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## Preventive Interventions Addressing Underage Drinking: State of the Evidence and Steps Toward Public Health Impact

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### Abstract

The epidemiological features of underage drinking and evidence of its social, health, and economic consequences suggest compelling reasons for the development and dissemination of effective preventive interventions. To clarify the nature and extent of the current evidence base on preventive interventions addressing underage drinking, a review of the literature was conducted through extensive searches of the research literature on outcome evaluations, existing reviews of this body of outcome research ( $N = 25$ ), and summary reports of evidence on specific interventions. More than 400 interventions were identified and screened, and the evidence for 127 was reviewed. Criteria for the evaluation of evidence were established for intervention studies with alcohol-specific outcome measures for 3 developmental periods (<10, 10–15, and 16 to  $\geq 20$  years of age). Ultimately, 12 interventions met criteria for “most promising” evidence and 29 met criteria for “mixed or emerging” evidence. Conducting this review revealed clear advances in the number of evidence-based interventions available and the quality of outcome research; however, much work remains to achieve greater public health impact through evidence-based interventions. This work should consider (1) the great need for intervention research related to understudied developmental phases, intervention domains (eg, family, school, community, and media), and populations (eg, early tweens, late teens, young adults not attending college, and nonmajority populations); (2) the critical importance of addressing key issues in research design and methods (eg, limited longitudinal studies, replication studies, and dissemination research); and (3) the need for improved consistency in application of evidence and reporting standards. Finally, we recommend the application of emerging consumer-oriented and community-participatory models for intervention development and research, designed to increase the likelihood of “real-world” public health impact through improved translation of intervention science into practice.

### Keywords

interventions; alcohol; youth; evidence

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Many of the published reports on outcomes of preventive interventions addressing underage drinking open with statements on the broad scope of the problem, based on epidemiological data and results from studies of health, and economic consequences of underage drinking. It is eminently clear from such findings that the magnitude of the problem is great. In this country,

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lifetime prevalence rates of alcohol use among eighth-, 10th-, and 12th-graders are 41.0%, 63.2%, and 75.1%, respectively.<sup>1</sup> Prevalence rates for past 30-day use are substantial, at 17.1%, 33.2%, and 47.0% for the 3 grade levels. Of considerable concern are the levels of more-problematic types of use, including binge drinking and drunkenness. For example, the past 30-day rates of drunkenness among eighth-, 10th-, and 12th-graders in 2005 were 6.0%, 17.6%, and 30.2%, respectively.<sup>1</sup> It is noteworthy that these problematic levels of alcohol use occur worldwide.<sup>2</sup>

There is extensive literature on the social, health, and economic consequences of underage drinking.<sup>3–6</sup> To begin, the single greatest mortality risk of underage drinking is traffic crashes<sup>7</sup>; adolescents who indulge in heavy drinking are more likely to engage in risky driving behaviors.<sup>8,9</sup> Underage drinking also is a major factor in both unintentional and intentional injury deaths.<sup>7</sup> Furthermore, adolescents who drink heavily are at increased risk for development of physical health problems, during adolescence and subsequently.<sup>10</sup> Among the major health problems are those associated with an increased likelihood of unprotected sexual activity.<sup>8,9,11</sup> Underage drinking also is associated with a range of mental health and other behavioral problems, including depression and suicidality,<sup>4,12,13</sup> delinquent behaviors,<sup>14</sup> and violence, including rapes,<sup>15</sup> as well as poorer academic performance.<sup>16,17</sup> The costs of underage drinking are estimated to be more than \$62 billion, although estimates are wide-ranging<sup>18,19</sup> and a comprehensive, definitive, economic analysis remains to be performed.<sup>7</sup>

Perhaps the single most important point to be made about underage drinking is that there can be substantial, lifelong consequences that take a tremendous toll on individuals, families, communities, and society as a whole. Emerging evidence suggests that heavy drinking may have significant lasting effects on brain structure and function that adversely affect positive youth and young adult development.<sup>20,21</sup> Notably, early onset of alcohol use is associated with problematic substance use in later adolescence and an increased likelihood of alcohol-related disorders in adulthood. For example, individuals who initiate drinking before 15 years of age are 4 times as likely to develop alcohol dependence as are those who wait until  $\geq 21$  years of age; each additional year of delayed drinking reduces the likelihood of dependence by 14%.<sup>22</sup> The adult alcohol use disorders that are rendered more likely by underage drinking are associated with serious health problems and substantial negative economic impact.<sup>7</sup>

The prevalence rates and problematic consequences of underage drinking warrant a comprehensive public health approach, firmly grounded in evidence-based preventive interventions and policy-making. From a public health perspective, there are many challenges in addressing the underage drinking problem in this country. Our view is that a major challenge is the design and testing of interventions across developmental stages for a wide range of subpopulations, interventions designed to reduce risk factors and to promote protective factors that delay initial use and lower rates of binge drinking and other forms of alcohol abuse. This includes the need for a range of effective interventions and policies, including comprehensive community-level interventions. A related challenge is the widespread dissemination of interventions demonstrating effectiveness, as addressed below.<sup>23,24</sup>

This review responds to recommendations for addressing the prevention of underage drinking in the recent *Surgeon General's Call to Action on Preventing Underage Drinking*.<sup>6</sup> In addition, this review is written as a companion piece to the exhaustive review by the National Institute on Alcohol Abuse and Alcoholism Underage Drinking Initiative Steering Committee of the developmental antecedents and consequences of underage drinking for 3 developmental periods (<10 years of age, 10–15 years of age, and 16 to  $\geq 20$  years of age) presented in this supplement. It was considered essential to have a current comprehensive review of the evidence on interventions addressing underage drinking (both prevention and treatment) for each of these 3 developmental periods. Our review was conducted in the context of numerous existing

reviews of the literature on a range of preventive interventions and reports summarizing evidence-based interventions. Indeed, for purposes of the current review, we uncovered 25 reviews or meta-analyses of the literature addressing the more-general topic of substance-related interventions. Those most relevant to the present review were published since the middle 1990s and capture the findings and conclusions of earlier reviews, as well as extending them. Among those published since the middle 1990s, most reviews were directed toward preventive interventions targeting the full range of preventive intervention outcomes, such as those targeting a broad range of substance use, as well as risk and protective factors for substance use,<sup>25–32</sup> other problem behaviors such as violence and antisocial behavior,<sup>33,34</sup> mental health,<sup>35,36</sup> or positive youth development.<sup>37</sup> Only 2 relatively recent reviews focused exclusively on alcohol misuse,<sup>38,39</sup> and 1 had a relatively narrower focus on primary prevention and long-term outcomes.<sup>38</sup>

None of the reviews and meta-analyses met all of the criteria for the current review. That is, there were no reviews that had all 4 of the following: (1) exclusive focus on alcohol outcomes or effects on primary risk factors for problematic alcohol use among youths, (2) classification of reviewed evidentiary literature on specific interventions on the basis of levels of evidence, (3) inclusion of all developmental periods, and (4) inclusion of all types of interventions, beyond primary or universal interventions, such as in the present review. Moreover, most reviews on interventions targeting alcohol outcomes did not pay special attention to (and weigh more heavily) evidence from intervention outcome studies that had conducted follow-up evaluations beyond intervention posttests or beyond the time point at which the primary core components of the intervention were delivered, as did the current review. One exception was the systematic review of primary preventions for alcohol misuse among young people by Foxcroft et al.<sup>38</sup> This systematic review did examine a number of interventions also evaluated for the current review; however, because of the differences in the inclusion/exclusion criteria considered and because of the application of different evaluation criteria, conclusions drawn by the 2 reviews are somewhat different.

As described below, a second type of “review” that provides the context for the present review is a summary report of evidence-based interventions. There has been a proliferation of such summaries over the past 10 years, including those by the Blueprints for Violence Prevention,<sup>40</sup> Substance Abuse and Mental Health Services Administration National Registry of Evidence-Based Programs and Practices,<sup>41</sup> and the US Department of Education Safe and Drug-Free Schools Program.<sup>42</sup> A summary of 12 of these reports has been completed ([www.colorado.edu/cspv/blueprints](http://www.colorado.edu/cspv/blueprints)). For the most part, these summary reports state their selection criteria and then provide synopses of the selected interventions, including their evidence base. Like the current review, they typically cover interventions targeting all developmental periods. None, however, focus exclusively on alcohol outcomes. Notably, work is underway through the What Works Repository<sup>43</sup> to create a classification framework that will allow comparison of interventions from all extant model intervention summary reports, using a common frame of reference. The criteria for classification in the What Works Repository were among those considered in determining the classification criteria for the current review, as described below.

The objectives of this review are threefold. The first objective is to highlight the compelling reasons for greater attention to evidence-based preventive interventions addressing underage drinking. The second objective is to provide a review of alcohol-targeting interventions with evidence of efficacy or effectiveness, for interventions involving 3 age groups (<10, 10–15, and 16 to ≥20 years of age). The third objective is to discuss key findings and their implications from a public health perspective, including coverage of needed areas of intervention, critical research issues, standards of evidence, and future directions in achieving greater public health impact through preventive interventions.

## METHODS

### Intervention Selection Criteria

**Type of Intervention**—The scope of interest for this review included universal (for everyone in an eligible population), selective (for those who are members of population subgroups at higher risk), and indicated (for those with existing risk factors or conditions that identify them as being individually at risk) prevention interventions.<sup>44</sup> With this scope in mind, interventions that entailed treatment for youths who already showed an alcohol-related disorder were excluded.

**Target Population Age**—The review was organized around the age groups targeted by the National Institute on Alcohol Abuse and Alcoholism Underage Drinking Initiative, to the extent possible. That is, as noted earlier it focused on interventions targeting 3 age groups (<10, 10–15, and 16 to  $\geq 20$  years of age). Reviews addressing the age 16 to  $\geq 20$  group considered interventions targeting high school students and noncollege populations beyond high school; interventions directed toward college-attending populations were excluded because comprehensive reviews specifically directed toward that population had already been conducted. Larimer and Cronce,<sup>27</sup> for example, provided an excellent review of interventions directed toward college students.

To elaborate, Larimer and Cronce<sup>27</sup> reviewed universal, selective, and indicated interventions for college students, implemented with individuals, small groups, or classrooms, or delivered by mail and computer/Internet, from 1999 through 2006. Although their review uncovered >1000 studies, only 42 met the inclusion criteria ( $\geq 1$  active individual intervention condition, a drinking behavior outcome, a control condition, prospective random assignment to conditions, 70% participant retention, 6-month follow-up period, and >25 individuals per condition). Interventions were categorized into 3 groups, that is, (1) educational/awareness-building (information/knowledge programs, values clarification, and normative reeducation), (2) cognitive-behavioral skills-based (expectancy challenge programs, self-monitoring, multicomponent alcohol skills training, and general life skills training), and (3) motivational feedback-based (brief motivational interventions and mailed or computerized motivational feedback). Briefly, the review indicated empirical support for multicomponent, skills-based interventions, and in-person, mailed, or computer motivational interventions that provided respondents with personalized feedback about drinking perceptions and tendencies. In contrast, no support was found for general life skills training, values-clarification programs, or informational or knowledge-based programs delivered alone; there was only limited support for expectancy challenge programs (1 study, with male participants only; female participants experienced iatrogenic effects). The review thus highlights the extensive research on preventive interventions conducted with college samples to date.

**Outcomes of Interest**—For youths  $\geq 10$  of age, interventions were included only if the intervention studies incorporated outcome measures of alcohol use or abuse. Interventions were excluded if their outcome assessment included only measures of illegal drug use, smoking, or broad indices of substance or drug use but not direct measures of alcohol use. (When only broad substance abuse indexes were reported, an attempt was made to contact the research team to assess whether other analyses had been conducted to disaggregate findings regarding effects on alcohol use.) In other words, interventions that broadly targeted and measured illegal drug (but not alcohol) use, smoking, sexuality, or health promotion were excluded. If, however, prevention or health promotion programs showed multiple effects that included alcohol-specific measures, then the programs were included in the review.

It is noteworthy in this context that an exception to the alcohol-specific measure requirement was made for interventions that were directed toward policy, law, or environmental changes.

In such cases, if the relevant outcome study measured an action that was the logical consequence of alcohol use or abuse behavior (eg, alcohol-related traffic incidents among adolescents), then the study was included. In the case of outcomes concerning alcohol-related harm, we remained cognizant of the fact that harm-related measures could show positive outcomes even in the absence of evidence for decreases in alcohol use.

Because of the relative absence of alcohol use among most children <10 years of age, different outcome measure-related selection criteria were used for interventions designed for this age group. In the case of children <10 years of age, interventions related to key risk factors predicting later alcohol use also were reviewed. On the basis of a review of the relevant etiologic literature, the primary alcohol risk outcome considered was early aggressive behavior, because it is the only risk factor (other than parental alcoholism) that has consistently shown a relationship with early initiation of underage drinking.<sup>45–50</sup> Early aggressive behaviors include direct aggression, fighting, and hitting, as well as behaviors defined by a broader construct often called either externalizing behavior problems or conduct problems, as reported by teachers, parents, observers, and peers.

### Types of Intervention Literature Reviewed

As noted earlier, 3 types of literature were reviewed, to ensure that all relevant evidence on specific interventions was uncovered, including studies of specific interventions, reviews of the outcomes literature (particularly systematic reviews that focused on evidence concerning individual interventions), and summary reports of the evidence on specific interventions produced by agencies conducting evidence-based intervention reviews. First, given the quality assurance inherent in the peer review process, the focus was on refereed professional journals, which were searched via available databases; peer-reviewed research was weighted most heavily. The search of databases included Science Citation Index Expanded, PsycINFO, Medline, and the Social Science Citation Index. For example, >400 abstracts concerning interventions targeting the developmental period of 10 to 15 years of age were reviewed. Additional relevant books and book chapters also were reviewed. Second, literature reviews and meta-analyses ( $N = 25$ ) were used, such as those cited above,<sup>38,51,52</sup> among others.

Third, relevant Internet sources were checked, such as the Web pages of the National Institutes of Health, Centers for Disease Control and Prevention, Office of Juvenile Justice and Delinquency Prevention, American Psychological Association, Department of Education, Center for the Study and Prevention of Violence (University of Colorado), Society for Prevention Research, Early Career Preventionists' Network, Collaborative for Academic, Social, and Emotional Learning, and individual armed services branches (for the age group of 16 to  $\geq 20$  years of age). These sources were cross-checked against the core group of interventions yielded by the first 2 types of reviews, to identify and to secure articles addressing additional relevant interventions. For each new document obtained, the reference list was reviewed against the list of identified interventions, to avoid omissions.

From these collective sources, a set of core interventions was identified for inclusion in this report. When necessary, the originating research team was contacted during the review process, to address specific questions or to review the information for accuracy. Initially, the review led to the identification and screening of >400 interventions, 127 of which seem to show at least some evidence concerning the desired outcomes. Among those, 41 met the criteria discussed below and thus are included in this report (18 for <10 years of age, 13 for 10–15 years of age, and 10 for 16 to  $\geq 20$  years of age).

## Intervention Evaluation Criteria

A set of criteria was devised to evaluate interventions uncovered through the literature search process described above. The approach had 3 levels of evidence, that is, (1) most promising, (2) mixed or emerging, and (3) insufficient evidence or no evidence of effects. For an intervention to be considered among the relatively most promising, it was required that 6 criteria or sets of criteria be met through examination of an interventions research base, as follows. The first criterion concerned experimental design, that is, either a randomized trial design or a quasiexperimental design that used an adequate comparison group. The second criterion entailed sample specification, that is, the sample for which outcomes were measured and its behavioral and social characteristics must have been specified. The third criterion concerned outcome assessments, that is, preintervention, postintervention, and follow-up findings must have been included. The need for follow-up findings was considered essential, given the frequently observed dissipation of positive posttest results. We set the criterion that follow-up data must be reported  $\geq 6$  months beyond a posttest assessment or  $\geq 6$  months beyond the time point at which the primary core components of the intervention were delivered, for examination of the duration and stability of intervention effects. The fourth criterion concerned effects observed, that is, there was a measurable difference in alcohol or alcohol-related outcomes in statistical significance testing. The fifth criterion involved additional quality-of-evidence criteria, that is, evidence that 7 quality-of-evidence criteria consistent with those of the National Registry of Evidenced-based Programs and Practices<sup>53</sup> were met, including (1) reliability of outcome measures, (2) validity of outcome measures, (3) pretest equivalence, (4) intervention fidelity, (5) analysis of missing data, (6) degree and evaluation of sample attrition, and (7) appropriate statistical analyses. The sixth criterion concerned manualization, with a written manual that specified the target population and procedures to be used in the intervention, except in the case of law- or policy-focused interventions (eg, minimum drinking age law).

The original plan for this review called for a strong evidence category for programs that met the additional criteria of consistent follow-up impact on alcohol use and independent replication of effects. Sufficiently few programs met these additional criteria that this category of strong evidence was dropped.

Because we concluded that a precise metric for classification of interventions on the basis of their outcome research was problematic (eg, scoring the 6 criteria or sets of criteria with appropriate weighting of individual criteria; see a discussion of issues with scoring systems in the next section), classification was based on our overall judgment, after careful consideration of how well all specified criteria were met. All interventions that failed to meet the criteria for most promising evidence were considered for classification as mixed or emerging. Those that did not meet the criteria for mixed or emerging received no more attention in this evaluation. In addition to how well the criteria delineated above were met, key considerations in classifying interventions as mixed or emerging were as follows.

First, there was a mixture of positive and null intervention condition main effects across studies of a given intervention or across alcohol-related measures within an intervention outcome study. In the case of mixed results, we made a judgment regarding whether a preponderance of evidence favored inclusion. When the preponderance of evidence favored inclusion, the mixed results are noted in the summary tables. Second, there were positive alcohol-related findings but also methodologic limitations that diminished confidence in the validity of reported positive findings to the point that classification as most promising evidence was considered inappropriate. Related methodologic limitations are noted in the summary tables. Third, there were no intervention condition main effects but there were positive effects for a subsample (eg, a high-risk subsample). In such cases, we considered whether possible confounds with subsample analyses were addressed (eg, a higher level of intervention dosage

or exposure among a high-risk subsample), as well as whether there was an examination of any subgroups beyond the 1 in which findings were observed (eg, low-risk), for which there could be negative effects. In cases in which parallel positive subgroup findings were reported in subsequent studies, the evidence was considered to be relatively stronger, even if confounding could not be ruled out definitively. Fourth, all studies in which the intervention occurred at <10 years of age and data showed an impact only on the risk factor of aggression and not on later alcohol use were classified as emerging.

Earlier it was noted that interventions directed toward policy, law, or environmental changes warranted special consideration of their alcohol-related outcomes. A review of the literature on interventions involving raising the minimum drinking age and zero-tolerance laws also suggested special attention to criteria for their classification in 1 of the 3 categories designated above. For both of these types of law-based interventions, there were no studies identified that met all of the criteria discussed earlier for classification as most promising or mixed or emerging evidence (eg, regarding experimental design, outcome assessments, effects observed, and the quality-of-evidence criteria consistent with those of the National Registry of Evidenced-based Programs and Practices). In this context, it is important to note that an inherent limitation in the research on policy, law, or environmental types of interventions is that randomized designs with the criteria discussed above are sometimes not feasible. Therefore, we considered studies that had quasiexperimental designs, including longitudinal data collection and multiple data collection points  $\geq 6$  months before and after the implementation of the law or policy,<sup>54</sup> that had suitable comparison groups,<sup>55</sup> or that examined the policies by contrasting multiple school districts.<sup>56–58</sup>

Taking into consideration all relevant design and inference issues, the body of evidence on laws raising the drinking age warranted consideration of classification in the mixed or emerging evidence category. Other laws and policy-focused interventions also were considered, such as mandated server training regarding alcohol crashes,<sup>59</sup> alcohol pricing,<sup>60</sup> and laws on blood alcohol concentrations of 0.08%.<sup>61,62</sup> These were not included in our final report for one or more reasons, that is, the study was not focused on 16- to 20-year-old subjects (eg, mandated training), it assessed outcomes other than the accepted alcohol measures described earlier, or it did not meet the other modified criteria we applied to evaluations of the efficacy of policy, law, and environmental interventions.

The reasons why most interventions were classified as having insufficient or no evidence of effects were wide-ranging. Among the criteria that were least frequently met, and thus led to this classification, were <6 months of follow-up data (as defined above), insignificant effects, weak experimental design, and failure to use alcohol-specific measures (among interventions that originally seemed to show at least some positive evidence concerning substance-related outcomes).

## SUMMARY DESCRIPTION OF INTERVENTIONS AND SUPPORTING EVIDENCE

Interventions classified as having the most promising or mixed or emerging evidence are summarized in Tables 1 to 6. Detailed analyses of evidence for each of the intervention categories are well beyond the scope and space constraints of the present report. Rather, tabular summary descriptions of all interventions and supportive evidence are provided. Tables 1 and 2 review interventions for subjects  $\leq 10$  years of age, Tables 3 and 4 review interventions for those 10 to 15 years of age, and Tables 5 and 6 review those for ages 16 to  $\geq 20$  years of age. Each intervention that had sufficient evidence was first categorized as most promising versus mixed or emerging. Each intervention was then designated by type (universal, selective, or indicated) and domain (school, family, community, workplace, or multicomponent).

Information is provided on sample size, time of data collection, age/grade level, ethnicity, and urban/rural or other location (where available). Summary results are presented with key citations and Web sites that provide additional information. For mixed or emerging interventions, there is a brief description of the reason for this designation (eg, the type of mixed findings or the methodologic shortcomings).

## OVERVIEW OF KEY FINDINGS AND IMPLICATIONS

### Topics Covered

The extensive review of the evidence for interventions addressing underage drinking suggested several topics for discussion. Collectively, these topics frame both the summary of our key findings and their salient implications. The first of these topics is the “coverage” of the evidence base or how well it addressed all phases of the 3 developmental periods addressed, intervention domains, and the full range of populations that could benefit from intervention. Additional topics concern the state of the art in intervention research that produced the evidence base, including key research issues and standards of evidence, as well as standards for reporting research in the professional literature.

### Coverage of Needed Areas of Intervention Evidence

The review of effective preventive interventions for underage drinking illuminates both the strong scientific advances that have been made in the field of prevention of alcohol use in underage populations in certain areas and the need for better coverage in others. Here our focus is on coverage with respect to intervention domain, developmental phase, and population. Readers are referred to reports by Offord et al<sup>63</sup> and others<sup>64</sup> for discussion of the relative advantages of the different types of preventive interventions (eg, universal, selective, indicated, or tiered).

Offord et al<sup>63</sup> delineated key advantages and disadvantages of universal, selective (or targeted), and indicated (or clinical) interventions, indicating important trade-offs to consider among them. To conduct the suggested trade-off analyses, it is necessary to have data on (1) the prevalence and costs of the problem the intervention addresses, (2) the effectiveness of the intervention, (3) the extent to which the intervention reaches those who need it, (4) the quality of implementation of the intervention (particularly compliance), and (5) intervention costs. As an illustration of related trade-off analyses presented in the article, a universal intervention would likely be a better choice than an indicated or clinical intervention alone when the condition it addresses is highly prevalent, the costs of that condition are high, the intervention is relatively inexpensive, and the intervention has been proven to be effective. In general, Offord et al<sup>63</sup> suggested a strategy that entails implementation of effective universal interventions, followed by selective interventions for those who are not sufficiently helped by the universal interventions, and entry into clinical services for those not benefiting from the selective interventions (often referred to as a tiered strategy). The authors concluded by recommending that an optimal mixture of interventions become available.

There are numerous ways to summarize intervention findings, that is, according to developmental periods (<10, 10–15, or 16 to ≥20 years of age), domains (family, school, workplace, community policy/environmental, or multiple domains), or targeted populations. Here we discuss areas where evidence-based intervention is relatively stronger or weaker by focusing on coverage of developmental phases within key domains, with additional attention to coverage of special populations and culturally-based population subgroups or nonmajority populations.

Family-focused interventions delivered in the infant and preschool years have focused primarily on building healthy parent-children relationships, decreasing aggressive behavior, and building children's social and cognitive competence for the transition to school (eg, The Incredible Years and Triple-P programs). These interventions have shown reductions in children's aggressive behavior in the short term, whereas only 1 preschool program has shown effects on reduced use of alcohol in the teen years (Nurse Family Partnership). With few exceptions, these early family interventions have evidence limited to the risk precursor of later alcohol use (aggressive behavior).

Although family-focused interventions are prevalent before school entry, there have been fewer family-focused interventions that have been implemented with elementary school-aged children and tested for efficacy, especially those targeting "tweens" during the later elementary school years. A number of family or family-school integrated interventions during the elementary school years, however, have shown effects on either delayed initiation or reduction in alcohol use in adolescence (eg, Linking the Interests of Families and Teachers, Seattle Social Development Project, Raising Healthy Children, and the Preventive Treatment Program). The family interventions that target the period of 10 to 15 years of age and meet the qualifying criteria described above seem to have considerable promise, consistent with the conclusion of the Cochrane systematic review.<sup>38</sup> Independent of the targeted developmental phase, these interventions typically address a range of risk and protective factors originating in the family, including child monitoring, parent-child bonding or affective quality, effective discipline, and parental involvement in child activities (eg, Strengthening Families Program: For Parents and Youth 10–14, Guiding Good Choices, and Family Matters). Both small group-format and home-based interventions have been developed; small group interventions have shown relatively stronger evidence. Although no family-based interventions have shown effectiveness with young people 16 to  $\geq 20$  years of age who are not college-bound, findings with the college-bound population indicate their potential effectiveness.<sup>65</sup>

There have been significant advances in the field of school-based prevention. Related findings indicate that such interventions can reduce early initiation of alcohol use and progression of use in the young adolescent and adolescent years. Furthermore, a number of interventions for younger children have shown significant reductions in aggression and disruption, the primary risk precursors of early alcohol use (eg, I Can Problem Solve, Promoting Alternative Thinking Strategies, Second Step, and Good Behavior Game). Interventions that have shown effects typically address the following: role-playing that provides practice in the use of new skills, a broad focus on life skills, support to improve emotional regulation, a focus on positive peer relationships and, with youths, provision of accurate norms for alcohol and substance use, plus instruction in peer refusal skills.

Most elementary school interventions have shown effects only on the risk precursor of aggressive behavior and not on alcohol use. Elementary school interventions have focused primarily on building social competencies and reducing aggressive behaviors. Although a few classroom intervention trials have monitored their samples through the middle-school period and demonstrated effects on alcohol use (eg, Classroom Centered Intervention), most studies have not been funded for a sufficient period to demonstrate whether there are direct effects on alcohol use.

It is noteworthy that we could find no interventions meeting the aforementioned criteria for efficacy or effectiveness that focused on early alcohol use and that provided prevention curricula in the later elementary school years (grades 3 through 5), just before the transition to middle school. Also, although numerous interventions exist that have shown effects on the delay of initiation of use during the middle and early high school periods, there was only 1 intervention that could be classified as most promising<sup>66</sup> and 1 that could be classified as mixed

or emerging<sup>67</sup> in reducing the rate of drinking during the high school years. The latter was limited in that it focused only on high school football players and not on the general population. Given the high rates of binge drinking reported by US high school students, this is an area in need of substantial attention.

Multidomain interventions focus on  $\geq 2$  different domains of the child's or youth's life (among individual, family, school, worksite, community/environmental, and policy domains). By intervening in multiple domains, it has been hypothesized that the effects of preventive approaches might be maximized (eg, Midwestern Prevention Project and Project Northland). Not surprisingly, such interventions are more likely to occur with less-mobile and -independent younger or middle schoolchildren than with those in high school or older. It is noteworthy that most of the effective interventions in the younger age group used multidomain models (eg, Linking the Interests of Families and Teachers, Fast Track, Seattle Social Development Project, Raising Healthy Children, and Preventive Treatment Program). Although such interventions may be somewhat more difficult to implement with adolescents, this area of research requires additional effort. One promising model for developing multidomain interventions is to combine 2 different interventions with proven efficacy that focus on the separate domains of school and family.<sup>24,68</sup> A recent interesting finding concerning 1 of the most-promising multidomain interventions reviewed (Project Northland; see Table 3) was that analyses of components across domains suggested that the relatively strongest effects on tendency toward alcohol use were shown for the parent program component.<sup>69</sup>

The literature on prevention research often has differentiated preventive interventions (which are usually curricular and teach skills) from policy, law, or environmentally focused interventions (eg, media, regulations, or enforcement). Although there has been much discussion of policy- and environment-level interventions, we were not able to locate any effective policy inventions for children below 16 or 17 years of age; no evidence-based policy interventions that have been shown to delay the initiation of alcohol use or to reduce its early use before the age of high school graduation seem to exist.

We were able to find 2 relatively effective interventions that focused on decreasing sales to minors, increasing identification checks by vendors, or reducing community tolerance of underage purchasing and consumption of alcohol.<sup>70,71</sup> Studies of these interventions provided only mixed or emerging evidence, either because of failure to measure specific alcohol use outcomes (or direct logical consequences of use) or because too few communities were studied to allow definitive statements regarding the generalizability of findings. Although media-based interventions have been devised to address drug use (with mixed results)<sup>72</sup> and they have been incorporated into multidomain interventions,<sup>73</sup> no stand-alone media interventions targeting alcohol use and showing strong evidence could be found. Future research in this area is warranted, especially considering the literature on mass media influences on underage drinking.<sup>74–76</sup>

Concerning the effects of laws raising the minimum drinking age and zero-tolerance laws, the evidence from studies with quasiexperimental designs suggests that minimum legal drinking age laws can reduce rates of underage drinking,<sup>58</sup> single-vehicle night time car accidents,<sup>55</sup> and fatalities.<sup>77</sup> The preventive effects from studies examining the minimum drinking age laws were not completely consistent, however. For example, some studies noted that drinking levels among 18- to 19-year-old students on college campuses remained high after enactment of underage drinking laws<sup>78,79</sup>; in other cases, rates of accidents and fatalities remained the same after the change in law.<sup>80,81</sup> In addition, the issue of whether drinking was not reduced as a result of these laws but there was a change in where teens drank and how they obtained alcohol has been raised.<sup>82</sup> Although our conclusions are consistent with those of other reviews, that the minimum legal drinking age laws seem to have a preventive effect,<sup>83,84</sup> these interventions

were included in the review as having mixed or emerging evidence, considering the criteria discussed above.

Overall, it is worth underscoring the point there is very limited research on interventions that specifically target emerging alcohol use among late elementary school-aged children, as well as those targeting high school students or young people in the age range of 16 to  $\geq 20$  years who are not currently in college. There is very limited intervention research specifically focusing on children in the later elementary school years, despite the indicators for it, as articulated by a number of prevention researchers.<sup>85,86</sup> In addition, our review of high school and post-high school interventions focused on the following areas: school-based, community-based, armed services, primary health care settings, alcohol and driving safety, and workplace-based. Despite the broad range of areas investigated and the numerous studies examining the causes of consumption in this developmental period, there were few theory-driven interventions targeted toward young people. Data from large national surveys have consistently indicated that high levels of consumption and misuse of alcohol tend to occur between 17 and 25 years of age.<sup>87</sup> There are few non-college-based interventions targeted to this age range. Therefore, there remains a large disconnect between those who are consuming alcohol at high rates and the efforts being undertaken to reduce such practices. Because approximately one half of US individuals in the age range of 18 to 21 years are not attending a 4-year college, future work with this population is greatly needed.

Addressing optimal coverage of evidence-based interventions requires consideration of the optimal mixture of the universal, selective, and indicated types of interventions, as well as the potential role of tiered interventions, wherein universal-level interventions are used as a point of entry to selective interventions, which in turn are used to direct participants toward indicated-level interventions, which are potentially beneficial.<sup>63,88,89</sup>

### **Need for Additional Coverage of Cultural Adaptations and Special Populations**

It was encouraging to discover a number of interventions with promising or emerging evidence that were designed to be culturally competent for minority populations, that were implemented with other understudied populations (eg, rural), or that otherwise addressed cultural adaptations (eg, Keepin' It REAL). There is, however, a clear need to strengthen the cultural competency of interventions, as well as the need to develop additional culturally specific interventions in some cases. In addition, there is a need to demonstrate the generalizability of findings of already proven, evidence-based models across cultural groups; some related efforts to date have produced mixed results.<sup>90</sup> As part of this process, it will be important to differentiate surface-structure changes (changes in wording, pictures, and stories to represent culturally relevant models) from deep-structure changes (actual changes in the skills, attitudes, cognitions, or policies that may be necessary with different cultural groups).

### **Key Issues in Current Intervention Research**

**Overview**—It is evident there has been increasing attention to research methods, with attendant improvements in study design and analysis (eg, hierarchical linear and nonlinear modeling for studies with cluster randomization and hierarchical data structures). The use of randomized, clinical trials has been crucial to legitimizing prevention efforts by creating greater credibility for the outcomes observed. The current review, however, points to a number of important gaps and other issues to be addressed in future research on the prevention of underage drinking. Most of these issues cut across all types and domains of prevention programs.

**Limited Longitudinal Study**—The first issue is a need for rigorous studies with longitudinal data that track both the initiation and growth of alcohol use (and abuse) over time. Numerous studies that might have the promise of preventing underage drinking could not be

reviewed in this article because they reported only data obtained shortly after completion of the primary intervention. Furthermore, even among those studies that met the criterion of having  $\geq 6$  months of follow-up data, there were very few that had extensive, regular, longitudinal data collection that allowed examination of longer-term effects, the possibility of either decay or growth of effects, or the longer-term public health significance of the findings. Also, because the growth of initiation follows a different trajectory and timeline than does heavy use or binge drinking, it is essential to study both of these processes across early to later adolescent periods.

**Specificity in Logical Models**—The second issue concerns the studies that did have longitudinal findings. There were sometimes mixed results among multiple outcomes from a single wave of data, as well as mixed results across multiple waves of data. Given the rapid changes in the use of alcohol during adolescence, it is not surprising that there is some inconsistency in results across time. Intervention researchers and developers, however, need to specify more clearly the logic of their intervention models and to differentiate more fully the objectives and interventions designed to achieve them, including delay of initiation of use, prevention of regular use or binge drinking, harm reduction, and prevention of alcohol abuse and addiction. It is clear that some interventions, especially those that are universal, may have very specific objectives that follow from the intervention logical model.

**Specificity in Self-Reported Outcome Measures and Related Issues**—The third issue concerns the need for prevention trial reports to provide more-specific evidence on measures of alcohol use. In a number of instances, programs that might be effective were not reviewed here because the only measures reported were broad omnibus measures of substance abuse, with no specific analyses that differentiated use of alcohol, marijuana, or other illegal substances. Considering that some programs may be quite effective for some substances and not for others, reporting of outcome for each substance used is necessary. It is not sufficient to examine a broad substance abuse index, if the field is to have a better understanding of alcohol use, differentiated from use of other drugs. In addition, the field would benefit from additional work on the validity of self-reports, including setting-specific effects on reporting.<sup>91</sup>

**Limited Replication Study**—As indicated earlier in this review, there is a great need for independent replications of the intervention outcome studies reviewed, as well as for standards guiding replication studies.<sup>23,92</sup> Independent replications of the interventions reviewed were very rare. The literature specifies different types of replications (eg, exact, scientific, conceptual, and systematic) and discusses their applicability across different phases of prevention research.<sup>92</sup> Systematic replications, which entail the study of the effects of systematic variations of intervention procedures, for example, are especially important to consider. As an illustration, a replication study of a school-based intervention<sup>93</sup> suggested that an alternative to teacher implementers might be less effective. In addition to the clear need for more replication research, there is a great need to address other issues in this type of research, such as how much difference in intervention content is allowable for a study to be considered a replication study,<sup>94</sup> and to develop a set of standards to guide replication research.<sup>24,93</sup>

**Limited Study of Active Ingredients or Core Components and Outcome Mediators**—Earlier discussion of the domains of the interventions reviewed discussed multicomponent interventions. Another issue that needs to be addressed concerns the type of intervention that covers  $>1$  domain, such as 1 having components at the family, school, and community levels, like the Midwestern Prevention Program.<sup>95</sup> It may be important to assess which components of these interventions are producing the observed effects, considering the capacity and resources they require for effective implementation. A number of approaches to the identification of core or active ingredients have been discussed in the literature, including

dismantling designs and factorial designs,<sup>96</sup> along with modeling of outcome mediators. Outcome mediator modeling is used to identify key mechanisms of effects by examining which components of interventions (components that target specific, mediating risk or protective factors) account for substantial proportions of the variance in the targeted alcohol-related outcomes.<sup>97</sup> Complementing mediational analyses are dose-response evaluations that examine how the dose level of each component of a multicomponent intervention affects outcomes and relative contributions to those outcomes. These types of analyses are especially helpful in determining whether individual components are differentially effective; multicomponent dose-response analyses also can evaluate whether there are synergistic effects among components.<sup>69</sup>

In the context of considering which intervention components contribute most substantially to targeted outcomes, it also should be noted that some multicomponent interventions have a clear logical model that calls for the multiple components and their synergy; dismantling designs might be especially useful in testing whether the multicomponent models are in fact necessary to achieve positive effects. This issue is rendered more salient by reviews suggesting that single-component, family interventions are among the most effective.<sup>38</sup>

**Limited Economic Analyses**—Economic analyses of any kind were conducted with only a limited number of interventions reviewed; even fewer evaluated economic benefits specific to alcohol outcomes.<sup>98</sup> Economic analyses<sup>99</sup> conducted to date (by the Washington State Institute for Public Policy, for example) clearly indicate the potential cost-effectiveness and cost benefits of a number of preventive interventions. Although a detailed analysis of this issue and its importance is beyond the scope of this report, these types of analyses specific to alcohol-related cost savings would greatly benefit broader dissemination of effective interventions, as discussed below. For example, the decision to adopt an evidence-based intervention can be greatly influenced by the availability of supportive economic analysis data.<sup>64</sup>

**Limited Study of Factors That Moderate Effects**—Especially in the case of universal interventions, there is a need to confirm whether intended effects for general populations are achieved across the risk spectrum represented by participating individuals. In cases where benefits to participants are not uniform, the intervention design should be modified<sup>100–102</sup>; this is particularly important at the effectiveness or dissemination phases of research. Relatively more of this type of work has been conducted with school-based interventions than with other types (eg, family focused); research focused on moderation of alcohol-related outcomes is especially limited.<sup>16</sup> Moreover, there are limited findings supporting the “universality” of intervention effects on alcohol outcomes, with the possible exception of family-focused interventions.<sup>16</sup>

**Small Samples for Community, Policy, and Environmental Interventions**—Of the few community-based studies we reviewed, most were conducted in a single community or a small number of communities.<sup>70,103</sup> Although the findings of these studies showed some evidence of efficacy, the small sample sizes in these studies limit the validity and generalizability of the findings. Future efforts should build on this work and examine larger numbers of communities and community heterogeneity, in an attempt to identify what factors might foster or inhibit success for adaptations of community interventions beyond the communities involved in the initial study samples.

## **Strong Consistent Standards for Evidence and Research Reporting**

**Need for Consistency in and Broader Application of Evaluation Criteria**—During the past few decades, there has been a proliferation of published criteria with which to evaluate the effects of evidence-based interventions, including the summary reports cited above. For

example, in the area of evidence-based medicine, a review indicated 20 different scales and 11 different checklists with which reviews assessed the nature of evidence from randomized trials.<sup>104</sup> In every case, literature reviews and program lists used somewhat different criteria for the inclusion of effective programs.<sup>23</sup> The use of different criteria has resulted in, at most, a moderate degree of overlap across rating groups.<sup>105</sup>

One way to address inconsistency in the application of standards of evidence is to apply standardized scoring of the quality of evidence. There are several potentially major issues with standardized scoring, however. When many evidence-quality criteria are weighted equally in the scoring, study factors that may pose direct and substantial threats to the validity of outcome conclusions (eg, the quality of design—with designs considered ranging from simple, single-group—before/after designs to randomized, controlled trials, or appropriate treatment of differential attrition) could be weighted the same as factors that may have much more limited relevance to validity (eg, participant expectations). Also, quality criteria that are intended to be applied across all types of interventions (individual, small-group, and policy interventions), across all phases of intervention research (from pilot study to effectiveness trial), and across outcomes at all levels (from individual to system levels) do not allow adequate differentiation of the applicability of the criteria to study-specific characteristics and objectives. For example, information on rating for effect size to indicate the practical significance of outcomes may be less exclusively important in universal intervention studies, where impact is a product of both population reach and effect size.<sup>106</sup> Finally, it may be difficult to score specific evaluation criteria readily and reliably in complex studies, such as scoring involving single ratings of reliability and validity for multimethod, multiinformant studies with measures of varying psychometric quality. Therefore, the application of standardized scoring for consistency in the application of standards of evidence warrants additional careful consideration.

In addition, although the field of prevention science has shown great improvement in evaluating programs in the area of substance abuse and mental health, many documents that we reviewed were substandard in a number of ways. We think that it would be helpful to have researchers fully use widely accepted, rigorous standards of evidence. One example is the standards of evidence developed by the Society for Prevention Research regarding the criteria for efficacy, effectiveness, and dissemination.<sup>92,107</sup>

We refer readers to published documents<sup>92</sup> for an in-depth consideration of standards of evidence. Although no single method can be used to assess all interventions, the standards place a high priority on the use of randomized trials, when feasible. The standards also note the importance of using multiple unbiased reporters, examining follow-up effects with a minimal follow-up period of 6 months, fully reporting all outcome data, and taking into account the level of assignment in the method of analysis. Furthermore, to meet the criteria for efficacy, there should be consistent findings in 2 different, high-quality studies that each have adequate statistical power and that demonstrate a consistent pattern of statistically significant findings, in which no serious negative or iatrogenic effects occur and there is some demonstration of the practical public health significance of the findings.

In addition, there are additional standards to be met for an intervention to be considered an effective program or one that is ready for full dissemination or “going to scale.” An effective intervention not only would meet all standards for efficacious interventions but also would (1) offer manuals, appropriate training, and technical support to allow third parties to adopt and to implement the interventions, (2) be evaluated under real-world conditions in studies that include sound measurements of the levels of implementation and engagement of the target audience in both the intervention and control conditions, (3) demonstrate the practical importance of intervention outcome effects, and (4) specify the populations to which intervention findings can be generalized.<sup>92</sup>

Although meeting the complete set of standards is a goal toward which researchers should aspire, it is recognized that few intervention research programs meet all of the current standards (for example, multiple replications). This is 1 reason why we had designations for interventions as most promising or showing mixed or emerging evidence but not as meeting the complete criteria for effectiveness. As noted earlier, one of the greatest needs is to conduct multiple, independent replications of currently existing programs, to test their efficacy and effectiveness fully.<sup>23</sup>

**Need for Improved Standards Concerning Intervention Replications**—Earlier in this report, 2 issues concerning replication research were discussed, namely, the limited amount of replication study overall and limited standards for judging when a replication study is truly a replication study (eg, when a program has been changed substantially and those changes are not being evaluated systematically, a study may not qualify as a replication study). There is a related issue that would benefit from clearer standards, that is, standards for judging when the data for an originally developed intervention are applicable to an intervention that has been revised in significant or substantial ways but has not yet undergone replication study. This issue concerns the applicability of the evidence on efficacy or effectiveness of tests of original versions of interventions in published reports to subsequently revised versions of interventions that have not been studied themselves. It is common for intervention developers and researchers to use process evaluation data and evaluations of intervention-mediating mechanisms to refine interventions after outcome studies. The refined version of the program, not the originally tested version, may be the only one that is available to prospective consumers. Under these circumstances, the question of whether the findings in the published studies are applicable to the currently available version of an intervention arises. Standards to guide an answer to this question would be helpful (eg, guidelines to evaluate the degree to which “active ingredients” of an intervention are affected by revision).

**Need for Improved Reporting Standards**—The reporting of many of the studies reviewed failed to include many types of information important for the evaluation of evidence in the studies (eg, randomization model or differential attrition). Because of the great concern regarding variation in the quality of reporting in medical and public health trials, there has been a recognized need for a stronger focus on the development of clear criteria for both designs and reporting. Among the most important innovations has been the Consolidated Standards of Reporting Trials (CONSORT) Statement (available at: [www.consort-statement.org/index.html](http://www.consort-statement.org/index.html)). The CONSORT Statement was developed in the health care area and has become the standard for the reporting of randomized, controlled trials in the field of health care and medicine. The CONSORT Statement provides a 22-item checklist for the transparent reporting of randomized, clinical trials. It covers specific aspects of the background, methods, results, and discussion sections. It also provides a model flow diagram to show the progress of all participants in the trial from the time they are randomly assigned until the end of their involvement. This allows readers to see clearly how many subjects are involved at any point in the trial. Since 1996, the CONSORT Statement has been adopted by >150 journals (mostly medical or psychological); although it is subject to additional improvement, it is quite useful. Transparent Reporting of Evaluations with Nonrandomized Designs ([www.trend-statement.org/asp/statement.asp](http://www.trend-statement.org/asp/statement.asp)) provides a similar kind of model for reporting evaluations with non-randomized trials. The model is consistent with the CONSORT model but is more focused on behavioral interventions.

Although some of the studies we reviewed herein were reported before the establishment of the CONSORT criteria, quite a number were more recent. In numerous cases, there was inconsistent reporting of information on subjects, design, measurement, and analysis. We think that consistent use of the CONSORT model and the Society for Prevention Research standards of evidence would lead to substantial improvement in the validity and interpretability of results.

## Adopting Public Health Impact-Oriented Models

Although an essential step in the process of developing effective interventions to prevent underage drinking on a larger scale is the clear demonstration of positive effects for individual interventions, there are additional steps that need to be taken to ensure greater public health impact. Most currently implemented programs and practices do not meet standards of evidence such as those of the Society for Prevention Research.<sup>92,107</sup> For example, a number of reviews of the actual implementation of interventions disseminated in school and community settings have shown that only a limited proportion are interventions considered to be evidence-based.<sup>108–110</sup> Among those that are evidence-based, many are not implemented with sufficient quality to be expected to produce desired, long-term, alcohol reduction outcomes.<sup>36,111,112</sup> Furthermore, among the evidence-based interventions implemented initially with quality in a community setting, few are implemented with quality on a sustained basis. When the total group of interventions designed to address underage drinking, across all developmental stages, is considered, only a very small proportion of interventions are evidence-based and implemented with quality in sustained ways.<sup>43,113</sup>

Additional steps entail translating effective interventions into widespread practice, effective interventions that ultimately have the kind of broad coverage suggested above (across developmental phases, domains, and populations). Key among these additional steps is substantial expansion of the knowledge base regarding factors influencing dissemination of evidence-based interventions and sustained quality implementation of them, guided by current intervention research models tailored to specific phases of research.<sup>64</sup>

To achieve large-scale public impact, existing models of preventive intervention research<sup>44</sup> could be adapted to enhance the likelihood of such impact. The Institute of Medicine model specifies that developmental and etiologic theories guide the design and pilot testing of interventions. After refinement on the basis of pilot test results, interventions are subjected to rigorous testing intended to evaluate their efficacy. This is followed by replication and effectiveness studies that evaluate the extent to which the intervention is efficacious for different populations in different settings, after which the intervention is ready for the final step of dissemination.

There is extensive literature on factors that promote effective dissemination of evidence-based interventions, to guide the achievement of broad, population-based, public health impact.<sup>40, 114</sup> Such factors include the readiness and capacity of organizations for implementation, the quality of training and technical assistance, the level of opinion leadership, and support from administrators in the implementation system. The relevant literature also incorporates guidance on factors influencing the quality of implementation of evidence-based interventions,<sup>36,111, 115,116</sup> as well as the sustainability of quality implementation.<sup>117</sup> In addition, there is guidance from this body of literature on addressing barriers to dissemination of evidence-based public health interventions and carefully considering how to adapt dissemination strategies that were designed originally for the health care field.<sup>118</sup>

Of great relevance to the achievement of public health impact through dissemination of evidence-based interventions are emerging models that build on the traditional Institute of Medicine model<sup>45</sup> of the phases of intervention development and evaluation summarized above. These emerging models entail greater emphasis on community participatory- and consumer-oriented research, from the earliest formative phases of research forward.<sup>24,119–121</sup> Emerging models focus on better integration of private enterprise procedures for product development and marketing<sup>120</sup> or service development models<sup>121</sup> that, much like health care,<sup>122</sup> incorporate careful consideration of consumer, provider, and funder issues of relevance. These considerations may be useful for optimizing effective, broad-based dissemination.

In addition to broader application of emerging models of intervention development, testing, and dissemination, progress toward public health impact would be facilitated by more-extensive and -consistent evaluation of “dissemination values” at each phase of research; an applicable set of procedures and methods has been developed<sup>123</sup> for this purpose. Also of relevance is a community-university partnership model implemented through the outreach and dissemination arm of the national land-grant university system linked with public school systems.<sup>124</sup> Data indicate that community teams supported by the community-university partnerships can effectively engage prospective intervention participants in evidence-based interventions that can be implemented with quality on a sustained basis, with a range of positive community-level outcomes.<sup>112,116</sup> Most importantly, much more emphasis is needed on the translational function of intervention-related research, defined as the translation of research from basic causes (eg, peer and family influences on young adolescent decisions to drink alcohol) to real-world applications.<sup>125</sup> The translational function centers on translating science into widespread prevention practice. This requires transdisciplinary research<sup>105</sup> that could serve to shift the field of prevention of underage drinking toward a paradigm emphasizing the social value of translating science into practice with public health impact, or following a translational impact paradigm designed to accelerate the rate of population-level effects.<sup>113</sup>

To summarize the range of current models for dissemination of evidence-based preventive intervention, oriented toward translation of science into practice, offer great promise for taking critically important steps to achieving public health impact through reduced underage drinking. Implementing these models warrants increased federal resources and the use of innovative funding mechanisms, such as those that “braid” funding for evidence-based services with that for preventive intervention research (eg, see [www.preventionresearch.org](http://www.preventionresearch.org)).

## CONCLUSIONS

This review indicated that a number of preventive interventions, particularly universal and selective ones, significantly reduced the rate of alcohol use in studied underage populations, as well as bolstered protective factors among children that reduce risks for alcohol use. The review also underscores a number of advances in preventive interventions to address underage drinking over the past 15 years, advances that reflect progression of the field of prevention more generally. For example, there have been substantial methodologic improvements in study design and analyses, along with the use of randomized, clinical trials that have been crucial to legitimizing prevention efforts by enhancing the credibility of reported outcomes. In addition, there is an expanding armamentarium of interventions that are ready for dissemination, as illustrated by the current number of carefully manualized, replicable models of intervention presented in Tables 1 to 6. The growing number of evidence-based interventions reflects progress in the field of prevention science and its application to public health issues.<sup>43,44,126,127</sup>

Reaching the potential suggested by recent advances will require careful attention to needed work indicated by this review, such as filling the gaps in the intervention evidence base, particularly for early tweens, late teens, and young adults who are not in college and for nonmajority populations, addressing critical research issues, and promulgating stronger, more consistently applied standards of evidence and reporting. In particular, it will require the application of emerging models for engaging consumers, providers, funders, and scientists in an enterprise oriented toward real-world impact. A public health approach of this kind has several salient features, that is, ecologically valid, evidence-based, preventive interventions on a large scale, well integrated across individual, family, school, work-place, and community domains. Most importantly, it has the necessary infrastructure and capacity-building to support ongoing research and sustained, quality implementation of interventions, at the community,

state, and national levels. A strategy for mobilizing community, state, and federal resources to accomplish such an impact clearly is indicated.

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## Abbreviation

CONSORT Consolidated Standards of Reporting Trials

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**TABLE 1**  
Interventions for Children <10 Years of Age With Most Promising Evidence on Alcohol Outcomes

<b>Intervention</b>	<b>Type</b>	<b>Domain/Level</b>	<b>Sample (at Pretest), Ethnicity, and Setting</b>	<b>Summary Results</b>	<b>Key Outcome Research/Program Information Sources</b>
Linking the Interests of Families and Teachers	Universal	Family and school	6 schools; 651 students, grades 1–5, college town, primarily white	Grade 1 intervention showed effects on child physical aggression (intervention is multiyear and ongoing); grade 5 intervention showed effects on patterned alcohol use across grades 6–8 (2–3-y follow-up data)	Eddy et al, <sup>130</sup> 2000; Eddy et al, <sup>131</sup> 2003; www.oslc.org
Raising Healthy Children	Universal	Family and school	10 schools; 989 students, grades 1–7, suburban, primarily white	Reductions in teacher reports of disruptive and aggressive behavior at grade 2 (intervention is multiyear and ongoing); no effects by parent report; at 2- and 3-y follow-up times, reductions seen in growth of alcohol use; no reductions in alcohol initiation rates	Catalano et al, <sup>132</sup> 2003; Brown et al, <sup>128</sup> 2005; depts.washington.edu/sdrp
Seattle Social Development Project	Universal	Family and school	18 schools; 810 students, grades 1–5, urban, multiethnic	Effects at second grade on school-age aggression (white boys only; intervention is multiyear and ongoing); effects on alcohol initiation at grade 5; reductions in heavy drinking at age 18 (6 y follow-up data); high rates of attrition (quasiexperimental)	Hawkins et al, <sup>129</sup> 1991; Hawkins et al, <sup>133</sup> 1992; depts.washington.edu/sdrp/page4.html#SSDP
Nurse-Family Partnership Program	Selective	Family	300 pregnant women, rural, white	Reduced maternal behavioral problems attributable to alcohol or drug abuse; fewer days of alcohol consumption among 15-y-old youths (13-y follow-up data)	Olds et al, <sup>134</sup> 1998; www.nursefamilypartnership.org
Preventive Treatment Program (Montreal)	Selective	Multicomponent	166 children, grades 1–2, with early behavioral	Significant effects on drinking to the point of being drunk at age 15 (7-y follow-up data)	Tremblay et al, <sup>135</sup> 1996; www.gripinfo.ca/Grip/Public/www

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
			problems, urban, French-Canadian		

In all tables, statements concerning the point at which follow-up assessments occurred (eg, referencing the intervention posttest, the number of years of follow-up monitoring, or a participant grade level) reflect the statements about such time points in the published articles. In every case, the reviewers ascertained that the relevant time point met the stated criterion of ~6-month follow-up assessments.

**TABLE 2**  
Interventions for Children <10 Years of Age With Mixed or Emerging Evidence on Alcohol Risk or Alcohol Outcomes

<b>Intervention</b>	<b>Type</b>	<b>Domain/Level</b>	<b>Sample (at Pretest), Ethnicity, and Setting</b>	<b>Summary Results</b>	<b>Key Outcome Research/Program Information Sources</b>
Classroom-centered intervention	Universal	School	9 schools; 576 students, grades 1–2, urban, multiethnic	At 4-y follow-up evaluation (sixth grade), lower rates of DISC-IV diagnosis of conduct disorder; no effects on alcohol initiation	Ialongo et al, 136 2001; Furr-Holden et al, 137 2004; nialongo@jhsph.edu
Families and Schools Together	Universal	Family and school	100 children, kindergarten to grade 2/3 schools, rural, American Indian	Reductions in teacher reports of aggression at 1-y follow-up evaluation; 48% attrition	Kratochwill et al, 138 2004; www.wcer.wisc.edu/FAST
Fast Track	Selective	Multicomponent	4 communities; 891 children selected in kindergarten, scoring high on behavior problems, grades 1–5, urban and rural, multiethnic	Grades 1 and 3: effects on teacher-rated aggression; grade 3: effects on parent-rated aggression (intervention is multiyear and ongoing); grades 4 and 5: effects on parent reports and self-reports of problem behaviors; no effect on teacher reported behavioral problems (intervention is multiyear and ongoing)	Conduct Problems Prevention Research Group, 139,140 1999, 2004; www.fasttrackproject.org
First Steps to Success	Selective	School	46 kindergarten-aged children with behavior problems, small urban, white	Reductions in aggression by teacher report at 1-y follow-up assessment (grade 1) but no control group at follow-up assessment	Walker et al, 141 1998; www.uoregon.edu/~ivdb
Good Behavior Game	Universal	School	864 students, grades 1–2, large urban, multiethnic	At 4-y follow-up evaluation (grade 6), effect varied as function of aggression severity;	Kellam et al, 142 1994; Kellam et al, 143 1998; www.dsgonline.com/mpg2.5/TitleV_MPG_Table_Ind_Rec.asp?id=298

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
I Can Problem Solve	Universal	Family	217 preschool-aged children, urban, black only	lower rates of aggression in sixth-grade boys who began high in aggression; no effect on aggression in girls  Reduction in impulsive behavior by teacher reports at 6-mo follow-up evaluation (kindergarten)	Shure, 144 1982; www.thinkingchild.com/icps.htm
Olweus Bullying Prevention	Universal	School	42 schools; 2500 children, grades 4–7, urban (Oslo, Norway)	Quasiexperimental design; effects on self-reports of fighting and alcohol use at 2-y follow-up evaluation; no replications of effects in other countries	Olweus, 145 1991; Olweus et al, 146 1999; Smith et al, 147 2004; www.clemson.edu/olweus
Perry Preschool Program	Selective	School and family	123 children, 3–4 y of age, small urban, primarily black	Less antisocial behavior by teacher ratings at 1–3-y follow-up evaluation (data summarized across grades 1–3; intervention ended in preschool years); no differences in adult alcohol use	Schweinhart and Weikart, 148 1980; Schweinhart et al, 149 1993; www.highscope.org
Promoting Alternative Thinking Strategies	Universal and selective	School	Study 1: 133 special needs students, grades 1–3, urban, multiethnic; study 2: 4 schools; 316 second- and third-graders, urban, multiethnic; study 3: 46 first-graders, urban and rural, multiethnic	Study 1: 1-y follow-up evaluation (grades 3 and 4), effects on teacher reports of child behavior problems; study 2: 1-y follow-up evaluation (grades 3 and 4), effects on teacher reports of child behavior problems; study 3: sociometric ratings of aggression and disruption and teacher reports of behavior problems (end of grade 1;	Kam et al, 150 2004; Riggs et al, 151 2006; Conduct Problems Prevention Research Group, 152 1999; www.channing-bete.com/positiveyouth/pages/PATHS/PATHS.html

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
Schools and Families Educating Children	Selective	Multicomponent	7 schools; 444 children, grade 1, large urban, multiethnic	intervention is multiyear and ongoing) 6-mo follow-up effects (grade 2) found on aggression only in children who began with high baseline rates of aggression	Tolan and Dodge, 153 2005; www.dsgonline.com/mpg2.5//TitleV_MPG_Table_Ind_Rec.asp?id=417
Second Step	Universal	School	12 schools; 790 second- and third- graders, urban, multiethnic	No effects on teacher or parent reports of aggression at 1-y follow-up assessment (grades 3 and 4), but reductions in observed aggression on playground	Grossman et al, 154 1997; www.cfchildren.org
The Incredible Years	Selective	Family and preschool, multicomponent	Study 1: 634 Head Start, preschool-aged children, 4 and 5 y of age, urban, multiethnic; study 2: 272 Head Start, preschool-aged children, 4 and 5 y of age, urban, multiethnic; study 3: 208 low-income, preschool-aged children, urban, multiethnic	Study 1: Head Start mothers reported lower intensity of behavior problems at 1-y follow-up evaluation; no effect of frequency of behavior problems; Study 2: at 1-y follow-up evaluation, greater rate of improvement in conduct problems, in subsample that had higher risk at baseline; Study 3: teacher-reported effects at 1-y follow-up evaluation in high-problem children receiving only parent training; no effect on group receiving both parent and teacher training; no effects at follow-up evaluation on parent-reported behavior problems	Study 1: Reid et al, 155 2002; Study 2: Webster-Stratton and Taylor, 156 2001; Study 3: Gross et al, 157 2003; www.incredibleyears.com

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
Triple P-Positive Parenting	Universal and selective	Family	Study 1: 219 children, 2–6 y of age, urban (Germany); study 2: 305 preschool-aged children, 3 y of age, urban (Australia)	Study 1: Universal prevention trial; at 1-y follow-up evaluation, reductions in externalizing problems by mother and father reports, compared with control subjects; Study 2: sustained effects on child aggression and negative behavior by mother and father reports and observed behavior	Study 1: Heinrichs et al, 158 2006; Study 2: Sanders et al, 89 2000; www.pfsc.uq.edu.au/02_ppp/ppp.html

Interventions considered were those that assessed aggressive behavior outcomes placing children <10 years of age at risk for early alcohol use and/or alcohol outcomes. DISC-IV indicates Diagnostic Interview Schedule for Children, version IV.

**TABLE 3**

Interventions for Youths 10 to 15 Years of Age With Most Promising Evidence on Alcohol Outcomes

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, Setting, and Data Collection Dates	Summary Results	Key Outcome Research/Program Information Sources
Keepin' It REAL	Universal	School	35 public schools; 4235 students, multiple ethnicities, urban (Phoenix, AZ), 1998–2000	Significantly lower increases in past-month alcohol use at wave 4 (19 mo after curriculum completion) for all 3 conditions, each of which represented a different version of the program (Mexican American, black/white, or multicultural)	Hecht et al, 159 2003; www.dsgonline.com/mpg2.5/TitleV_MPG_Table_Ind_Rec.asp?td=634
Midwestern Prevention Project/ Project STAR	Universal	Multicomponent	42 public middle and junior high schools; 3412 students, white and black, urban (Kansas City, MO, and Indianapolis, IN), 1987–2001	Significant effects on proportion of students reporting past-week and past-month use of alcohol at 1-y follow-up evaluation; secondary prevention effects on baseline users were observed up to 1.5 y after baseline but not 2.5 and 3.5 y after baseline	Report 1: Pentz et al, 73 1989; report 2: Pentz and Valente, 160 1995; report 3: Pentz et al, 95 1990; report 4: Chou et al, 161 1998
Project Northland	Universal	Multicomponent	24 school districts; most ethnicities, tribal, urban and rural (northeastern Minnesota), 1991–2004	Phase 1 intervention: conducted when targeted cohort was in grades 6–8; students in intervention group showed significantly less past-month and past-week use than did students in control group at 2.5 y after baseline; phase 2 intervention: conducted when cohort was in grades 11–12; students in intervention group showed significantly less binge drinking ( $\geq 5$ in a row in past	Report 1 (phase 1): Perry et al, 162 1996; report 2 (phase 1): Klepp et al, 163 1995; report 3 (phase 2): Perry et al, 164 2002; http://ibs.colorado.edu/cspv/www/cgi-bin/progdetails.pl?progid=65

Intervention	Type	Domain/Level	Sample (at Prefest), Ethnicity, Setting, and Data Collection Dates	Summary Results	Key Outcome Research/Program Information Sources
Strengthening Families Program: For Parents and Youth 10-14	Universal	Family	Study 1: 33 public schools; 667 students, primarily white, rural; study 2: 36 public schools; 1650 students, primarily white, rural (rural Iowa) 1998-2004	week) than did students in control group at 6.5 y after baseline  Study 1: significantly lower rates of initiation in each of 3 alcohol lifetime or new-user measures (with parental permission, without permission, and drunkenness) at 4-y postbaseline follow-up evaluation, relative to control group; lifetime use and drunkenness and time to initiation were significant at 6 y after baseline; study 2: when combined with Life Skills Training Program, showed significantly less alcohol initiation at 1.5 y after baseline and slower growth in weekly drunkenness but not regular alcohol use across data collection points through 2.5 y after baseline	Study 1A: Spoth et al, 165 2001; study 1B: Spoth et al, 166 2004; study 2A: Spoth et al, 68 2002; study 2B: Spoth et al, 167 2005; www.strengtheningfamiliesprogram.org; http://ibs.colorado.edu/cspv/www/cgi-bin/progdetails.pl?progid=235

**TABLE 4**

Interventions for Youths 10 to 15 Years of Age With Mixed or Emerging Evidence on Alcohol Outcomes

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, Setting, and Data Collection Dates	Summary Results	Key Outcome Research/Program Information Sources
Bicultural Competence Skills Program	Universal	Clinic and school	27 public and tribal schools; 1396 students. Native American, tribal (American Indian reservation in western Washington), 1986–1999	At 30- and 42-mo follow-up evaluations, alcohol use ( $\geq 4$ drinks during week before assessment) was significantly lower for subjects in schools assigned to skills program-only group, compared with control group; results for skills program plus community group were not significant; intra-unit dependence not addressed	Schinke et al, 168 2000; www.dsgonline.com/mpg2.5/TitleV_MPG_Table_Ind_Rec.asp?id=301
Family Matters	Universal	Family	1326 adolescents (random-digital sample), all ethnicities, urban and rural (random households throughout United States), 1996–1999	Significant effects on lifetime use in repeated-measures analysis, although diminishing effects across follow-up assessments (report 2); no significant effects on any measure in earlier $\chi^2$ analyses focusing on users only (report 1)	Report 1: Bauman et al, 169 2000; report 2: Bauman et al, 170 2002; report 3: Bauman et al, 171 2001; report 4: Ennett et al, 172 2001; www.helpingamericasyouth.gov/programdetail.cfm?id=593
Families That Care: Guiding Good Choices (formerly Preparing for the Drug-Free Years)	Universal	Family	33 public schools; 667 students, primarily white, rural (rural Iowa and Seattle, WA), 1993–2003	At 4-y postbaseline follow-up evaluation, growth in alcohol use (alcohol use index measure) was significantly lower than in control group (report 1); past-month alcohol use and past-month frequency of use but not past-year use were significant at 4 y after baseline (report 1); nonsignificant new-user and lifetime rates at 4- and 6-y postbaseline data collection points (reports 1 and 2)	Report 1: Spoth et al, 165 2001; report 2: Spoth et al, 166 2004; report 3: Park et al, 173 2000; www.dsgonline.com/mpg2.5/TitleV_MPG_Table_Ind_Rec.asp?id=392
Healthy School and Drugs	Universal	School	12 public schools; 1930 students (Netherlands)	Significant differences in proportions of users, drinks per week, and drinks per occasion; quasiperimental, differential attrition and	Cuijpers et al, 174 2002

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, Setting, and Data Collection Dates	Summary Results	Key Outcome Research/Program Information Sources
Life Skills Training	Universal	School	Study 1: 56 public schools; 5954 students, white, urban, 1985–1991; study 2: 20 innercity public schools; 758 students (high-risk subsample), primarily black and Hispanic, urban; study 3: 9 public schools; 732 students, white, rural, 1999–2002; study 4: 36 schools; 1650 students, primarily white, rural, 1998–2006	intraunit dependence not addressed Study 1: Long-term outcome evaluations of skills training showed significantly lower alcohol use rates 6 y after initial baseline assessment for monthly drunkenness only (not monthly, weekly, or $\geq 3$ drinks per occasion); $\geq 1$ of 2 experimental conditions showed significantly lower use on all measures in high-fidelity subsample; study 2: at 1-y follow-up evaluation, significantly lower drinking composite measure for high-risk subsample; study 3: no significant findings; study 4: significantly less lifetime use at 1.5 y after baseline, became nonsignificant at 2.5 y past baseline; difference from control group in weekly drunkenness at 2.5 y after baseline marginally significant	Study 1: Botvin et al, 175 1995; study 2: Griffin et al, 176 2003; study 3: Smith et al, 147 2004; study 4: Spoth et al, 167 2005; <a href="http://ibs.colorado.edu/espv/www/cgi-bin/progdetails.pl?progid=4">http://ibs.colorado.edu/espv/www/cgi-bin/progdetails.pl?progid=4</a>
New Beginnings Program	Selective	Family (MPCP = mothers and children; MP = mothers only)	N = 240 families; children between ages 9 & 12 and their recently divorced custodial parent; urban; primarily white	At a 6-year follow-up, only among participants with higher baseline levels, significant differences between MP and control for past year alcohol frequency. No significant differences for MPCP.	Wolchik et al, 177 2002
Project Alert	Universal and selective	School	Study 1: 55 public schools; 4276 students, primarily white, urban and rural, 1997–1999; study 2: 8 public schools; 1649 seventh-graders, most ethnicities, urban, suburban, and rural, 1999–2003; study 3: 30	Study 1 significant difference observed for alcohol misuse but not lifetime, past-month, or past-year use; study 2: no significant results; study 3: significant results for 3-mo posttest observed but no significant results at 12- and 15-mo follow-up evaluations	Study 1: Ellickson et al, 178 2003; study 2: St Pierre et al, 93 2005; study 3: Ellickson and Bell, 179 1990; <a href="http://www.metapress.com/openurl.asp?genre=article&amp;id=doi:10.1007/s1112-05-00115-0">www.metapress.com/openurl.asp?genre=article&amp;id=doi:10.1007/s1112-05-00115-0</a>

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, Setting, and Data Collection Dates	Summary Results	Key Outcome Research/Program Information Sources
School Health and Alcohol Harm Reduction Project	Universal	School	schools; 6527 students; multiple ethnicities, urban, suburban, and rural (California, Oregon, and Pennsylvania), 1984–1986	During first and second program phases, intervention students consumed less alcohol; differences were converging 17 mo after program delivery	Report 1: McBride et al, 180 2004; report 2: McBride et al, 181 2000; www.ndri.curtin.edu.au/shaharp/results.html
SODAS City	Universal	Family	14 public secondary schools; 2300 youths 13–17 y of age, metropolitan (Perth, Australia), 1997–1999	CD-ROM alone and CD-ROM plus parent intervention showed significantly lower past-month use at 3-y follow-up evaluation; intraunit dependence and differential attrition effects on outcomes and key sociodemographic variables not addressed	Schinke et al, 182 2004

**TABLE 5**  
Interventions for High School Students or Older Participants (16 to ≥20 Years of Age) With Most Promising Evidence on Alcohol Outcomes

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
Project Toward No Drug Abuse	Selective and indicated	School	42 schools; 2,468 high school youths, multiple ethnicities (southern California)	Reduction in levels of alcohol use among baseline users at 1-y follow-up evaluation	Sussman et al, <sup>66</sup> 2002
Yale Work and Family Stress Project	Universal	Workplace	4 job sites; 239 female secretarial employees, primarily white (Connecticut-based corporations)	Reduced number of drinks per month at 22-mo postintervention follow-up evaluation	Snow et al, <sup>183</sup> 2002
Mississippi Alcohol Safety Education Program and Added Brief Individual Intervention	Indicated	Community	4074 adjudicated first-time DUI offenders, predominantly male, 36% minority sample (Mississippi)	Problem drinkers benefited more from enhanced program in reducing DUI recidivism; women tended to have lower recidivism rates and higher rates of depressed mood than did men, assessed 28–55 mo after intervention (mean: 39 mo)	Wells-Parker and Williams, <sup>184</sup> 2002

DUI indicates driving under the influence.

**TABLE 6**  
Interventions for High School or Older Participants (16 to  $\geq 20$  Years of Age) With Mixed or Emerging Evidence on Alcohol or Alcohol Consequence-Related Outcomes

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
Athletes Training and Learning to Avoid Steroids	Universal	School	31 high school football teams; 3207 athletes, multiple ethnicities, predominately white (Portland, OR)	Reduced use of alcohol at 1-y follow-up evaluation but not at posttest evaluation; no data on differential retention in treatment vs control groups for short- and long-term follow-up periods	Goldberg et al. <sup>67</sup> 2000
Brief Motivational Intervention in Emergency Department	Universal and selective	Community	539 injured patients treated in emergency department, mostly male, primarily white (72%), urban (southern New England)	Patients receiving brief intervention with booster reduced alcohol-related negative consequences and alcohol-related injuries more than did those in control group; no differences were observed for heavy drinking days at 1-y follow-up assessment	Longabaugh et al. <sup>185</sup> 2001
Communities Mobilizing for Change on Alcohol	Universal	Community	15 communities (mean population: 20 836; mean: 49 retail liquor outlets), primarily white, relatively few racial minorities (upper Midwestern region of United States)	In assessments conducted 3 y after baseline, reductions in sales to minors were observed, along with increased identification checks by vendors; reduced availability from noncommercial outlets; reduced community tolerance of underage purchase and consumption; no alcohol outcomes or outcomes that were direct logical consequence of alcohol use (eg, alcohol-related traffic accidents)	Wagenaar et al. <sup>71</sup> 1999

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
Community Trials Intervention to Reduce High-Risk Drinking	Universal	Community	3 communities (population: ~100 000), diverse race and ethnicity, mixed urban, suburban, and rural (northern and southern California and South Carolina)	Study 1: at 10 mo after intervention, increased enforcement combined with media advocacy and other community activities had significant effect on reducing sales to apparent minors; no main effects were observed regarding responsible beverage service training for alcohol sales clerks; study 2: across 3-y period after initial intervention implementation, 6% decrease in self-reported amounts of alcohol consumed per drinking occasion and 49% decrease in self-reported "having had too much to drink"; small number of communities	Study 1: Grube, 103 1997; study 2: Holder et al, 70 2000
Problem Drinking in Workplace	Universal	Workplace	155, primarily white (85%), medium-sized company (Pacific Northwest)	Female problem drinkers who received intervention were more likely than those in no-treatment control group to reduce alcohol-related negative consequences at follow-up evaluation; significant multivariate treatment effect, suggesting that participants who received intervention were significantly more likely to reduce drinking frequency at 6-mo postbaseline follow-up assessment; only 1 company assessed	Anderson and Larimer, 186 2002

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
Raising minimum drinking age law	Universal	State-level	<p>Study 1: 11 069 youths 16–20 y of age surveyed over ~14-y period (1811 surveyed before legal purchase age raised to 19, 1798 surveyed 1 y after purchase age change, 2757 surveyed 3 y after purchase age change, 2698 surveyed 1 y after purchase age change to 21, 2005 surveyed 10 y after purchase age change), primarily white (New York State); study 2: <i>N</i> not reported, evaluated alcohol related-crashes, 1976–1993 (Wisconsin); study 3: <i>N</i> not reported, pooled data from 47 states using the Fatal Accident Reporting System, 1975–1984; study 4: <i>N</i> not reported, crash data from the Fatal Accident Reporting System (Tennessee); study 5: 2000 youths 16–20 y of age surveyed 1 mo before purchase age changed to 19 and 1 y after law change (New York State); study 6: <i>N</i> not reported, data collected from all 50 states and District of Columbia; study 7: <i>N</i> not reported, data collected on traffic crashes in 1976–1984 to compare 18–20-y-old drivers with ≥21-y-old drivers (Michigan); study 8: 1800 youths 16–20 y of age contacted 1 mo before minimum legal purchase age raised from 18 to 19; second sample surveyed 1 y after change (New York State); study 9: ≥250 driver fatalities for each of 3 states in the United States in 1975–1981 (Illinois, Michigan, and Massachusetts); study 10: 1000 youths 16–19 y of age (Massachusetts, with New York State as comparison group)</p>	<p>Study 1: continuous decrease of 16- and 17-y-old alcohol purchase rates from 1982 to 1996; by 1996, self-reported impaired driving rates reduced by one half for 19- and 20-y-old youths, compared with those in 1985 before enactment of the age 21 purchase age law; from 1982 to 1995, alcohol-related crashes decreased by 78% for &lt;21-y age group; study 2: significantly fewer teens were involved in alcohol-related crashes after minimum drinking age was raised to 21; study 3: decrease in single-vehicle fatalities among 19- and 20-y-old youths but not single-vehicle night time fatalities; did not address whether reduction of fatalities was attributable to age increase or inexperience in driving; study 4: decreases of mean blood alcohol levels and single-vehicle night time fatalities among 15–18-y-old and 19–20-y-old youths after age law change in 1985; authors not certain whether decreases were attributable to age law change or grass roots organizations that were gaining popular publicity at the same time (MADD and</p>	<p>Study 1: Yu and Shackel, 54 1998; study 2: Figlio, 187 1995; study 3: Asch and Levy, 188 1990; study 4: Decker et al., 77 1988; study 5: Lillis et al., 189 1987; study 6: Wilkinson, 190 1987; study 7: Wagenaar, 191 1986; study 8: Williams and Lillis, 192 1986; study 9: MacKinnon and Woodward, 193 1986; study 10: Hingson et al., 55 1983</p>

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
				SADD); study 5: reduction in fatal crashes involving 17- and 18-y-old drinking drivers; DWI arrests were significantly decreased for 18-y-old drivers; rate of 18-y-old youths reporting drinking and driving decreased significantly; rate of beer purchasing decreased significantly after purchase age increase to 19; study 6: consumption of alcohol reduced after minimum legal drinking age was raised to 21; however, age groups were not specified regarding which were affected by law change; study 7: reductions in single-vehicle night time crashes among 18–20-y-old youths, compared with period before drinking age was raised; drunk-driver crashes decreased 19%; study 8: after increase in purchase age to 19, reductions in quantity and frequency of drinking among age groups affected by law change (18 y of age); study 9: significant 18% reduction of 4.5 fatalities per month for 16–21-y-old youths after drinking age raised in Illinois; significant 11% reduction of 2.8 fatalities per month	

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
Raising minimum drinking age law	Universal	School-level	<p>Study 1: <i>N</i> not reported, pooled data from high school seniors in 44 states using 1977–1992 Monitoring the Future surveys; study 2: ~17 000 youths 17–20 y of age per year (for 10 y), 130 high schools across the United States, representing 4 major geographic regions (Northeast, North Central, West, and South); study 3: 4202 students over 3-y period, 9 state universities in Florida; study 4: 3145 (1982–1983), 2797 (1984–1985), and 3375 (1987–1988) students, 56 colleges and universities across the United States</p>	<p>for 16–21-y-old youths after drinking age raised in Michigan; reduction in Massachusetts not significant; study 10: reduction of single-vehicle night time crashes in Massachusetts among 18- and 19-year-old youths, compared with New York; no reduction in overall teenage drinking and nonfatal accidents in Massachusetts after law change</p>	<p>Study 1: Dee,<sup>56</sup> 1999; study 2: O'Malley and Wagenaar,<sup>58</sup> 1991; study 3: Gonzalez,<sup>79</sup> 1989; study 4: Engs and Hanson,<sup>57</sup> 1988</p>

Intervention	Type	Domain/Level	Sample (at Pretest), Ethnicity, and Setting	Summary Results	Key Outcome Research/Program Information Sources
				decrease in drinking for students who were drinkers in 1985–1986, compared with 1987–1988; significant reduction in students who indicated they drank while driving and reduction of driving after having too much to drink; heavy drinkers remained constant over time and proportion of underage students who drank was higher than proportion of legal-age students who drank; no comparison group	

MADD indicates Mothers Against Drunk Driving; SADD, Students Against Drunk Driving; DWI, driving while intoxicated.