reminder systems, provider assessment plus feedback) and/or at least one intervention to increase client demand for vaccination services (client reminder systems, client education). The Task Force found insufficient evidence to determine the effectiveness of all but one intervention when used alone to increase targeted vaccines coverage: among provider- or system-based interventions, the Task Force found strong evidence of the effectiveness of provider reminders. Evidence was insufficient to

determine the effectiveness of any of the following interventions when used alone: increasing community demand for targeted vaccines through client reminders, clinic-based education, community-wide education, client or family incentives, or vaccination requirements; enhancing access to targeted vaccination services by expanding access in healthcare settings or reducing client out-of-pocket costs; or improving provider- or system-based delivery of targeted vaccines through assessment plus feedback for vaccination providers, provider education, or standing orders. Details of these reviews are being published<sup>265,286,318</sup> and these articles, along with additional information about the reviews, are available at [www.thecommunityguide.org/vaccine](http://www.thecommunityguide.org/vaccine). Updates and expansions of this chapter are in progress and will also be available at that site.

### **INCREASING VACCINATION COVERAGE THROUGH USE OF THESE RECOMMENDATIONS**

Putting the recommendations in this chapter into practice offers many opportunities for increasing vaccination coverage among children, adolescents, and adults. Many decision makers, policy makers, planners, and implementers in communities and healthcare systems can carry out recommended interventions. A detailed list of interventions and potential implementers is shown in Table 6–3. Following the four steps shown below can help ensure that recommended interventions will achieve their goals.

#### ***Assess Activities, Coverage, and Vaccine-Preventable Disease in the Community***

As a first step, states, communities, and healthcare systems can assess the current vaccination-related activities, levels of vaccination coverage, and rates of vaccine-preventable disease, both within their organizations or groups and throughout the community as well. To help determine where local changes and improvements are needed, these rates can be compared with relevant goals, such as those in *Healthy People 2010* (Table 6–1). Next, the recommendations in this chapter can be compared with current interventions and activities to answer two questions: Are the interventions already in place adequately implemented and funded? and What other recommended interventions, if any, should we try?

Another key question to ask is whether special efforts should be made to reach and vaccinate groups at high risk of not receiving the vaccinations they need, of being exposed to a disease, or both. For example, most vaccine-preventable diseases are primarily spread by person-to-person contact among unvaccinated people. Crowding and low vaccination coverage levels can be

**Table 6–3.** Examples of Implementers and Specific Interventions That Might Benefit Them

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*Healthcare Systems*

Client reminder and recall systems (managed care and provider offices)  
Multicomponent interventions that include education  
Reducing out-of-pocket costs  
Expanding access plus multicomponent intervention  
Home visits  
Provider reminder and recall systems (managed care and provider offices)  
Assessment plus feedback for providers (managed care and provider offices)  
Standing orders for adult vaccinations (managed care, provider offices, and hospitals)

*Insurers*

Client reminder and recall systems  
Reducing out-of-pocket costs  
Assessment plus feedback for providers

*Employers*

Client reminder and recall systems  
Reducing out-of-pocket costs

*Public Health Departments*

Multicomponent interventions that include education  
Vaccination requirements for child care, school, and college attendance  
Expanding access plus multicomponent intervention  
Vaccination programs in schools  
Home visits

*Community Organizations*

Multicomponent interventions that include education  
Home visits

*Legislatures*

Vaccination requirements for child care, school, and college attendance  
Reducing out-of-pocket costs

*Schools*

Vaccination requirements for child care, school, and college attendance  
Vaccination programs in schools

*Government Agencies*

Reducing out-of-pocket costs  
Vaccination programs in women, infants, and children (WIC) settings  
(U.S. Department of Agriculture/Food and Nutrition Service)

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particularly common among urban and low socioeconomic populations. Therefore, improving coverage of the urban poor should be a top priority. In general, the lower the vaccination coverage rate and the higher the burden of vaccine-preventable diseases in a population, the greater the need to increase coverage.

### ***Assess Applicable Barriers to Vaccination***

It is also important to identify the barriers that may keep people from getting the vaccinations they need. Success in delivering vaccinations requires participation from both those who need vaccines and the people and systems that provide them. Individuals may lack knowledge about vaccinations or have negative attitudes or fear of vaccination; they may also have little or no contact with the healthcare system. And, although most people in the United States accept the need for vaccinations and are seen periodically in healthcare settings, providers and systems often miss opportunities to vaccinate. In addition, people must have financial and physical access to the healthcare system.

### ***Select Approaches that Address Applicable Barriers***

Assessing and diagnosing your local barriers—in as simple or complex a way as your resources will allow—can help you select the most effective choices to reduce those barriers. If a key barrier is individuals' lack of knowledge or negative attitudes, coverage might be improved by implementing interventions that increase community demand, such as client reminder and recall systems; vaccination requirements for child care, school, and college attendance; or multicomponent interventions including education. If lack of access to the healthcare system is a key barrier, improvements might come from reducing out-of-pocket costs; implementing programs in non-healthcare settings such as WIC settings, schools, or homes; or enhancing access to the healthcare system using multicomponent programs that include expanding access. Finally, if providers or healthcare systems are missing opportunities to vaccinate, provider reminder and recall systems, provider assessment plus feedback, or standing orders might be useful. You may also find barriers in more than one area, in which case implementing a combination of interventions may be appropriate.

Conversely, using additional interventions when vaccine coverage is already high, or using additional interventions that are poorly matched to local problems (e.g., provider-oriented interventions when the undervaccinated population lacks access to services), are unlikely to result in important benefits.

### ***Monitor Program Progress and Effects***

After selecting and implementing one or more interventions, keep track of whether each is being implemented as planned and evaluate its progress to see if it is achieving its objectives—in as simple or complex a way as your resources will allow. Remember that efforts to increase coverage are likely to be most effective and cost effective when baseline coverage rates are low because of the large number of people needing vaccines; when baseline rates are high, there is literally less room for improvement. Single approaches alone often will not reach goals if baseline coverage is very low. For example, most of the effective interventions we reviewed showed improvements of 10–20 percentage points. If your baseline coverage is low, such improvements may not be sufficient. Therefore, you may need to use more than one approach, change your approach, or make corrections to programs in progress.

### ***Additional Issues in Increasing the Use of Targeted Vaccines***

Use of recommendations to increase targeted vaccines coverage has much in common with use of recommendations for increasing universally recommended vaccines coverage. The following specific considerations related to increasing targeted vaccines coverage may also be helpful.

Although coverage rates for influenza and pneumococcal polysaccharide vaccines have steadily improved among adults over 65 years of age in the past decade, improvements in vaccination coverage among younger adults with risk conditions have been less dramatic, and coverage rates remain low.<sup>281</sup> Similarly, significant increases in vaccination coverage for HBV among healthcare workers have not been matched in harder-to-reach populations engaging in high-risk behaviors. To close these gaps, communities, healthcare systems, and providers may consider implementing or adding one or more interventions to improve vaccination coverage among adults at high risk.

These reviews looked at three different vaccines, a number of at-risk populations, and a variety of community and healthcare settings. Despite some limitations in the available evidence, the Task Force recommendations, except as noted below, should be broadly applicable. For example, although few studies of population-based interventions to increase hepatitis B vaccine coverage among healthcare workers were identified, the Task Force recommendation reflects confidence that effective efforts to increase influenza coverage among healthcare workers are potentially applicable.

Significant gaps exist, however, in the evidence on effectiveness of community-based efforts to increase vaccination coverage of people with high-risk behaviors for hepatitis B. The Task Force notes that efforts to address significant differences in the vaccination requirements (a series of three in-

jections), the target populations (people with such high-risk behaviors as injection drug use), and the settings for intervention (limited access to health care and healthcare settings), which have not been evaluated in depth in the published literature, are unlikely to be successful through the application of effective healthcare system strategies developed for use with other populations and settings. (Areas in which additional research is needed are described elsewhere.<sup>265</sup>)

In 2000, the Advisory Committee on Immunization Practices (ACIP) extended the universal recommendation for annual influenza vaccination to include adults between the ages of 50 and 64 (in addition to adults 65 years of age and older).<sup>280</sup> Efforts to increase coverage with influenza vaccine in this “new” population can benefit from recommendations for both universally recommended and targeted vaccines. For initial efforts, the recommendations in the universal review may provide a number of effective and flexible intervention options. Those wishing to enhance initial program efforts may find the information on interventions implemented in combination in the review of targeted vaccines helpful.

Finally, some studies included in these reviews evaluated interventions or combinations of interventions to increase vaccine coverage among *all* adult clients within a healthcare system (those with both universal and high-risk indications). To match effective interventions to local needs, existing disparities, if any, in vaccine coverage among adult patients with universal and targeted indications should be considered.

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