

# A Systematic Review of Effective Interventions for Reducing Multiple Health Risk Behaviors in Adolescence

We systematically searched 9 biomedical and social science databases (1980–2012) for primary and secondary interventions that prevented or reduced 2 or more adolescent health risk behaviors (tobacco use, alcohol use, illicit drug use, risky sexual behavior, aggressive acts).

We identified 44 randomized controlled trials of universal or selective interventions and were effective for multiple health risk behaviors. Most were school based, conducted in the United States, and effective for multiple forms of substance use. Effects were small, in line with findings for other universal prevention programs. In some studies, effects for more than 1 health risk behavior only emerged at long-term follow-up.

Integrated prevention programs are feasible and effective and may be more efficient than discrete prevention strategies. (*Am J Public Health*. 2014;104:e19–e41. doi:10.2105/AJPH.2014.301874)

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## ADOLESCENCE IS ASSOCIATED

with an increased prevalence of health risk behaviors, including substance use, sexual risk, and aggressive behavior.<sup>1</sup> The vast majority of substance use is initiated in adolescence.<sup>2,3</sup> In the United Kingdom, adolescence is associated with higher rates of sexually transmitted disease and abortion relative to other age groups.<sup>4,5</sup> The majority of young people will experience bullying or aggression during adolescence.<sup>6</sup> In addition, adolescent mortality has increased relative to other age groups, largely because of accidents and unintentional injuries.<sup>7</sup> Early initiation of health risk behaviors is associated with negative outcomes throughout adolescence and adulthood, such as addiction and substance abuse; poor sexual, mental, and physical health; and lower occupational and educational attainment.<sup>8,9</sup> The social and economic costs associated with adolescent risk behaviors have made them a key focus of public health policy initiatives internationally.<sup>10</sup>

A growing body of research suggests that health risk behaviors often do not occur in isolation. Smoking, drinking, illicit drug use, sexual risk, and aggressive behaviors are all mutually predictive.<sup>11</sup> For drug use and some forms of sexual risk, co-occurrence with other risk behaviors is essentially normative. Previous research suggests that co-occurrence of risk behaviors is driven by shared risk factors such as peer influences or sensation seeking or by state-specific traits such as the direct

effects of substance use or aggression on other risk behaviors. Common risk factors can be found in many domains, including social, psychological, family, school, and neighborhood.<sup>12–14</sup> Evidence also suggests gateway effects, whereby participation in a given health risk behavior leads to increased risk for others, partially attributable to exposure effects and decreases in perceived danger of such behaviors.<sup>15</sup> For example, adolescent smoking and drinking have been linked with subsequent illicit drug use.<sup>16</sup>

This typical co-occurrence is often not reflected in the organization of policies and interventions to reduce adolescent risk behavior. National policy regarding adolescent health risk behavior is often organized in nonoverlapping risk-specific policies.<sup>10</sup> Some intervention developers recognize that single-risk interventions for adolescents may trigger effects on other risk behaviors, particularly on multiple forms of substance use.

For several reasons, targeting multiple health risk behaviors (MHRBs) simultaneously may be more effective and efficient than targeting a single risk behavior. Limited funding for prevention interventions requires that interventions reduce health risks efficiently, highlighting the importance of synchronized prevention efforts. Time constraints, for example in schools, also make coordinated intervention for multiple risks attractive. Furthermore, it is unclear how discrete interventions might interact in cases where

they are not coordinated both theoretically and practically, raising the possibility that uncoordinated interventions could be ineffective or cause harm.<sup>17</sup>

Beyond these logistic concerns, research regarding the mechanisms for MHRBs suggests that integrated interventions may be essential for the effective prevention of risk behaviors. If common risk factors explain co-occurrence of risk behaviors, then targeting those risk factors should prove effective for MHRBs. Gateway theories offer further support for integrated intervention strategies; if a given risk behavior increases risk for another, effective prevention strategies for the latter must also focus on the former. For example, sexual intercourse accompanied by alcohol or illicit drug use is linked to a lower likelihood of condom use,<sup>18</sup> so targeting substance misuse may be a feasible approach to reducing unsafe sex.

Although the development of integrated interventions for MHRBs requires an understanding of their mechanisms, including common risk factors and gateway effects, the existing literature regarding effective interventions is also a key source of evidence for the development of interventions. The majority of evaluations report on interventions that target 1 risk behavior. However, identifying interventions that have reduced MHRBs can help inform the development of future interventions by indicating which combinations of risk behaviors can be targeted in coordinated approaches, what

contexts and approaches are most successful, and what are the other attributes of coordinated interventions, such as duration and participant age.

Limited data exist on effective intervention programs to prevent MHRBs. To date, we are aware of only 1 published review that assessed the effectiveness of interventions on MHRBs in young people.<sup>13</sup> That review focused exclusively on studies reporting concurrently on substance use and sexual risk outcomes. We expanded on this work by reviewing additional combinations of outcomes. We undertook a systematic review designed to identify randomized controlled trials that reported significant universal or selective intervention effects for at least 2 health risk behaviors among adolescents.

## METHODS

We conducted a systematic literature search and selection of articles in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.<sup>19</sup> We used a standardized search protocol (Appendix A, available as a supplement to this article at <http://www.ajph.org>) to identify randomized controlled trials that evaluated interventions that reduced population-level MHRBs ( $\geq 2$  of the following outcomes: tobacco, alcohol, or illicit drug use; sexual risk behavior; aggressive behavior). We searched 8 electronic databases (PsycINFO, PubMed, Embase, ERIC, British Education Index, Australian Education Index, Social Sciences Citation Index, CINAHL Plus); in addition we searched the Cochrane Library for reviews on each of the relevant risk behaviors. We then hand-searched references in

review articles and studies and consulted a recent related systematic review to identify any additional studies.<sup>13</sup>

## Selection Criteria

We selected studies for appraisal in a 2-stage process. First, we scanned titles and abstracts identified from the search strategy and excluded them as appropriate with the program EPPI-Reviewer 4 (EPPI-Centre, Social Science Research Unit, Institute of Education, University of London, UK). We limited our review to peer-reviewed articles published in English between January 1980 and April 2012. Eligible studies (1) were randomized controlled trials with participants who were aged 10 to 19 years at baseline, (2) reported on universal or selective interventions (targeting at-risk subpopulations), and (3) reported statistically significant effects on 2 or more of the following: tobacco use, alcohol, illicit drug use, sexual risk behavior, and aggressive behavior (e.g., delinquency, truancy) as either primary or secondary outcomes. We excluded studies that evaluated prevention programs offered in colleges or universities, indicative intervention trials (in which participants were selected because of a priori involvement in the targeted risk behavior), and studies that reported attitudinal rather than behavioral changes.

As illustrated in Figure 1, the initial search generated 6299 empirical studies. To ensure interrater reliability, 2 authors reviewed titles or abstracts to assess eligibility of studies identified by the database search. This screening and removal of duplicates eliminated 6120 items. Most excluded articles were descriptive reports and not intervention studies or their participants did not

meet our age restrictions. We reviewed articles in full when abstracts did not provide enough detail to make a decision. We retrieved 179 full articles and applied our inclusion and exclusion criteria. We discussed discrepancies in selections until we reached consensus. Our final review comprised 55 articles.

We carried out quality assessment with a validated assessment tool that rates the following criteria relevant to public health studies: selection bias, allocation bias, confounding, detection bias, data collection, methods, and attrition bias.<sup>20</sup> Reviewers then rated each criterion as weak, moderate, or strong. A final global rating was subsequently determined. The quality assessment tool has demonstrated good reliability (Cohen's  $\kappa = 0.74$ ) and validity.<sup>20</sup> We resolved discrepancies in the quality ratings by discussion.

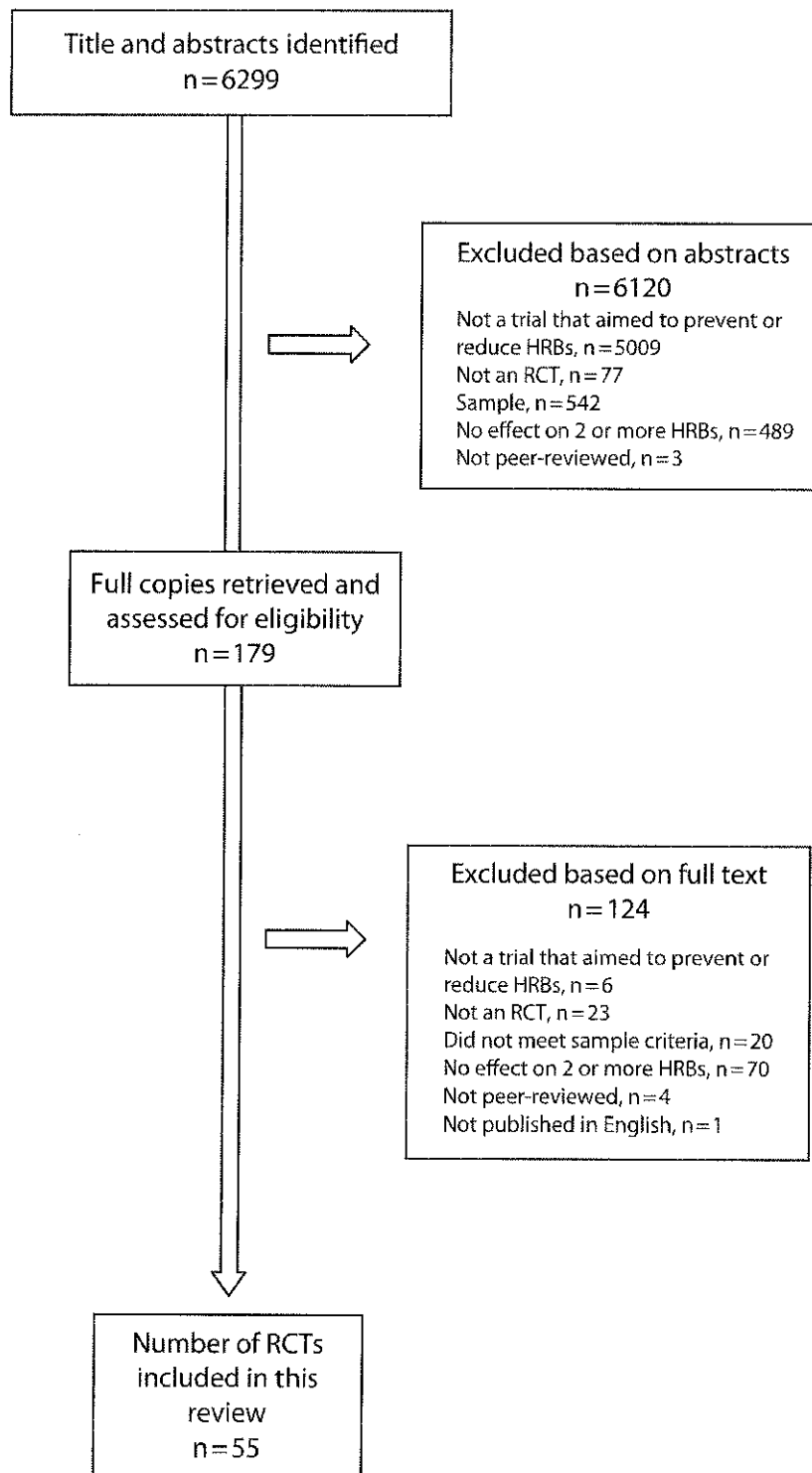
## Data Extraction and Analysis

We recorded detailed information about each study to identify characteristics of the intervention and its evaluation. We used a data extraction form to collect information on project title, author, publication date, intervention objectives, setting of intervention (e.g., school, community center, family home), study population (including control group), intervention type, domain of effectiveness (i.e., tobacco, alcohol, or illicit drug use; sexual risk; aggressive behaviors), length of follow-up, and key findings. To systematically describe the scope and components of the interventions, we extracted specific features from each article (description, educational theory, duration of intervention). In all cases, 2 authors assessed the articles and extracted the data, with discrepancies resolved by joint review and consensus.

The studies chosen for our review differed substantially in the following areas: setting, study population, duration, intensity and comprehensiveness of the intervention, timing of outcome assessments, and outcome measures. The high degree of heterogeneity in both the studies and the reporting of outcomes precluded a meta-analysis. We therefore composed a narrative report of the findings, with interventions categorized by setting (school, community, or family), outcomes, and methodological quality.

We determined effects on health risk behavior outcomes as effect sizes or odds ratios. We selected Cohen  $d$  (difference between posttest means divided by the pooled standard deviation) as the effect size index. Where the relevant descriptive statistics were not available, we estimated effect sizes (unadjusted) from available inferential statistics. Depending on the information provided in each study, we calculated effect size(s) from the following data (in order of preference): means, standard deviations or frequencies, and sample sizes for all groups; test of significance value (e.g.,  $F$  ratio) and significance level; and sample size. When studies presented data from different subgroups separately (e.g., data for male and female participants presented independently), we calculated effect sizes for each subgroup.

In line with the Cohen classification,<sup>21</sup> we divided effect sizes into 3 levels: small ( $> 0.2$ ), medium ( $> 0.5$ ), and large ( $> 0.8$ ). We calculated odds ratios and 95% confidence intervals for dichotomous outcomes and categorized them as small ( $\leq 2.5$ ), medium ( $> 2.5 - \leq 4$ ), and large ( $> 4$ ).<sup>22</sup> We conducted all analyses with an effect size calculator.<sup>23</sup>



**FIGURE 1—Identification of eligible randomized controlled trials (RCTs) in systematic review of effective interventions for reducing multiple health risk behaviors (HRBs) in adolescence.**

## RESULTS

The 55 randomized controlled trials that met our inclusion and quality criteria described 44 discrete interventions aimed at changing at least 2 types of adolescent health risk behavior.

### Study Characteristics

Study populations, type and intensity of interventions, and outcome measures varied (Table 1). Forty-five studies (82%) took place in the United States; the remaining 10 (18%) took place in Canada, Namibia, Australia, Hong Kong, and Europe. Forty-three studies (78%) evaluated school-based interventions, 11 (23%) of which included a community or family component. The remaining 12 (22%) were either family, community, or Web based. Of the 44 interventions, 14 targeted problem behaviors or aimed to increase healthy behaviors, 17 targeted general substance use, 4 aimed to reduce at least 1 type of substance use and violence or delinquent behavior, 1 focused on alcohol use and sexual risk, 5 focused on drug use, and sexual risk, alcohol use, and smoking were each the focus of 1 study (Figure 2). The studies took place in suburban, mixed urban, or rural areas. Several were conducted in places with high levels of economic deprivation.

The ages of participants in the studies ranged from 10 to 21 years, with the majority of interventions targeting adolescents aged 11 to 13 years. Four studies targeted only adolescent girls. Two studies only found significant effects among adolescent boys.

Intervention providers were usually teachers or peer or health educators who had received specialist training and members of the

**TABLE 1—Overview of Interventions in Systematic Review of Effective Interventions for Reducing Multiple Health Risk Behaviors in Adolescence**

Intervention	Study	Setting, Location	Population Characteristics	Intervention Aim	Intervention Description	Intervention Duration
Web-based mother-daughter program	Fang et al. <sup>24</sup>	Family home based, several Asian communities	Asian girls aged 11–14 years and their mothers who had access to a computer	Substance use prevention, universal	Designed to improve girls' psychological states, strengthen substance use prevention skills, increase mother-daughter interactions, enhance maternal monitoring, and prevent girls' substance use.	9 sessions, 1/wk, 45 min/session
Adolescent Alcohol Prevention Trial	Taylor et al. <sup>25</sup>	School based, Los Angeles, CA area	Grade 7 students, 47% White, 28% Hispanic, 16% Asian, and 2.5% African American	Substance use prevention, universal	Lessons about health consequences of alcohol and drugs (which constituted the control condition) combined with lessons about social norms about substance use and social acceptability as well as resistance skills training.	Unspecified
Adolescents Transition Program	Connell et al. <sup>26</sup>	School and family based, northwest United States	Sixth-grade students and their families from 3 middle schools in an ethnically diverse metropolitan community	Target problem behaviors, universal	Multilevel program incorporating Family Check-Up intervention and SHAPE curriculum, modeled after Life Skills Training program. The 6 SHAPE sessions focused on school success, health decisions, building positive peer groups, the cycle of respect, coping with stress and anger, and solving problems peacefully.	6 sessions
Preventing alcohol use among urban youth	Schinke et al. <sup>27</sup>	Community-based after-school agencies (e.g., recreation centers, tutoring services, sports centers), New York City	Mostly African American and Hispanic children, aged 10.8 y at baseline	Substance use prevention, universal	Two intervention arms: (1) CD Intended to increase knowledge and change attitudes regarding substance use and teach problem solving, norms, social influences, self-efficacy, coping with pressure, assertiveness, refusal responses, stress reduction, relaxation, and social supports; (2) parent intervention with printed material and videotape teaching skills for helping youths apply program content.	10 45-min lessons, annual booster sessions over 7 y
All Stars Program	McNeal et al. <sup>28</sup>	14 secondary schools in Lexington and Louisville, KY	Students aged 11–13 y	Substance abuse prevention, universal	Aimed to reduce adolescent risk behavior by targeting key mediators strongly linked to adolescent risk behavior: normative beliefs, lifestyle incongruence, commitment, and bonding to school. Delivered by 2 groups: specialists hired by the project who were outsiders to the school, and regular classroom teachers.	22 sessions over 1 y
Big Brothers Big Sisters	Grossman and Tieney <sup>29</sup>	Community agencies in Texas, Ohio, Minnesota, Pennsylvania, New York, Kansas, and Arizona	Children and adolescents from single-parent households, aged 10–16 y	Mentoring, selective	Unrelated adult volunteers paired with youths, met 2–4x/mo for ≥ 1 y; typical meeting lasted 3–4 h.	1 y

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TABLE 1—Continued

BRAVE	Griffin et al. <sup>30</sup>	School based, Atlanta, GA	Eighth-grade African American students from a working-poor to middle-class neighborhood	Substance use and violence prevention, selective	Aimed to address economic disadvantages and prevent alcohol and drug use and violence through skill-building exercises with reinforced practice across social contexts. Classroom teachers, who were certified instructors, conducted health education sessions, including training in HIV/AIDS prevention and personal hygiene. Aimed to reduce early risk behaviors in primary school. The classroom intervention had 3 components: curricular enhancements, improved classroom behavior management practices, and supplementary strategies for children not performing adequately. The family intervention aimed to enhance parent-school communication and provide parents with effective teaching and child behavior management strategies.	90-min sessions 2–3x/wk for 9 wk during school year
Classroom-centered and family-school partnership intervention	Furr-Holden et al. <sup>31</sup>	School and family based, mid-Atlantic US states	First-grade students from 9 urban primary schools in a single public school catchment area, 80% of the sample followed until eighth grade	Substance use prevention, universal	Alcohol and cannabis course embedded in the school health curriculum, delivered as cartoons via the Internet. Intervention communities selected 13 different tested and effective prevention programs to implement in the first year, 16 in the second year, and 14 in the third year. Programs were school based (e.g., All-Stars, Life Skills Training), community based, youth focused (e.g., Big Brothers Big Sisters), and family focused (e.g., Strengthening Families). Sought to reduce risk through mother-daughter interactions. Increased communication and monitoring of adolescent behavior while building adolescent self-esteem and establishing rules and consequences for substance use.	During first grade
Climate Schools	Newton et al. <sup>32</sup>	School based, Sydney, Australia, metropolitan area	Secondary school students aged 13 y	Prevention of alcohol and cannabis use, universal	Alcohol and cannabis course embedded in the school health curriculum, delivered as cartoons via the Internet. Intervention communities selected 13 different tested and effective prevention programs to implement in the first year, 16 in the second year, and 14 in the third year. Programs were school based (e.g., All-Stars, Life Skills Training), community based, youth focused (e.g., Big Brothers Big Sisters), and family focused (e.g., Strengthening Families). Sought to reduce risk through mother-daughter interactions. Increased communication and monitoring of adolescent behavior while building adolescent self-esteem and establishing rules and consequences for substance use.	12 40-min sessions over 6 mo
Communities That Care	Hawkins et al. <sup>33,34</sup>	Community based, Colorado, Illinois, Kansas, Maine, Oregon, Utah, and Washington	Fifth-grade students in 24 towns	Drug use and delinquency prevention, universal	Alcohol and cannabis course embedded in the school health curriculum, delivered as cartoons via the Internet. Intervention communities selected 13 different tested and effective prevention programs to implement in the first year, 16 in the second year, and 14 in the third year. Programs were school based (e.g., All-Stars, Life Skills Training), community based, youth focused (e.g., Big Brothers Big Sisters), and family focused (e.g., Strengthening Families). Sought to reduce risk through mother-daughter interactions. Increased communication and monitoring of adolescent behavior while building adolescent self-esteem and establishing rules and consequences for substance use.	3 y, fifth-eighth grades; follow-up study 6 y after installation of Communities That Care and 1 y after study resources ended
Computer-delivered, parent-involvement substance use prevention	Schinke et al. <sup>35</sup>	Family based, New York City	Adolescent girls (average mean age = 12.67 y)	Substance use prevention, universal for girls	Alcohol and cannabis course embedded in the school health curriculum, delivered as cartoons via the Internet. Intervention communities selected 13 different tested and effective prevention programs to implement in the first year, 16 in the second year, and 14 in the third year. Programs were school based (e.g., All-Stars, Life Skills Training), community based, youth focused (e.g., Big Brothers Big Sisters), and family focused (e.g., Strengthening Families). Sought to reduce risk through mother-daughter interactions. Increased communication and monitoring of adolescent behavior while building adolescent self-esteem and establishing rules and consequences for substance use.	9 45-min sessions
DARE-Plus	Perry et al. <sup>36</sup>	School based, Minnesota	Seventh-grade students in schools with ≥200 students	Drug prevention, universal	Alcohol and cannabis course embedded in the school health curriculum, delivered as cartoons via the Internet. Intervention communities selected 13 different tested and effective prevention programs to implement in the first year, 16 in the second year, and 14 in the third year. Programs were school based (e.g., All-Stars, Life Skills Training), community based, youth focused (e.g., Big Brothers Big Sisters), and family focused (e.g., Strengthening Families). Sought to reduce risk through mother-daughter interactions. Increased communication and monitoring of adolescent behavior while building adolescent self-esteem and establishing rules and consequences for substance use.	14 sessions

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TABLE 1—Continued

Drug abuse prevention program	Gomez-Fraguela et al. <sup>37</sup>	School based, Santiago de Compostela, Spain	Students aged 14–16 y in 5 public secondary schools	Substance prevention, universal	Presented information on consequences of substance use and targeted self-esteem, decision-making, anxiety, social skills, and healthy use of leisure time. Two intervention versions tested: 1 teacher led and 1 researcher led.	16 45–50 min sessions in first year, 9 reminder sessions in second year
EcoRT	Stormshak et al. <sup>38</sup>	School and family based, United States	Sixth-grade students from 3 public middle schools serving an at-risk, low-income ethnically diverse population	Problem behaviors, universal	Provided “family resource centres” in schools to provide infrastructure for collaboration between staff and families and promote positive parenting practices. These provided training, consultations and feedback for parents.	Average of 146 min over 3 years
Especially for Daughters	O'Donnell et al. <sup>39</sup>	Family based, New York City	Sixth-grade girls at baseline (aged 11–13 y), predominantly Latino and African American from high-poverty public schools	Alcohol and sexual risk, selective	Four audio CDs for parents and their daughters with role model stories about 4 fictional families. Aimed to increase awareness of the risks girls may face and what parents can do to prevent risk behaviors.	4 sessions at 6-wk intervals
Families Unidas	Paritin et al. <sup>40</sup>	Family based, Florida	Students with mild problems on ≥1 subscale (conduct disorder, socialized aggression, attention problems) on the Revised Behavior Problem Checklist. Sampled from schools with primarily Hispanic students in a low-income district	Problem behavior, selective	Integrated Hispanic-specific cultural content. Provided parents with skills and knowledge to raise adolescents and minimize adolescent risk behavior.	9 2-h group sessions, 10 1-h family visits, 4 booster sessions at 10, 16, 22, and 28 mo follow-up
Family Matters Program	Bauman et al. <sup>41</sup>	Family based, United States	Adolescents aged 12–14 y and their families sampled from several contiguous states	Tobacco and alcohol reduction, universal	Adolescent-parent pairs received 4 booklets, with follow-up telephone calls to parents from health educators. Adolescents were reached through family members and not contacted directly by health educators.	15 mo
IMPACT, Focus on Kids	Stanton et al. <sup>42</sup>	School based, Baltimore, MD	African American students aged 13–16 y from low-income schools	Risk behaviors, universal	Three interventions emphasizing decision-making, goal setting, and information regarding unsafe behaviors: 1 intervention group received booster sessions to review material.	1 IMPACT session, 8 Focus on Kids sessions over 1 y plus 4 90-min booster sessions over second y
IMPACT, Focus on Kids	Telch et al. <sup>43</sup>	School based, California	Seventh-grade students (age = 12 y)	Smoking, universal	Videotapes about consequences of smoking and examples of pressure to smoke, smoking advertisements, and strategies to resist pressure. One intervention group also involved peer leaders.	5 sessions

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TABLE 1—Continued

Keepin' it REAL	Kulis et al. <sup>44</sup>	School based, Phoenix, AZ	Seventh-grade students of Mexican heritage from 35 public middle schools	Substance use prevention, universal	Intervention to enhance cultural identification, promote personal antidrug norms and behaviors, and develop decision-making and resistance skills. Curriculum adapted for cultural differences and values for 3 intervention groups: version 1 reflected Mexican American and Mexican values; version 2 was grounded in European American and African values, and version 3 was multicultural, with half the lessons from each of first 2 versions. Multicomponent substance abuse prevention classroom curriculum focusing on major social, psychological, cognitive, and attitudinal factors that appear to promote the use of tobacco, alcohol, and marijuana. Two intervention groups: 1 delivered by specially trained older students and 1 by trained classroom teachers.	10 lessons over 2 y
Life Skills Training	Borvin et al. <sup>45</sup>	School based, New York State	Predominantly White, middle-class seventh-grade students from 10 suburban junior high schools	Equip students with coping skills to hinder drug social influences, universal	Students learned cognitive behavioral skills for building self-esteem, resisting advertising pressure, managing anxiety, communicating effectively, developing personal relationships, and asserting their rights. Two intervention conditions: (1) 1-d teacher workshop and implementation feedback by project staff, (2) teacher training provided by videotape and no implementation feedback.	20 cognitive behavioral sessions
Life Skills Training	Borvin et al. <sup>46,47</sup>	School based, New York State	Predominantly White seventh-grade students from 56 suburban schools; follow-up with 12th-grade students representing 60.41% of original sample	Substance abuse prevention, universal	Taught students cognitive behavioral skills for building self-esteem, resisting peer pressure and media influences, managing anxiety, communicating effectively, developing personal relationships, and asserting their rights and problem-specific skills related to alcohol and drug use, such as ways to be assertive in situations where they experienced interpersonal pressure from peers to engage in substance use.	12 curriculum units taught in 15 class sessions in grade 7, 10 booster class sessions in grade 8, and 5 class sessions in grade 9
Life Skills Training	Griffin et al. <sup>48</sup>	School based, New York State	Seventh-grade students from 56 secondary schools in middle-class suburban and rural areas. Followed up in young adulthood (mean age = 24 y)	Drug abuse prevention, universal	Taught students cognitive behavioral skills for building self-esteem, resisting peer pressure and media influences, managing anxiety, communicating effectively, developing personal relationships, and asserting their rights and problem-specific skills related to alcohol and drug use, such as ways to be assertive in situations where they experienced interpersonal pressure from peers to engage in substance use.	6 parent group-individual sessions and an average of 7 phone calls from a parent interventionist

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TABLE 1—Continued

Linking the Interests of Families and Teachers	DeGarmo et al. <sup>49</sup>	School based, metropolitan area in Pacific Northwest	12 public elementary schools in neighborhoods with a higher than average police contacts	Prevention of antisocial behaviors, universal	Taught students cognitive behavioral skills for building self-esteem, resisting peer pressure and media influences, managing anxiety, communicating effectively, developing personal relationships, and asserting their rights and problem-specific skills related to alcohol and drug use, such as ways to be assertive in situations where they experienced interpersonal pressure from peers to engage in substance use.	6 parent group-individual sessions and an average of 7 phone calls from a parent interventionist
Michigan Model for Health	O'Neill et al. <sup>50</sup>	School based, Michigan and Indiana	Students (average age = 9.56 y) in schools with an average of 46% of students eligible for free meals	Health education, universal	Skills-based program focusing on emotional health, substance use, safety, and nutrition and exercise. Targeted cognitive, attitudinal, and emotional risk factors for health-promoting behavior.	25 20-50 min sessions in grade 4, 28 in grade 5
My Future is My Choice	Stanton et al. <sup>51</sup>	School based, Namibia, South Africa	Students aged 15-18 y from 10 secondary schools	HIV risk reduction, universal	Program based on Focus on Kids with sessions in school after school hours. Focused on knowledge of reproductive biology, HIV, and related risks, such as use of alcohol and relationship violence and development of skills such as communication skills and decision-making.	14 sessions
Opening Doors	Dawitt et al. <sup>52</sup>	School and family based, Ontario, Canada	Ninth-grade students aged 14 y at risk for such problems as drug use, truancy, behavioral problems at school, and violent and other antisocial behavior, from 21 schools 12 boards across Ontario.	Reduce alcohol and drugs use and deviant behavior, selective	Designed to ease the transition from elementary to high school. Student component taught social skills and health-enhancing beliefs and values. Parent component fostered home environment to reinforce student component.	17 student sessions and 5 parent sessions delivered over 10 wk
Peer pressure resistance training	Hansen and Graham <sup>53</sup>	School based, Los Angeles and Orange counties, CA	7th grade students from 12 junior high schools	Substance use prevention, universal	Normative education: lessons on information and conservative norms regarding substance use.	9 lessons
Plan for Success	Werch et al. <sup>54</sup>	School based, Florida	Students in grades 11-12 (average age = 17 y)	Health behaviors, universal	Designed to elicit a positive self-image of success that incorporates healthy behaviors. Control group received a goal survey asking respondents to identify obstacles (including risk behaviors) to success. Group 2 also signed a contract with self-concordant goals. Group 3 completed survey as well as a career consultation that provided feedback about their goals and how to reach them.	20-min session

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TABLE 1—Continued

Positive Action Program	Beets et al. <sup>55</sup>	School based, Hawaii	First- and second-grade students from 20 elementary schools that had $\geq 25\%$ free meal eligibility; were in the lower 3 quartiles of SAT scores among Hawaiian schools; were Oahu, Maui, or Molokai public school; and had annual stability rate $> 80\%$	Substance use, violent behavior, and sexual activity prevention, universal	Classroom teacher–delivered multicomponent social and character development program grouped into 6 units: self-concept, mind and body positive actions, social and emotional actions, getting along with others, being honest with self, and self-development.	140 15–20 min lessons/y, over 5 school years
Positive Action Program	Li et al. <sup>56</sup>	School based, Chicago, IL	Fifth-grade students from 14 elementary schools	Improve academics, behavior, and character, universal	Targeted distal and proximal influences on multiple health behaviors. Intervention schools received kindergarten through eighth-grade portion of program's classroom curriculum, school staff training from the program developer, and kits for school preparation, schoolwide climate development, counselors, and family classes.	$> 140$ 15-min lessons/grade delivered 4 d/wk over 2 school years
Preparing for the Drug Free Years	Mason et al. <sup>57</sup>	Family based, Midwest United States	Sixth-grade students and their families from 22 rural schools in 19 contiguous states	Drug use and problem behavior prevention, universal	Designed to reduce adolescent drug use and behavior problems with skills-based curriculum to help parents address risks that can contribute to drug abuse while strengthening family bonding by building protective factors.	5 ~2-h weekly parenting sessions
Skills-based CD-ROM Intervention	Schwinn and Schinke <sup>58</sup>	School and family based, New York City	Students aged 11 y at baseline, majority African American, from schools in impoverished areas	Alcohol reduction, selective	CD-ROM taught goal setting, peer pressure, refusal skills, and substance use norms. One intervention condition also included parent intervention with 30-min videotape and print materials that introduced parents to program and its goals and how parents could help children avoid substance use.	10 sessions + 3 annual booster sessions
Prevention of drug and alcohol abuse in Native American youths	Schinke et al. <sup>59</sup>	School and community based, US reservations	Native American (mean age = 10.28 y)	Substance use prevention, universal	Conventional life skills training (for substance risk situations, peer influences, and healthy lifestyles) tailored to Native American culture. A community involvement intervention arm also participated in activities to raise awareness of the substance abuse prevention message through posters, flyers, and informational meetings.	15 50-min sessions + semiannual booster sessions
Prevention of drug and alcohol abuse in Native American youths	Schinke et al. <sup>60</sup>	School based, Washington State	Native Americans students aged 11.8 y at baseline	Drug and alcohol abuse prevention, universal	Taught communication and coping skills as well as skills to anticipate temptation and explore healthy alternatives to substance use.	10 sessions

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TABLE 1—Continued

Project ALERT	Ellickson et al. <sup>61,62</sup>	School based, South Dakota	Seventh-grade students from 55 middle schools in rural, small town, and urban areas; follow-up to age 21 y of students who were sexually active but not married	Drug use prevention, universal	Focused on knowledge and consequences of drug use, reducing barriers to drug resistance, building social norms against drug use, and skills for resisting pro-drug pressures and linkage to other risky behaviors.	14 class lessons over grades 7 and 8
Project ALERT	Orlando et al. <sup>63</sup>	School based, South Dakota	Seventh-grade students	Smoking and alcohol use, universal	Interactive teaching methods focused on smoking cessation and alcohol use with social norms approach to build self-efficacy and provide role models.	11 lessons in grade 7 and 3 lessons in grade 8
Project Charlie	Hurry et al. <sup>64</sup>	School based, Hackney, London, UK	Students from 2 primary schools	Drug education, universal	Drug prevention package based on the life skills model, aiming to develop children's self-esteem and their ability to express their feelings and to resist peer and social pressure and to inform them of both positive and negative effects of drugs (medicines, tobacco, and alcohol).	13-min sessions weekly for 1 or 2 y
Project PATHS	Shek and Yu <sup>65</sup>	School based, Hong Kong, China	Students aged 12 y from secondary schools	Risk behaviors, universal	Focused on developmental concerns (drugs, sexual intercourse, finances, responsibility, life meaning) and developing strengths (concern for society, information technology skills); additional support given to those identified as at increased risk (~20% of students).	20 h/y over 3 y
Project SMART	Graham et al. <sup>66</sup>	School based, California	Seventh-grade students, 3 cohorts: 1982-1983, 1983-1984, 1984-1985 school years; follow-up measured 70% in eighth grade	Drug use prevention, universal	The social skills program (SOCIAL) taught students social skills for resisting drug offers. The affect management program (AFFECT) contained no social skills sessions for 1 cohort and some for 2 cohorts but focused on personal decision-making, values clarification, and stress management techniques.	12 sessions of either SOCIAL or AFFECT program over 1 y
Project SPORT	Werch et al. <sup>67</sup>	School based, Florida	Students in grades 9 and 11 (mean age = 15.24 y)	Health behavior, universal	One-on-one consultation for health behavior screen, fitness prescription, and information on healthy behavior. Designed to promote positive self-image and healthy activities and present negative consequences of substance use.	12-min session + take-home materials
Project Toward No Drug Abuse	Dent et al. <sup>68</sup>	School based, Los Angeles, CA	Students aged 14-17 y (9th-11th grades) enrolled at 3 public high schools	Drug use prevention, universal	Classroom sessions taught skills, such as healthy coping and self-control; educated students about myths and misleading information that encourage substance use and warned of chemical dependency and other negative consequences.	3 50-min sessions/wk for 3 consecutive wk

Continued

TABLE 1—Continued

Raising Healthy Children	Brown et al. <sup>69</sup>	School and family based, Seattle, WA	First- and second-grade students and their families from 10 suburban public elementary schools	Target developmentally appropriate risk and protective factors, universal	Social developmental program incorporating school, family, and individual strategies. School interventions designed to enhance learning, problem skills, school connectedness, and academic performance. Individual strategies focused on academic achievement, school connectedness, refusal skills, and prosocial beliefs about healthy behaviors. Family strategies focused on parental skills, educational support, decreasing family conflict, peer resistance skills, and clarifying family standards and rules about student behaviors.	Teachers in grades 1-7 received ≥ 6 staff development workshop sessions; family intervention delivered during grades 1-8; student intervention delivered in grades 4-6
RealTeen	Schwinn et al. <sup>70</sup>	Web based, 42 US states and 4 Canadian provinces	Girls aged 14 y at baseline, recruited through adolescent-oriented Web site	Drug abuse prevention, universal for girls	Web site provided news feed, horoscopes, forum, and training in self-efficacy, communication, assertiveness, goal setting, drug facts, and dealing with situations that involved drugs. Classroom teachers planned and wrote a health/personal development curriculum coordinated across the school years (kindergarten to year 12) that aimed to bring about positive changes in health knowledge, attitudes, and behaviors of children.	12 online training sessions
Health development program	Homat et al. <sup>71</sup>	School based, Sydney, Australia	Students from 1 secondary and 2 infant and primary schools	Health development, universal	Classroom teachers planned and wrote a health/personal development curriculum coordinated across the school years (kindergarten to year 12) that aimed to bring about positive changes in health knowledge, attitudes, and behaviors of children.	2 y
Skills enhancement program	Gilchrist et al. <sup>72</sup>	Community based, Pacific Northwest	Native American youths (mean age = 11.34 y)	Substance use prevention, universal	Intervention sites received culturally tailored skills enhancement training sessions delivered in classrooms and tribal centers. Skills taught included self-praise, communication, and identifying precipitants of alcohol and drug use.	10 60-min sessions
Strengthening Families Program	Spoth et al. <sup>73,74</sup>	School and family based, Iowa	Students recruited from 33 rural schools in communities with < 8500 population and ≥ 15% eligible for free meals; age 11 at pretest follow-up after 6 y	Substance use prevention, universal	Targeted poor disciplining skills and parent-child relationships in families and increased resilience in adolescents by encouraging empathy, communication skills, and resistance skills.	7 weekly 2-h sessions
Strengthening Families Program combined with Life Skills Training	Spoth et al. <sup>75</sup>	School and family based, midwestern US state	Seventh-grade students from 36 rural schools with 20% of families below or close to poverty level	Substance use prevention, universal	Family intervention delivered to parents and students concurrently in the evening. Life Skills Training delivered in school to promote skills and develop self-management, resistance skills, and other social skills.	Family intervention, 7 sessions + 4 booster sessions; Life Skills Training, 15 sessions + 5 booster sessions
Social development curriculum and school/community intervention	Floy et al. <sup>76</sup>	School and community based, Chicago, IL	Fifth-grade students from a high-risk sample of 12 poor African American inner-city and suburban schools	Target risk behaviors of violence, provoking behavior, substance use, school delinquency, and sexual practices, selective	Social development curriculum focused on social competence skills necessary to manage situations in which high-risk behaviors occur. School/community intervention had social development curriculum, schoolwide climate, parent, and community components.	16-21 lessons/y in grades 5-8

Continued

TABLE 1—Continued

Unplugged	Faggiano et al. <sup>77,78</sup>	School based, Austria, Belgium, Germany, Greece, Italy, Spain, and Sweden	Students aged 12–14 y; follow-up after 18 mo	Substance use prevention, universal	Intervention targeted experimental and regular use of alcohol, tobacco, and illicit drugs with curriculum based on comprehensive social influence approach, incorporating components of life skills into a cognitive social influence model. Three intervention arms: group 1, basic curriculum; group 2, basic curriculum with peer involvement; group 3, basic curriculum with parent involvement.	12 1-h weekly units over 1 school year
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local community. In 3 cases, the intervention was computer based and used no facilitators. Table 1 also shows the amount of curriculum time devoted to each program and whether the program provided booster sessions to reinforce program messages. The intervention intensity varied from 4 to 140 sessions, and the duration ranged from 10 weeks to 8 years. Seven studies included booster sessions. The majority of studies incorporated a follow-up measurement of 6 months or more. Studies reported on a variety of substance use, sexual risk, and aggressive behavior measures. All studies relied on self-reported substance use with no biochemical verification, although 1 study also conducted a saliva test to encourage honest reporting. In the majority of cases, self-reported marijuana use was the drug use outcome measure, although 10 studies (18%) measured other drug use (e.g., amphetamines, tranquilizers).

Overall, 28 studies (51%) were methodologically strong. Twenty-three (89%) of these reported on interventions based in schools, 2 (7%) that were family based, and 3 (11%) that were community based. All 44 studies applied intention-to-treat analyses. The majority had a follow-up of 6 months or longer.

#### Effectiveness

Most effect sizes were small, although several studies reported medium effect sizes. The findings and quality assessment of each study are presented in Tables 2 and 3.

**School-based interventions.** Forty-four studies evaluated 32 school-based interventions, of which 24 took place exclusively in the school setting. The other 8 school-based interventions

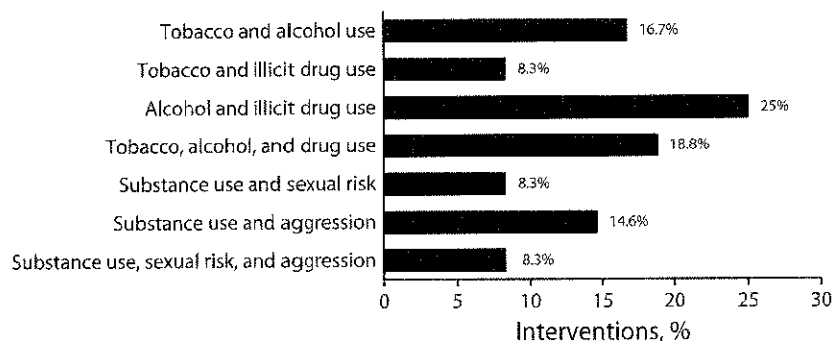
included family or community components, such as homework assignments with parents, parental skills training, or incorporation of prevention skills training into existing community events. Eighteen interventions showed a significant effect for 2 substances (smoking, alcohol use, or illicit drug use). Nine had a positive outcome for all 3 substances. All 9 of these interventions were multi-component and aimed to increase resilience by enhancing adolescents' refusal skills. This was achieved through developing students' basic life skills, such as problem-solving skills, personal decision-making, and stress management. Only 1 intervention focused on the health consequences of tobacco use; however, it also incorporated strategies to resist peer pressure. Three interventions included a family component designed to support positive parenting practices and help parents reinforce their child's refusal skills.

The majority of interventions focused on multiple substance use, but 5 were effective for both substance use and aggression and 2 for substance use and sexual risk behavior. Four interventions reported significant effects in all 5 domains. Some interventions reported significant effects for other health risk behaviors several years after program completion. For instance, Project ALERT was effective for alcohol, tobacco, and marijuana use up to 18 months,<sup>61</sup> but a later evaluation identified protective effects against sexual risk behavior in young adulthood.<sup>62</sup> The 32 interventions shared characteristics associated with recommendations for effective treatment of adolescent health risk behaviors.<sup>79</sup> All studies used empirically validated intervention strategies relevant to the

developmental needs of adolescents. They also focused on targeting the specific risks and protective factors associated with the initiation and maintenance of substance use. The majority of programs recognized the important influence of peers in risky behavior (Table 2).

**Family-based interventions.** Six studies evaluated 5 family-based interventions, 2 of which were rated strong. The family-based interventions comprised parenting skills, training in groups, homework tasks requiring parental participation, mailed booklets, home visits, and a mixture of these approaches. Most were based on family interaction theory or social or behavioral learning models and aimed to improve student–parent communication, reinforce refusal skills, teach effective parenting skills, and develop problem-solving approaches. All 5 interventions were effective for 2 health risk behaviors, and 1 produced positive results for 4 health risk behaviors. Two of the interventions had significant effects on both substance use and sexual risk, including an increase in condom use. One intervention targeted both substance use and aggression. All interventions demonstrated that health risk behavior change was maintained at follow-up (Table 3).

**Community-based interventions.** We identified 5 studies that evaluated 4 community-based interventions. They consisted of a skills enhancement program, a youth program with parental reinforcement, a multicomponent intervention, and a counseling supportive-listening approach. We identified 3 interventions that were effective for 2 health risk behaviors and 1 that was effective for 3 (tobacco and alcohol use and delinquent behavior). One study



**FIGURE 2—The proportion of interventions (school, family, or community based) targeting tobacco, alcohol, and drug use; sexual risk; and aggression in systematic review of effective interventions for reducing multiple health risk behaviors in adolescence.**

reported evidence of a medium effect of a skill enhancement program for Native American youths on decreasing alcohol, marijuana, and inhalant use. One program had a medium effect for smokeless tobacco initiation. For the other outcomes, effect sizes and odds ratios were relatively small. A study that evaluated the All Stars program reported significant effects for sexual risk behaviors 7 years after the end of the program. We did not identify any community interventions that had a significant effect for both substance use and sexual risk behavior (Table 3).

**Web-based interventions.** We found evidence from 1 randomized controlled trial that a Web-based intervention program can produce a long-term decrease in recent (past 30 days) alcohol use, binge drinking, and tobacco use. However, effect sizes were small for all behaviors.

## DISCUSSION

Our systematic review of effective interventions for MHRBs identified 55 studies, describing 44 interventions. These studies

varied considerably in quality, methodology, intervention techniques, and results, making cohesive data synthesis difficult. Effect sizes ranged from small to medium. In general, the methodological quality of included studies was strong to moderate. The majority of studies took place in the United States and examined school-based interventions that focused on the reduction or prevention of multiple-substance use.

We categorized the majority of effects as small; however, the Cohen categorization system was not specifically devised to assess universal prevention, for which effects are generally smaller than, for example, indicated intervention.<sup>80</sup> Effect sizes in the reviewed studies were generally in proportion with those reported for universal interventions on adolescent risk behavior.<sup>13,76,81</sup> This is important because it suggests that intervention effects for additional risk behaviors do not cause a dilution of effect sizes.

A large proportion of the interventions identified themselves as targeting substance use. This

partially explains why the majority were effective for multiple-substance use. Different forms of substance use appear to be conceptually similar, and intervention developers acknowledge that overlapping skills and attributes are necessary to prevent all forms of substance use or misuse. Arguably, the risk factors for sexual risk and aggressive acts and for smoking, drinking, and drug use are as comparable as the shared risk factors among substance use behaviors.<sup>14</sup> Furthermore, we found no clear differences in the extent to which any of these health risk behaviors are associated with one another.<sup>11</sup> Our review suggests that multirisk interventions targeting multiple-substance use can also be effective for other health risk behaviors.

The majority of the interventions were specifically designed to target MHRBs. However, several were designed to target a single health risk behavior, usually drug use, with intervention outcomes for other health risks characterized as secondary effects. Although we were unable to identify the mechanisms for these secondary effects, it is likely they relate to

targeting risk and preventive factors common to various risk behaviors or preventing gateway effects. Interventionists, researchers, and policymakers should be aware of the far-reaching potential of well-designed interventions—even those not focused on MHRBs—and efforts to monitor secondary effects may be warranted.

The wider literature on universal prevention indicates that intervention effects are typically strongest immediately after the intervention, and they often decrease or disappear by long-term follow-ups.<sup>82</sup> The general pattern for the interventions identified in our review differed from this norm. Often effect sizes were larger at later follow-ups, and in many cases, significant effects appeared for no or only 1 risk behavior at the first postintervention test, with further significant effects identified at long-term follow-up. This is likely related to the mechanisms for intervention effects. If, as theorized, these programs are targeting more distal factors, such as common risk factors, or are preventing gateway effects, it may take longer for effects to emerge, and they may prove more pervasive. For example, nearly all interventions we reviewed targeted individual attributes and skills, such as self-efficacy, and social competencies, such as refusal skills and strengthening peer relationships and connectedness. It may take time for effects to trickle down to risk behaviors or for participants to internalize and apply learned skills or attitudes. It was relatively rare for the programs to emphasize risk-specific knowledge. This fits the pattern of results we observed, because substance-specific knowledge would be

**TABLE 2—Health Risk Behavior Outcomes for School-Based Prevention Programs in Systematic Review of Effective Interventions for Reducing Multiple Health Risk Behaviors in Adolescence**

Domains for Effectiveness/Intervention	Study	Quality Assessment	Effect Size, Cohen d or OR <sup>a</sup> (95% CI)
Tobacco and alcohol use			
Life Skills Training	Botvin et al. <sup>47</sup>	Strong	3-y follow-up (adjusted) Intervention 1: training workshop and implementation feedback Smoked in past mo, OR = 1.33 (1.11, 1.59), small Smoked in past wk, OR = 1.23 (1.02, 1.49), small Frequency of getting drunk, OR = 1.29 (1.09, 1.54), small Intervention 2: training video, no feedback Smoked in past mo, OR = 1.40 (1.18, 1.67), small Smoked in past wk, OR = 1.39 (1.15, 1.67), small Pack-a-day smoker, OR = 1.37 (1.06, 1.79), small Frequency of getting drunk, OR = 1.35 (1.15, 1.59), small
Strengthening Families Program	Spoth et al. <sup>74</sup>	Strong	Annual up to 6-y follow-up Reduced growth rates for initiation of alcohol use without parental permission Reduced growth rates for lifetime cigarette use Reduced growth rates for incidence of drunkenness
Drug abuse prevention program	Gomez-Fraguela et al. <sup>37</sup>	Moderate	One-y follow-up (unadjusted) Teacher led Monthly frequency of beer, 0.23 (0.06, 0.40), small Monthly frequency of tobacco, 0.29 (0.11, 0.46), small Researcher led Monthly frequency of spirits, 0.24 (0.05, 0.42), small
Health development program	Hamel et al. <sup>71</sup>	Moderate	2-y follow-up Not smoking (boys only), 0.13 (0.02, 0.25), small Daily smoking reduced (boys only), 0.14 (0.02, 0.25), small Not drinking (boys only), 0.18 (0.05, 0.30), small Daily drinking rates (boys only), 0.35 (0.23, 0.47), small Daily drinking rates (girls only), 0.13 (0.01, 0.25), small
Adolescent Alcohol Prevention Trial	Taylor et al. <sup>25</sup>	Weak	Annual until 4-y follow-up Reduced growth for recent alcohol use, lifetime alcohol use, lifetime drunkenness, recent cigarette use, and lifetime cigarette use
Project SPORT	Werch et al. <sup>67</sup>	Weak	3-mo follow-up (unadjusted) 30-d alcohol frequency, 0.32 (0.16, 0.49), small 30-d alcohol quantity, 0.32 (0.16, 0.49), small 30-d heavy use of alcohol ( $\geq 5$ drinks in a row), 0.27 (0.11, 0.44), small Length of time using alcohol, 0.29 (0.13, 0.46), small Stage of alcohol initiation (from "never will try" to "have started using"), 0.35 (0.19, 0.52), small 30-d cigarette frequency, 0.19 (0.00, 0.35), small 1-y follow-up Length of time using alcohol, 0.20 (0.03, 0.37), small 30-d cigarette frequency, 0.28 (0.10, 0.45), small Stage of cigarette initiation, 0.33 (0.16, 0.50), small

Continued

TABLE 2—Continued

Tobacco and illicit drug use				
Classroom component and family-school partnership	Furr-Holden et al. <sup>31</sup>	Strong	Followed up each y first-eighth grade (adjusted) Classroom component Smoking initiation, OR = 1.22 (0.52, 7.33), small Illicit drug use, OR = 2.44 (1.11, 6.69), small Family-school partnership Smoking initiation, OR = 1.63 (0.64, 49), small	
Plan for Success	Werch et al. <sup>54</sup>	Strong	1-mo follow-up Reduction in length of time using alcohol Reduction in length of time using marijuana	
Project Charlie	Hurry et al. <sup>64</sup>	Moderate	4-y follow-up Ever smoked for subset 1, 0.90 (0.16, 1.63), large Ever smoked for subset 1/2, 0.28 (0.06, 0.50), small Ever tried an illegal drug, 0.29 (0.07, 0.51), small	
Alcohol and illicit drug use				
Raising Healthy Children	Brown et al. <sup>69</sup>	Strong	Posttest (adjusted) Less growth in frequency of alcohol use Less growth in frequency of marijuana use	
Project Toward No Drug Abuse	Dent et al. <sup>68</sup>	Strong	1-y follow up Reduction in frequency of hard drug use (30 d) Reduction in frequency of alcohol use (30 d)	
Opening Doors	Dewitt et al. <sup>52</sup>	Strong	Posttest (adjusted) ≥ 5 drinks on 1 occasion, 0.35 (0.05, 0.66), small Frequency of marijuana use (monthly), 0.40 (0.10, 0.71), small	
BRAVE	Griffin et al. <sup>30</sup>	Strong	1-y follow-up (after baseline; adjusted) Frequency of alcohol use (past 30 d), 0.60, medium Frequency of marijuana use (past 30 d), 0.41, small	
Climate Schools	Newton et al. <sup>32</sup>	Strong	6-mo follow-up (unadjusted change scores from pretest) Average weekly alcohol consumption, 0.20 (0.04, 0.36), small Frequency of marijuana use (past 3 mo), 0.19 (0.03, 0.34), small	
Michigan Model for Health	O'neill et al. <sup>50</sup>	Strong	Posttest (unadjusted) Ever consumed alcohol, OR = 1.51 (1.11, 2.04), small Drank in past 30 d, OR = 1.73 (1.12, 2.66), small Ever smoked cigarettes, OR = 1.54 (1.05, 2.27), small Smoked in past 30 d, OR = 3.17 (1.67, 6.01), medium	
Keepin' it REAL	Kulis et al. <sup>44</sup>	Strong	14-mo follow-up Multicultural version Recent substance use, 0.05, small Recent alcohol use, 0.04, small Recent marijuana use, 0.04, small	
Project Alert	Orlando et al. <sup>63</sup>	Moderate	Posttest (adjusted) Past-mo smoking, 0.10 (0.04, 0.17), small Alcohol misuse (including weekly use, bingeing, and negative consequences of alcohol), 0.06 (0.00, 0.12), small	
Strengthening Families Program and Life Skills Training	Spoth et al. <sup>75</sup>	Moderate	1-y follow-up (unadjusted) Rate of lifetime alcohol use, 0.14 (0.01, 0.28), small Rate of lifetime marijuana use, 0.15 (0.02, 0.28), small	

Continued

TABLE 2—Continued

Tobacco, alcohol, and Illicit drug use	Life Skills Training	Botvin et al. <sup>45</sup>	Strong	Posttest (adjusted) Peer led Tobacco use (monthly), 0.11 (0.00, 0.23), small Marijuana use (monthly), 0.13 (0.01, 0.25), small Marijuana use (weekly), 0.15 (0.02, 0.26), small Frequency of drunkenness, 0.14 (0.01, 0.27), small Amount of alcohol consumed, 0.15 (0.02, 0.29), small
	Life Skills Training	Botvin et al. <sup>46</sup>	Strong	Posttest Condition 1 Reduced tobacco use Reduced marijuana use Condition 2 Reduced tobacco use Reduced marijuana use Reduced frequency of getting drunk
Adolescents Transition Program		Connell et al. <sup>26</sup>	Strong	Posttest (age 11–17 y) Less growth in tobacco use Less growth in alcohol Less growth in marijuana use
Unplugged		Faggiano et al. <sup>77</sup>	Strong	3-mo follow-up Cigarette smoking (daily), OR = 1.43 (1.06, 1.92) 1 episode of drunkenness (30 d), OR = 1.39 (1.11, 1.72) ≥ 3 episodes of drunkenness (30 d), OR = 1.45 (1.01, 2.08) Marijuana use (30 d), OR = 1.30 (1.00, 1.67)
Unplugged		Faggiano et al. <sup>78</sup>	Strong	18-mo follow-up Any episode of drunkenness, OR = 1.25 (1.03, 1.49) Frequent episodes of drunkenness, OR = 1.61 (1.23, 2.13) Marijuana use (past 30 d), OR = 1.35 (1.00, 1.89)
Strengthening Families Program		Spoth et al. <sup>73</sup>	Strong	48-mo follow-up (adjusted) Ever drank alcohol, OR = 2.13 (1.28, 3.57), small Ever drank without parental permission, OR = 2.17 (1.35, 3.45), small Ever been drunk, OR = 2.27 (1.37, 3.70), small Ever smoked, OR = 2.04 (1.25, 3.33), small Ever used marijuana, OR = 2.70 (1.28, 5.88), medium Past-mo drinking, 0.26 (0.03, 0.49), small Past-mo cigarette use, 0.31 (0.08, 0.54), small
Peer pressure resistance training		Hansen and Graham <sup>53</sup>	Strong	Posttest Alcohol, 0.14 (0.06, 0.22), small Marijuana, 0.11 (0.03, 0.19), small Tobacco use, 0.09 (0.01, 0.17), small
Project SMART		Graham et al. <sup>66</sup>	Moderate	1 y follow-up Cigarette use Marijuana use Alcohol use
Skills-based CD-ROM intervention		Schwinn and Schinke <sup>58</sup>	Moderate	6-mo follow-up (adjusted) Past-mo use of alcohol, 0.29 (0.02, 0.55), small Past-mo use of marijuana, 0.36 (0.10, 0.63), small

Continued



TABLE 2—Continued

Prevention of drug and alcohol abuse in Native American youths	Schinke et al. <sup>60</sup>	Weak	<p>Posttest</p> <p>Smokeless tobacco use in past 2 wk</p> <p>Alcohol use in past 2 wk</p> <p>Marijuana use in past 2 wk</p> <p>Nonmedical drug use in past 2 wk</p> <p>6-mo follow-up</p> <p>Smokeless tobacco use in past 2 wk</p> <p>Alcohol use in past 2 wk</p> <p>Marijuana use in past 2 wk</p> <p>Inhalant use in past 2 wk</p> <p>Smoking use in past 2 wk</p>
Prevention of drug and alcohol abuse in Native American youths	Schinke et al. <sup>59</sup>	Weak	<p>30-mo follow-up (unadjusted)</p> <p>≥ 7 uses of smokeless tobacco in past wk, OR = 1.61 (1.08, 2.38), small</p> <p>≥ 4 drinks in past wk, OR = 1.25 (0.93, 1.67), small</p> <p>42-mo follow-up</p> <p>≥ 4 uses of marijuana in past wk, OR = 2.33 (1.56, 3.34), small</p> <p>≥ 7 uses of smokeless tobacco in past wk, OR = 1.89 (1.35, 2.63), small</p> <p>≥ 4 drinks in past wk, OR = 1.45 (1.12, 1.89), small</p> <p>≥ 4 uses of marijuana in past wk, OR = 2.33 (1.56, 3.34), small</p>
ImPACT Focus on Kids	Stanton et al. <sup>42</sup>	Weak	<p>2-y follow-up (adjusted)</p> <p>Both interventions (combined) compared with control group in past 6 mo</p> <p>Mean number of school suspensions, 0.14 (0.00, 0.28), small</p> <p>Carried a bat as a weapon, OR = 2.50 (1.39, 4.35), medium</p> <p>Smoked cigarettes, OR = 2.04 (1.41, 2.94), small</p> <p>Used illicit drugs other than marijuana, OR = 4.17 (1.72, 10.00), large</p> <p>Asked sexual partner if he or she always used a condom at past intercourse, OR = 1.91 (1.40, 2.61), small</p>
ImPACT Focus on Kids	Telch et al. <sup>43</sup>	Weak	<p>Posttest</p> <p>Peer leader</p> <p>Transition from nonsmoking to experimental smoking</p> <p>Transition from nonsmoking to regular smoking</p> <p>Transition from experimental to regular smoking</p> <p>Adoption rates for alcohol</p> <p>Adoption rates for marijuana</p> <p>Video only</p> <p>Transition from nonsmoking to regular smoking</p> <p>Transition from experimental to regular smoking</p> <p>Adoption rates for alcohol</p>
Substance use and aggression Linking the Interests of Families and Teachers	DeGarmo et al. <sup>49</sup>	Strong	<p>Grades 5–12 (adjusted)</p> <p>Reduced rates of growth in use of tobacco and illicit drugs for girls</p> <p>Lower average levels of use for tobacco, alcohol, and illicit drugs for all youths</p> <p>Tobacco initiation, 10% reduced risk</p> <p>Alcohol initiation, 9% reduced risk</p> <p>Reductions in playground aggression during fifth grade</p>
Positive Action Program	Li et al. <sup>56</sup>	Moderate	<p>3-y follow-up</p> <p>Reduction in substance use index</p> <p>Reduction in serious violent behaviors</p>

Continued

TABLE 2—Continued

DARE-plus	Perry et al. <sup>36</sup>	Moderate	6-mo and 18-mo follow-up (difference in growth rate, unadjusted) For boys only (no significant results for girls) Alcohol behavior and intentions, 0.07 (0.01, 0.15), small Past-y drinking, 0.07 (0.01, 0.15), small Past-mo drinking, 0.07 (0.01, 0.15), small Tobacco behaviors and intentions, 0.07 (0.01, 0.15), small Current smoking, 0.07 (0.01, 0.15), small Drug behavior and intentions, 0.07 (0.01, 0.15), small Physical victimization, 0.08 (0.00, 0.16), small
My Future is My Choice	Stanton et al. <sup>51</sup>	Moderate	Posttest Condom use among baseline virgins, OR = 7.14 (1.15, 50.00), large 6-mo follow-up (unadjusted) Discussing partner's history with new sexual partner, OR = 1.59 (1.03, 2.45), small Past 6-mo alcohol use, OR = 1.69 (1.05, 2.70), small 12-mo follow-up Abstinence among baseline virgins, OR = 2.07 (1.15, 3.73), small
EcoFIT	Stormshak et al. <sup>38</sup>	Weak	Annual follow-up for 3 y Antisocial behavior in past mo (including stealing, carrying a weapon, and physical aggression) 30-d cigarette use 30-d alcohol use 30-d marijuana use
Substance use and sexual risk			
Project ALERT	Ellickson et al. <sup>61</sup>	Strong	18-mo follow-up Reduced cigarette initiation Reduced marijuana initiation Reduced alcohol misuse
Project ALERT	Ellickson et al. <sup>62</sup>	Strong	5/7-y follow-up Unprotected sexual intercourse because of drug use (14% reduction) Sexual intercourse with multiple partners (12.5% reduction)
All Stars Program	McNeal et al. <sup>28</sup>	Weak	Teacher led Alcohol use, 0.06, small Cigarette use, 0.06, small Smokeless tobacco use, 0.04, small Inhalant use, 0.07, small
Substance use, sexual risk, and aggressive behaviors			
Positive Action Program	Beets et al. <sup>55</sup>	Strong	Posttest Substance use (lifetime), OR = 1.45 (0.33, 1.94), small Violent behaviors, OR = 1.39 (0.32, 2.70), small Sexual activity, OR = 3.13 (0.09, 1.95), medium
Project PATHS	Shek and Yu <sup>65</sup>	Strong	Semiannual until 3-y follow-up Delinquency in past 6 mo (included stealing, truancy, damaging property, assault) 6-mo ketamine use 6-mo psychotropic drug use Sexual intercourse in past 6 mo Trespassing

Continued

TABLE 2—Continued

Social development curriculum and school/community intervention	Flay et al. <sup>76</sup>	Moderate	Posttest Social development Violent behavior, 0.31, small Substance use, 0.42, small School/community intervention Violent behavior, 0.41, small Provoking behavior, 0.41, small School delinquency, 0.61, medium Substance use, 0.45, small Recent sexual intercourse, 0.65, medium Condom use, 0.66, medium
Life Skills Training	Griffin et al. <sup>48</sup>	Weak	10-y follow-up Reduced growth in alcohol Reduced growth in marijuana intoxication HW risk index score, OR = 1.43 (1.04, 1.96), small

Note. CI = confidence interval; OR = odds ratio. All odds ratios < 1 were converted to > 1 for ease of interpretation. Only intervention conditions with significant program effects are included. Effect sizes are presented for all studies in which effect sizes are presented in text or sufficient information is available to calculate them. Significant effects were always in favor of the intervention program. For effect sizes noted as adjusted, the study authors adjusted for key characteristics such as gender, ethnicity, socioeconomic status, or preintervention substance use.

<sup>a</sup>The effect sizes were reported as Cohen d except where indicated to be odds ratios (OR). All odds ratios above 1 indicate favourable outcomes in the intervention group.

less likely to influence multiple risk behaviors simultaneously and would also be more likely to disappear over time.

Several effective interventions made use of long-term booster sessions, delivered months or years after delivery of the main portion of the intervention. Neither the wider literature<sup>83</sup> nor our review provide much evidence that the absolute length of intervention programs is related to effectiveness. However, the use of booster sessions has been clearly linked to an increase in magnitude and longevity for intervention effects.<sup>84,85</sup> This may explain why intervention effects for many studies persisted over time.

The majority of identified interventions took place in schools. Schools offer a useful context (and a captive audience) for the widespread dissemination of universal adolescent prevention programs. Systematic reviews in adolescent

prevention in several domains suggest that school-based interventions are common.<sup>82,86,87</sup> However, in the prevention of MHRBs, targeting schools may not only be practical, but also substantially contribute to effectiveness. This is because of the importance of school and peer effects for many risk behaviors. School climate, including student participation and engagement and teacher–student relationships, is associated with several health risk behaviors.<sup>88,89</sup> Also, peer effects such as social mimicry,<sup>90</sup> peer pressure, and social norms<sup>18,91</sup> contribute to an increase in likelihood of risk behaviors, and these can be perpetuated in the school context. Targeting these common risk factors has been associated with reduced risk behavior in several domains.<sup>92</sup> School-based interventions provide a platform for effectively targeting common school and peer risk factors for MHRBs. However, it is important

to note that similar reasoning can be applied to family-based interventions, and our review affirms their effectiveness, both individually and in combination with school-based interventions.

### Limitations

The identified studies varied considerably in quality; although we found most to be of adequate quality, all suffered from some limitations that compromised reliability and validity (e.g., study dropout, weak outcome measures, selection bias, confounding). All risk behavior measures were self-reported. Although this is the norm in intervention studies, self-report is subject to bias from both over- and underreporting of behaviors.<sup>93</sup> Many studies reported analyses of a large number of behavioral outcomes, with few reporting adjustment for multiple hypothesis testing. Some positive findings

may therefore have been attributable to chance.

Studies varied substantially in outcome measures, analytic methods, and adjustment for confounders, thus making collating or comparing findings difficult. A similar problem applies to the interventions themselves: they varied in methods, theoretical underpinning, context, and participants, making it difficult to draw general conclusions about effective interventions. The majority of studies were conducted in the United States, so caution is warranted in generalizing findings to other countries. Furthermore, we included only randomized controlled trials, so interventions that did not lend themselves to evaluation by that method but that may have been effective in reducing MHRBs would not be represented in our results. Such interventions might involve changing legal frameworks, law enforcement

**TABLE 3—Health Risk Behavior Outcomes for Community-, Family-, and Web-Based Prevention Programs in Systematic Review of Effective Interventions for Reducing Multiple Health Risk Behaviors in Adolescence**

Domains for Effectiveness/Intervention	Study	Quality Assessment	Effect Size, Cohen <i>d</i> or OR <sup>a</sup> (95% CI)
		<b>Family based</b>	
Tobacco and alcohol use: Family Matters Program	Bauman et al. <sup>41</sup>	Strong	3- and 12-mo follow-up (adjusted) Smoking, OR = 1.36 (1.02 [lower bound]), <sup>b</sup> small Drinking alcohol, OR = 1.34 (1.06 [lower bound]), <sup>b</sup> small
Tobacco and illicit drug use: computer-delivered, parent-involvement substance use prevention	Schinke et al. <sup>35</sup>	Moderate	1-y follow-up (unadjusted) 30-d alcohol use, 0.26 (0.13, 0.40), small 30-d marijuana use, 0.14 (0.01, 0.28), small 30-d illicit prescription drug use, 0.14 (0.01, 0.28), small 30-d inhalant use, 0.08 (0.05, 0.21), small 2-y follow-up 30-d alcohol use, 0.30 (0.16, 0.43), small 30-d marijuana use, 0.20 (0.06, 0.34), small 30-d illicit prescription drug use, 0.13 (0.01, 0.26), small 30-d inhalant use, 0.06 (0.07, 0.20), small
Alcohol and illicit drug use: Web-based mother-daughter program	Fang et al. <sup>24</sup>	Moderate	6-mo follow-up (posttest) Alcohol use (30 d), 0.08, small Marijuana use (30 d), 0.07, small Prescription drugs for nonmedical purposes (30 d), 0.04, small
Substance use and aggression: Preparing for the Drug Free Years	Mason et al. <sup>57</sup>	Moderate	5 waves of data Slower rate of linear increase in polysubstance use Slower rate of linear increase in delinquency
Substance use and sexual risk Especially For Daughters	O'Donnell et al. <sup>39</sup>	Strong	3-mo follow-up (adjusted) Used alcohol or been drunk, OR = 2.63 (1.03, 6.67), medium Sexual risk, OR = 2.56 (1.14, 5.88), medium
Familias Unidas	Pantin et al. <sup>40</sup>	Moderate	6-mo, 18-mo, and 30-mo follow-up (unadjusted) Growth of 30-d substance use (smoking, drinking, and illicit drug use), 0.25, small Growth for condom use, 0.30, small
		<b>Community based</b>	
Tobacco and alcohol use: preventing alcohol use among urban youth	Schinke et al. <sup>27</sup>	Moderate	7-y follow-up (unadjusted), both intervention arms compared with control group 30-d alcohol consumption, 0.18 (0.03, 0.38), small 30-d binge drinking, 0.16 (0.04, 0.37), small 30-d cigarette use, 0.21 (0.00, 0.41), small
Alcohol and illicit drug use: skills enhancement program	Gilchrist et al. <sup>72</sup>	Strong	6-mo follow-up from pretest Alcohol use, 0.70 (0.29, 1.12), medium Marijuana use, 0.54 (0.13, 0.96), medium
Big Brothers Big Sisters	Grossman and Tierney <sup>29</sup>	Moderate	Inhalant use, 0.54 (0.13, 0.96), medium 18-mo follow-up Significantly less likely to have started using illegal drugs or alcohol

*Continued*

TABLE 3—Continued

Substance use and aggression			
Communities That Care	Hawkins et al. <sup>33</sup>	Strong	Grade 5–8 (adjusted) Alcohol use initiation, OR = 1.60 (1.05, 2.44), small Cigarette initiation, OR = 1.79 (1.09, 2.92), small Smokeless tobacco initiation, OR = 2.34 (1.34, 4.09), small Delinquent behavior initiation, OR = 1.41 (1.05, 1.89), small
Communities That Care	Hawkins et al. <sup>34</sup>	Strong	Grade 8 (adjusted) Alcohol use (past 30 d), OR = 1.25 (1.04, 1.52), small Smokeless tobacco use (past 30 d), OR = 1.79 (1.23, 2.62), small Binge drinking (past 2 wk), OR = 1.40 (1.07, 1.84), small Delinquent behaviors (past y), OR = 1.34 (1.20, 1.49), small Grade 10 (adjusted) Tobacco use (past 30 d), OR = 1.27 (1.01, 1.56), small Any delinquency (past y), OR = 1.20 (1.01, 1.45), small Any violence (past y), OR = 1.33 (1.03, 1.72), small
Tobacco and alcohol use: RealTeen	Schwinn et al. <sup>70</sup>	Web based Weak	6-y follow-up (unadjusted) Past mo alcohol use, 0.29 (0.08, 0.49), small Past mo heavy drinking, 0.20 (0.00, 0.41), small Past mo cigarette use, 0.23 (0.03, 0.44), small

Note. CI = confidence interval; OR = odds ratio. All odds ratios < 1 were converted to > 1 for ease of interpretation. Only intervention conditions with significant program effects are included. Effect sizes are presented for all studies in which effect sizes are presented in text or sufficient information is available to calculate them. Significant effects were always in favor of the intervention program. For effect sizes noted as adjusted, the study authors adjusted for key characteristics such as gender, ethnicity, socioeconomic status, or preintervention substance use.

<sup>a</sup>The effect sizes were reported as Cohen d except where indicated to be odds ratios (OR). All odds ratios above 1 indicate favourable outcomes in the intervention group.

<sup>b</sup>Only the lower bound of the CI was reported in this article.

strategies, social services, or public health guidelines.

We included in our review only studies in which the intervention was effective for 2 or more risk behaviors. We did not include all studies that assessed or reported 2 or more health risk behavior outcomes, effective or not. Our reasons were pragmatic. We believe that reporting bias, which restricts reporting of results in abstracts largely to positive findings, particularly for secondary outcomes, would make attempts to include the latter set of studies accurately essentially impossible. In addition, the sheer scale of identifying all trials that assessed 2 or more risk behavior outcomes in adolescents would make this infeasible. Because our aim was to identify effective interventions in a developing field rather than to assess the effectiveness of a particular

intervention, we chose not to attempt to include studies that were not effective across 2 or more behaviors.

It is possible that our review missed some trials that were effective for more than 1 risk behavior but did not report this in the abstract. Because our findings suggest that even interventions designed to target a single risk can have beneficial effects on other behaviors, some programs might not have been identified as effective for multiple behaviors if other risk behaviors were not measured. Furthermore, interventions might have been excluded from the review if data were split into multiple publications, each focusing on different outcomes. More important, we could not ascertain which characteristics of effective interventions differentiated them from ineffective ones.

Although it is important to identify which programs are efficacious for multiple health risk behaviors, further research is needed to determine what factors are associated with successful (and unsuccessful) prevention efforts.

## Conclusions

Integrated risk prevention programs can be effective across a range of health risk behaviors in adolescence, with effect sizes that are generally small but comparable to those of interventions that target single risk factors. The evidence is strongest for various forms of substance use and for school-based interventions. These interventions appear to be successfully targeting common risk factors for a range of health behaviors, contributing to both the breadth and the longevity of their

effectiveness. Evidence for interventions outside the United States is very limited, however, and a substantial proportion of studies involved high-risk ethnic minority groups in the United States. Further work is needed to assess the generalizability of these findings outside North America.

Our review serves as a comprehensive survey of effective interventions for MHRBs in adolescence that can be used by practitioners and policymakers to guide further development of intervention strategies in preventing MHRBs. ■

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## Contributors

D. R. Hale established the eligibility criteria and search strategy. D. R. Hale and N. Fitzgerald-Yau conducted database searches, quality assessment, and data extraction; applied eligibility criteria to identified studies; calculated effect sizes; and prepared the article. R. M. Viner was the project leader; contributed to study design, including search strategy and eligibility criteria; and supervised article preparation.

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