Journal of Adolescent Health 58 (2016) 382–396

ELSEVIER

JOURNAL OF ADOLESCENT HEALTH

www.jahonline.org

Review article

School-Based Interventions Going Beyond Health Education to Promote Adolescent Health: Systematic Review of Reviews

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Article history: Received October 14, 2015; Accepted December 10, 2015
Keywords: Systematic reviews; Adolescent; Schools; Sexual health; Violence; Smoking; Alcohol; Drugs

A B S T R A C T

Purpose: Health education in school classrooms can be effective in promoting sexual health and preventing violence and substance use but effects are patchy and often short term. Classroom education is also challenging because of schools' increasing focus on academic-performance metrics. Other school-based approaches are possible, such as healthy school policies, improving how schools respond to bullying, and parent outreach, which go beyond health education to address broader health determinants. Existing systematic reviews include such interventions but often alongside traditional health education. There is scope for a systematic review of reviews to assess and synthesize evidence across existing reviews to develop an overview of the potential of alternative school-based approaches.

Methods: We searched 12 databases to identify reviews published after 1980. Data were reviewed by two researchers. Quality was assessed using a modified Assessing the Methodological Quality of Systematic Reviews checklist and results were synthesized narratively.

Results: We screened 7,544 unique references and included 22 reviews. Our syntheses suggest that multicomponent school-based interventions, for example, including school policy changes, parent involvement, and work with local communities, are effective for promoting sexual health and preventing bullying and smoking. There is less evidence that such intervention can reduce alcohol and drug use. Economic incentives to keep girls in school can reduce teenage pregnancies. School clinics can promote smoking cessation. There is little evidence that, on their own, sexual-health clinics, antismoking policies, and various approaches targeting at-risk students are effective.

Conclusions: There is good evidence that various whole-school health interventions are effective in preventing teenage pregnancy, smoking, and bullying.

IMPLICATIONS AND CONTRIBUTION

Multicomponent school interventions are effective for sexual health, bullying, and smoking. There is less evidence that these can reduce alcohol and drug use. Economic incentives for school retention can reduce teenage pregnancies. School clinics can promote smoking cessation. Sexual-health clinics, smoking policies, and targeted approaches have little effect.

Conflicts of Interest: There are no conflicts of interests, including any financial, personal or other relationships with other people or organizations, which could inappropriately influence or be perceived to influence this work. The funder had no involvement in: study design; the collection, analysis, and interpretation of data; the writing of the report; or the decision to submit the manuscript for publication. No honoraria were involved in study authorship.

Disclaimer: The views and opinions expressed therein are those of the authors and do not necessarily reflect those of the funder or of the other commission members.

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1054-139X/
http://dx.doi.org/10.1016/j.jadohealth.2015.12.017

Health behaviors are shaped early in life and persist into adulthood [1]. Substance misuse, violence, and sexual risk behaviors commonly begin in adolescence [2,3]. They incur social and economic costs for individuals and societies [4]. Although these behaviors are declining among adolescents in some high-income countries, these trends are patchy and less clear in low- and middle-income countries (LMIC) [3]. Schools are key sites for improving adolescent health [5] because of the time spent there in both high-income countries and LMIC [6,7]. Traditionally, schools and health systems address these behaviors via health education delivered in classrooms. Although this is often effective in promoting knowledge and changing attitudes, effectiveness in reducing risk behaviors is patchy and often short term [8–11]. Educational approaches are least effective for deprived groups and may increase inequalities. There is increasing interest in schools promoting health in complementary ways, reflecting broader interest in the social determinants of health [12]. Schools face increasing pressure to achieve academic-performance metrics so there is often less space in curricula for health education [13,14] providing a further rationale to develop alternative school-based approaches.

This systematic review of reviews (RoRs), undertaken as part of the Lancet Commission on Adolescent Health and Wellbeing (http://thelancetyouth.com), examines the effects of school-based interventions, such as healthy school policies, improving how schools respond to bullying, and parent outreach, on young people's substance use, violence, and sexual health. It is part of a broader RoR which also synthesized reviews of observational studies of school effects. RoRs assess the quality and summarize the findings of existing systematic reviews. The existing methodological literature on RoRs makes clear that these are intended to provide policy-relevant overviews of research evidence [15]. It stresses that whereas systematic reviews of intervention studies are intended to synthesize evidence on narrow questions (typically on interventions with shared methods and theories of change), RoRs are intended to answer broader questions and so to encompass more heterogeneous evidence [15]. This heterogeneity may be regarding outcomes and interventions. It is useful to bring together evidence on different forms of intervention and on different outcomes because it is useful for policy makers to know what is the range of approaches previously evaluated and whether these have consistent effects across different outcomes [15]. We judged an RoR in this area useful because of the diversity of school-based actions that might promote health, the large number of systematic reviews in this area but the narrow scope of most of these. We focused on sexual health, violence, and substance use because existing evidence suggests these outcomes: tend to cluster together [16,17]; tend not to be subject to sustained positive effects by classroom-based health education [8–11,18]; and are strongly influenced by school-level and student-level engagement with school and education [5,19]. For these reasons, we hypothesized that school-based interventions other than health education might be potentially beneficial across these outcomes.

Methods

Reviews reported in this article were included if they: reported review questions, reported methods of searching, provided quality assessment, and evidence synthesis; were published after 1980; focused on physical violence, substance use (smoking, drinking, and drug use), or sexual and reproductive health among students aged 11–18 years; examined school-based interventions addressing the physical or social environment, management/organization, teaching, pastoral care, discipline, school health services, whole-school health promotion activities, policies, and extra-curricular activities; and predominantly included randomized controlled trial (RCT) or nonrandom controlled before-after (CBA) designs. Reviews were only included if they reported (in tables, text, or meta-analyses) results separately for interventions within our remit. Studies were not excluded based on language or publication mode. Reviews only focusing on classroom-based health education were excluded.

The following databases were searched in the final week of January 2015 without date or language restrictions: Cumulative Index to Nursing and Allied Health Literature; Database of Abstracts of Reviews of Effects; Education Research Index Citations; Medline; Embase; PsycInfo; Social Policy and Practice; Australian Education Index; Social Science Citation Index; British Education Index; the Campbell library; and the Cochrane Database of Systematic Reviews. See Supplementary File for a sample search strategy. We also checked citation lists of included studies. Searches involved terms for reviews and children/young people and school interventions.

Search results were uploaded onto EPPI-Reviewer 4 software (EPPI-Centre, London, UK) and duplicates removed. Records were initially screened using hierarchical criteria on title/abstract. N.S./C.B. double screened a random selection of 100 records with discrepancies resolved by discussion (96% agreement before reconciliation). N.S./C.B. then shared single screening of the remaining records. The full texts of references not thus excluded were retrieved and double screened by four reviewers (N.S., C.B., K.H., and K.D.) working in pairs. Disagreements were resolved by discussion (100% agreement).

Data were extracted and reviews quality assessed by N.S., checked by C.B. Disagreements were resolved through discussion. We adapted the Assessing the Methodological Quality of Systematic Reviews (AMSTAR) checklist [20] to assess review quality, qualitatively weighting findings in our narrative synthesis as high, medium, and low quality [21]. High-quality reviews provided a priori published designs; searched $>$ 1 databases plus another mode; listed and described studies; used $>$ one people for data extraction; documented the size and quality of studies and used this to inform syntheses; synthesized findings narratively or statistically; assessed the likelihood of publication bias; and mentioned conflicts of interest. Medium-quality reviews searched at least one database; listed and described included studies; documented the quality of studies; and synthesized findings narratively or statistically. Low-quality reviews failed to meet at least one of these criteria. In adapting AMSTAR, we did not require reviews to report: search terms; whether they included reports regardless of publication type or a test of homogeneity or use a random effects model to account for heterogeneity. We judged these criteria would not differentiate reviews of different quality.

Synthesis began by summarizing review results in note form. Reviews were then grouped based on outcomes and interventions. Notes of reviews in these groupings were combined. First, we identified an index review within each group based on quality, recentness, and/or the number of relevant included studies. We elaborated our notes on the index review into a narrative summary by referencing back to the review. We then

compared and contrasted this with the next most useful review and so on. Finally, we assessed whether the review-level findings appeared reasonable compared with information on primary studies in the reviews. Our synthesis minimized "vote-counting" (quantifying the number of studies reporting particular findings regardless of their size and quality) by weighing findings according to the size and quality of the evidence underlying them and identifying where a study was included in multiple reviews [21].

Results

Included reviews

Our search identified 7,544 unique references, of which, screening on title/abstract excluded 7,257. Of the remainder, we could retrieve 260 records, of which, 29 met the inclusion criteria for the Lancet Commission's overall RoR (Figure 1). One additional review was found from reference

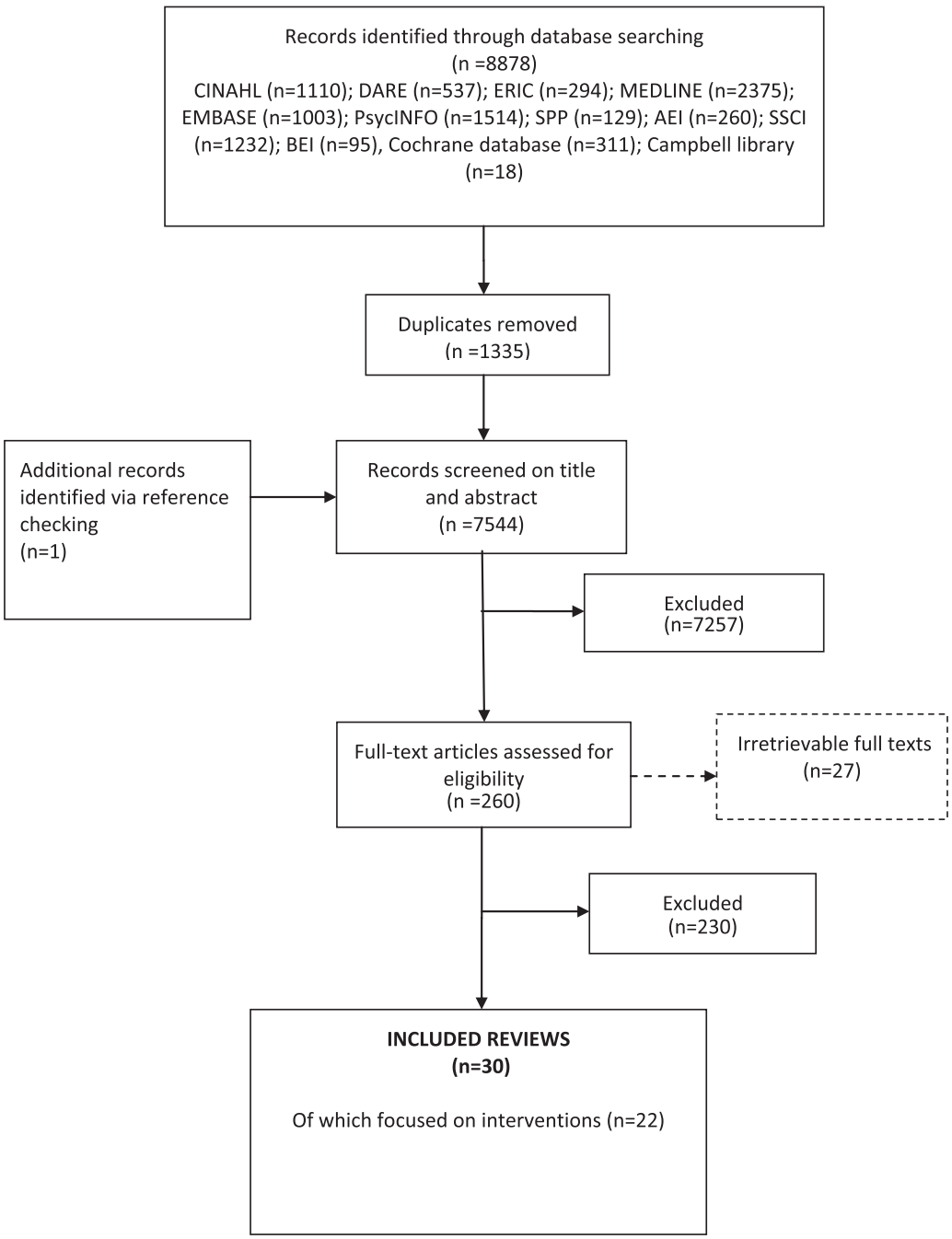

Figure 1. Flow of literature.

checking. Of the 30 reviews, 22 examined intervention studies (Table 1).

Included reviews were all written in English, published 2001–2013, and covered primary studies published 1974–2011. Seventeen reported the details of primary studies, most of which were conducted in the United States. At least eight studies were conducted in Australia; four in the United Kingdom and India; two in Canada, the Netherlands, Finland, Mexico, Brazil and China; and at least one in Germany, Italy, Japan, Denmark, Nigeria, Ethiopia, Portugal, Pakistan, Malawi, and South Africa.

Intervention types and outcomes assessed are reported in Table 1. Overlap in the studies included in reviews ranged 0%–90% (Table 1). Four reviews were classified as high quality; eleven as medium; and seven as low quality (Table 2). Table 3 summarizes how the reviews contributed toward our synthesis.

Sexual health

Multicomponent interventions. The effects of multicomponent sexual heath interventions were assessed in two medium-quality reviews [22,23]. We define multicomponent as involving more than one mode of intervention which could include classroom education plus other approaches. Overall, this evidence suggests that such interventions, for example, combining classroom-based health education alongside staff development or school organization and family or community components, can prevent teenage pregnancy and risky sexual behaviors. The evidence is drawn exclusively from United States, largely minority-ethnic populations.

The most recent review narratively synthesized evidence on six interventions that delivered health education alongside other components, concluding such interventions are effective for reducing teenage pregnancy [22]. Judged against primary studies, review-level findings seem warranted. The findings are supported by one RCT which reported increases in contraception use; as well as by two CBA studies of interventions combining health education and community volunteering, which were effective in preventing teenage pregnancy and risky sexual behavior. The second review [23] included three evaluations (n = 2,108) of youth development programs targeting disadvantaged youth. Such programs included health education alongside community service, academic support, work experience and so forth delivered during or after school. Meta-analysis reported a significant effect on pregnancy. An additional study excluded from the meta-analysis reported similar but nonsignificant results. Thus, review-level findings about the effectiveness of such interventions appear warranted.

Social work interventions. Two medium-quality reviews examined sexual-health interventions delivered by social workers or counselors in schools [22,24], reporting mixed, unreliable evidence. We prioritized the most recent [24]. Narrative synthesis reported that social work interventions are more effective at changing sexual knowledge and behavior when provided by trained professionals. Our check on primary studies concluded the evidence was weak and results were mixed. The review included one CBA and three before-after (BA) evaluations (n = 5,310). The manualized weekly treatments had medium-size effects increasing sexual knowledge, changing attitudes about sexual assault, and increasing abstinence, and this came only from BA studies. The second review [22] narratively synthesized three evaluations of the same intervention offered to different populations evaluated in CBAs. The intervention was delivered by social workers involving: individual case-management and home visits; medical care for mothers and infants; peer support; and community outreach. Blank et al. [22] concluded such interventions can be effective in preventing repeat adolescent pregnancy. Results of these reviews should be treated cautiously. Both draw on a few, small studies, none of which were RCTs. Each review attributed the success of the interventions in question to different components despite the designs not being able to disaggregate this.

School-based health centers. The impact of school-based health centers and condom-availability programs on contraceptive use were assessed in three medium-quality reviews [22,25,26]. All concluded that there is a lack of evidence that these increase contraceptive use. No review drew on RCTs, and results from other designs were mixed. We prioritized the review with the most relevant studies [26] which examined whether school-based or school-linked sexual health and contraception services reduce conceptions and sexually transmitted infections (STIs) and increase contraceptive use. The review concluded that: such interventions are largely ineffective in increasing contraceptive use; there is no good evidence that such interventions reduce conceptions; and such interventions may prevent STIs for males but not females. Our examination of included studies concurs. Five CBA studies examined intervention effects on contraceptive use, only one of which reported significant increases. Two high-quality studies examined condom-availability programs, one reporting increases and one decreases. Five CBA studies assessed effects on pregnancy, none reporting significant effects. Four CBA studies examined the effect of school-based health centers on STIs, one of which reported benefits for males only. The other two reviews included largely the same studies, concluding there is a lack of evidence for school-based health centers. One of these [22] suggested that school-based health centers may be more effective when contraception provision is available on site but this is informed by studies which examine contraception uptake rather than use.

Economic incentives. The effectiveness of economic incentives to stay in school in reducing adolescent marriage and pregnancy in LMIC was assessed in one medium-quality review [27]. The evidence suggests that such incentives, awarded to young people or the wider community, may be effective in increasing age at marriage and conception and total fertility rates. The four, large primary studies informing these conclusions were conducted in Mexico, Nicaragua, Pakistan, and Malawi; two RCTs; and two CBAs. Three interventions, including one subject to RCT, reportedly fewer adolescent marriages and lower conception and overall fertility. The other intervention subject to RCT was associated with nonsignificant reductions in adolescent pregnancies.

Other interventions. Four intervention studies included in a medium-quality review [27] conducted in LMIC did not fit any of the previously mentioned categories. All included health education, two combining this with peer education and two with school health clinics or counseling. There was mixed evidence that the former increased contraceptive use and age of marriage, while the latter appeared ineffective. Information on primary studies supported these conclusions. Of studies evaluating health education plus peer education, one was an RCT and one a CBA. The RCT, conducted in Nigeria, reported increases only in female

Table 1
Characteristics of included reviews

Review authors	Interventions	Included designs	Population	Comparators	Outcomes	Synthesis	% Interventions in other reviews
Allen-Meares et al. (2013)	Interventions were grouped into tier 1 (universal) and tier 2 interventions (targeted). Only universal interventions focusing on sexual assault, abstinence, and sexually risky behavior were within remit for this review.	Experimental, quasi-experimental, or pretest post-test design	Middle and high school students in the United States. Included studies cover period from 1991 to 2011.	Not stated	Sexual assault; abstinence; sexual risk behaviors	Narrative	25
Blank et al. (2010)	Whole-school behavioral interventions to improve well-being. Only the synthesis of studies which reported on the role of young people in whole-school interventions and the role of parents in whole-school interventions were within remit.	Randomized controlled trials, controlled before and after studies, and interrupted time series	Young people aged 11–19 years. Most of the included studies were conducted in state-run, mainstream schools; only one was conducted in a private school, and none was conducted in special or extended school settings. Several studies were conducted in populations described as having low socioeconomic status, and/or within locations where most children were from a particular minority-ethnic group such as African American and "minority youth." Most of the evidence comes from the United States (22 articles) with three studies from the United Kingdom and one each from Canada, Australia, Germany, Italy, Netherlands, Norway, Finland, and Japan. Studies cover period 1999–2007.	Not stated	Bullying; disruptive or problem behavior	Narrative	30
Blank et al. (2010)	Intervention types included: Pregnancy (preventing teenage pregnancy) repeat (preventing repeat pregnancy), multi (multiple outcomes related to teenage pregnancy and sexual health), SBHC (effectiveness of school-based sexual health care delivery), contraception (contraceptive provision/use), education plus (education interventions with additional elements). All interventions were within remit.	Randomized controlled trials, controlled before and after studies, and interrupted time series	Young people aged 19 years and under. Studies of wider age groups were included if most participants were aged under 19 years. All studies conducted in United States. Most (26/29) of the included studies were conducted in state-run mainstream middle and high schools, with two conducted in colleges and one in a university setting. Studies cover a period from 1995 to 2008.	Not stated	Teenage pregnancy; contraception use	Narrative	35
Coppo et al. (2014)	School tobacco policy interventions. There is only one intervention included in review.	Cluster-randomized controlled trials	Thirteen- to 15-year olds in four Chinese middle schools in two Chinese regions. 2014.	No intervention	Smoking	N/A	0

Table 1
Continued

Review authors	Interventions	Included designs	Population	Comparators	Outcomes	Synthesis	% Interventions in other reviews
Fletcher et al. (2008)	"Whole-school" interventions, which went beyond individual-focused, classroom-based drugs education, and involved changes to schools' overall organization, policies, working practices, culture, or environment. All interventions within remit.	Cluster-randomized controlled trials and quasi experimental	Young people in the age range of 11−16 years. Two studies were carried out in the United States. One was carried out in the Netherlands and one in Australia. Cover period from 2002 to 2004.	Not stated	Illicit drug use	Narrative	75
Foxcroft et al. (2011)	Any universal multicomponent psychosocial or educational prevention program. All interventions within remit.	Randomized and cluster-randomized controlled trials	Young people up to 18 years attending school. Seventeen of the 20 trials were conducted in the United States, one trial was conducted in India, one in the Netherlands, and one in Australia. The study participants' mean age at baseline in the included trials ranged from 7 to 15.2 years. Covers 1996−2009.	Mostly no intervention or standard curriculum. Four studies had information in print form as control. Two studies only had comparisons between intervention and enhanced intervention.	Alcohol use	Narrative	50
Harden et al. (2009)	Interventions were grouped into early childhood education and youth development programs. Only youth development programs were within remit.	Randomized and nonrandomized controlled trials	Relevant interventions could be targeted at children, young people, or their families. All trials were conducted in the United States and targeted disadvantaged groups of children and young people. Three reviews that were included in relevant synthesis included young people aged 13−17 years and included studies cover period 1994−2001.	No intervention	Teenage pregnancy	Statistical	0
Langford et al. (2014)	HPS interventions: input to the curriculum; changes to the school's ethos or environment or both; and engagement with families or communities or both. All interventions within remit.	Cluster-randomized controlled trials	Children and young people aged four to 18 years attending schools or colleges (including special schools). Nine studies carried out in the United States, three in Australia, one in Denmark, one in Finland. Covers 1996−2011.	No intervention or continued with their usual practice	Bullying; aggressive behavior; alcohol use; illicit drug use; and smoking	Statistical	85
Limbos et al. (2007)	Groups interventions into primary (universal), secondary (targeted at-risk individuals) and tertiary (targeted those who have already engaged in violent behavior). Only subsets of syntheses for school + home or school + community are within remit. Synthesis is vote count in table form.	Randomized controlled trial, experimental, quasi-experimental, or pretest−post-test design, cross sectional	Youth aged 12−17 years in the United States. Not clear what period covered.	Not stated	Aggressive behavior	Narrative	Unclear[a]

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Table 1
Continued

Review authors	Interventions	Included designs	Population	Comparators	Outcomes	Synthesis	% Interventions in other reviews
Mason-Jones et al. (2012)	School-based health centers	Evaluations	Adolescents in secondary schools/ high schools. Twenty-four studies in the United States, two in Canada, one in the United Kingdom. Studies cover a period from 1991 to 2011.	Not stated	Contraception use	Narrative	67
McQueston et al. (2013)	They grouped interventions based on intervention components and the site of the intervention. Synthesis of interventions referring to cash transfers, peer education and school-based interventions/workshops, and school-based intervention/workshops and communication and health services/counselling were within remit.	Randomized controlled trials, cluster-randomized trials, quasi-experiments, and studies that measured outcomes both before and after an intervention	Youth aged between 10 and 24 years in Brazil, Nigeria, India, and Ethiopia. Included studies cover 2001–2010.	Not stated	Teenage pregnancy; contraception use; and adolescent marriage	Narrative	0
Müller-Riemenschneider et al. (2008)	The synthesis of multisectoral interventions (encompassing school- and community-based approaches) were of interest for this review.	Randomized controlled trial	Youth up to 18 years of age. Eight studies conducted in the United States, one in India, one in the Netherlands, one in Europe. Included studies covered 2002–2005.	Mostly no intervention, three use standard prevention programs, one compares to other intervention, two studies state "N/A"	Smoking	Statistical	90
Owen et al. (2010)	School-based and school-linked sexual-health services	Controlled before and after studies, before/after comparisons, cross sectional	Children and young people of school age (11–18 years). Majority of studies in the United States, one in Brazil, one in the United Kingdom. Studies cover a period from 1989 to 2006.	Not stated	Teenage pregnancy; contraception use	Narrative	32
Saraf et al. (2012)	The syntheses of school-based interventions with a family and or community component were within remit.	Randomized controlled trials, cluster-randomized trials	Children and adolescents, aged on average between 12–17 years in relevant interventions. Four studies in the United States, one in India, one in Australia, and one in Europe. Included studies covered 2002–2009.	Not stated	Smoking	Narrative	86
Soole et al. (2008)	School-based drug-prevention programs. Interventions classified as "system wide" or "other" are within remit.	Experimental and quasi-experimental	School-aged children and young people. Included studies range between 1997 and 2004. In the overall review—16.39% of studies include elementary school-aged children, 72.13% include middle school-aged children, and 11.48% high school.	Not stated	Illicit drug use; smoking	Narrative	50

Table 1
Continued

Review authors	Interventions	Included designs	Population	Comparators	Outcomes	Synthesis	% Interventions in other reviews
Sussman et al. (2006)	Review included teen smoking cessation intervention. School clinics were within remit for this review.	Controlled studies no other information given	Twelve- to 19-year olds. No individual study information provided. The overall review included studies from 10 countries and manuscripts from 1970 to 2003.	Not stated	Smoking	Statistical	Unclear[a]
Thomas et al. (2006)	The synthesis of multimodal programs was of interest for this review.	Randomized controlled trials, cluster-randomized trials	Children (aged 5–12 years) and adolescents (aged 13–18 years) in school settings. In included studies youngest age is 11 years. Studies in Denmark, Finland, Portugal, China and three in the United States. Included studies covered 2000–2010.	Usual care	Smoking	Statistical	50
Ttofi et al. (2011)	Review included antibullying programs in schools. However, only overall information on specific intervention components is relevant: parent training/ meetings, playground supervision, classroom management, teacher training, classroom rules, whole-school policy, school conferences, and information for parents.	Randomized experiments, before and after quasi-experimental designs, other quasi-experimental designs, and age-cohort designs	Overall review includes students from kindergarten to high school in developed countries. Studies conducted between 1983 and May 2009.	Not stated	Bullying	Statistical but not relevant	Unclear[a]
Vreeman et al. (2007)	School-based interventions were categorized into "whole-school interventions", "social and behavioral skills group training," and "other". Only social and behavioral skills group training interventions were within remit due to young ages in other groups.	Quasi-experimental, pretest post-test	Students in grade 3 (one study) and grades 6–8 in other three studies. Two studies in the United States, one in South Africa, one in the United Kingdom. Included studies were conducted between 2000 and 2004.	Not stated	Bullying	Narrative	0
Wilson et al. (2001)	School-based prevention. Interventions are categorized into environmental and individually focused. All environmental interventions are within remit, and the individually focused the "counselling/social work/ other therapeutic" and the "recreation/community service/enrichment/and leisure activities" are within remit also.	Comparison group evaluation methodology, including nonequivalent comparison group	No individual study information is provided. Overall 55% included middle or high school students; 78% male. Countries and date range of studies not provided.	No treatment or minimal treatment condition	Disruptive or problem behavior; alcohol use; illicit drug use	Statistical	Unclear[b]

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Table 1
Continued

Review authors	Interventions	Included designs	Population	Comparators	Outcomes	Synthesis	% Interventions in other reviews
Wilson et al. (2006)	School-based social information processing programs. These were all selected/indicated pull-out programs. All interventions were within remit.	The intervention and control groups could be randomly or nonrandomly assigned but, if nonrandom, needed to be matched or provide evidence of initial equivalence	Nearly 90 percent of the studies were conducted in the United States, and slightly over half were published in peer reviewed journals. Studies were published from the 1970s to the present, with most programs in the 1980s and 1990s. The samples were predominantly male. Age ranged from six to 16, with 45% of the samples in the nine- to 11-year range. Among the studies that reported the ethnicity for their subject samples, over half were comprised primarily of minority youth. Forty percent of the studies were conducted with predominantly low-income populations.	Placebo, wait-list, no treatment, or "treatment as usual"	Aggressive behavior	Statistical	0
Wood et al. (2012)	School-based mentoring programs. Only those considering behavioral outcomes were within remit.	Randomized controlled trials	Participants were mainly in middle school, with an average age of 11 years. Just over half of the participants in the review are female. Most participants were from low-income families. Across trials, about 34% of participants were black, 31% Hispanic, and 24% white. All studies were conducted in the United States. Included studies covered 1996–2009.	No treatment or an alternative treatment	Disruptive or problem behavior; illicit drug use	Statistical	0

HPS = Health Promoting Schools; N/A = not applicable; SBHC = School-based Health Care.
[a] From the manuscript it is unclear which citations belong to the studies included in the synthesis.
[b] No citations for included studies given.

Table 2
Quality assessment

	Provides an "a priori" design	Duplicate data extraction	Search ≥2 databases plus another mode of searching	Searched for reports regardless of their publication type	Include a list of included studies	Report characteristics of each of the individual studies	Assess and document the scientific quality of the included studies	Use the scientific quality of the studies appropriately	Use appropriate methods to combine the findings of studies	Assess the likelihood of publication bias	Include conflict of interest statement	Overall rating
Allen-Meares et al. (2013)	N	N	Y	Y	Y	Y	Y	Y	Y	N	N	Medium
Blank et al. (2010a)	N	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Low
Blank et al. (2010b)	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Medium
Coppo et al. (2014)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Fletcher et al. (2008)	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Medium
Foxcroft et al. (2011)	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Medium
Harden et al. (2009)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Medium
Langford et al. (2014)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Limbos et al. (2007)	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Low
Mason-Jones et al. (2012)		Y	Y	Y	Y	Y	Y	Y	Y		Y	Medium
McQueston et al. (2013)	N	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Medium
Müller-Riemenschneider et al. (2008)	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Medium
Owen et al. (2010)	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Medium
Saraf et al. (2012)	N	N	Y	Y	Y	Y	Y	N	Y	N	Y	Medium
Soole et al. (2008)	N	Y	N	N	Y	N	Y	Y	Y	N	N	Low
Sussman et al. (2006)	N	N	Y	Y	Y	N	Y	N	Y	Y	N	Low
Thomas et al. (2006)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High
Ttofi et al. (2011)	N	Y	Y	Y	Y	N	Y	Y	Y	N	N	Low
Vreeman et al. (2007)	N	Y	Y	N	Y	Y	Y	N	Y	N	Y	Low
Wilson et al. (2001)	N	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Low
Wilson et al. (2006)	N	Y	Y	Y	Y	Y	Y	N	Y	N	Y	Medium
Wood et al. (2012)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	High

N = no; Y = yes.

Table 3
Summary of intervention reviews synthesized

Health themes	Sub-themes	High quality (++)	Medium quality (+)	Low quality (−)
Sexual health	Multicomponent intervention	None	Blank et al. 2010a; Harden et al. 2009	None
	School-based health centers	None	Blank et al. 2010; Mason-Jones et al. 2012; Owen et al. 2010	None
	Interventions delivered by social workers	None	Allen-Meares et al. 2013; Blank et al. 2010	None
	Economic incentives	None	McQueston et al. 2013	None
Violence	Multicomponent intervention	Langford et al. 2014	None	Blank et al. 2010b; Ttoti et al. 2011; Limbos et al. 2007
	Targeted interventions	Wood and Wilson 2012	Wilson and Lipsey. 2006	Vreeman and Carroll 2007; Wilson et al. 2001
	Peer mediation			Blank et al. 2010b
Substance use	Multicomponent intervention	Langford et al. 2014; Thomas and Perera 2006	Foxcroft and Tsertsvadze. 2011; Fletcher et al. 2008; Müller-Riemenschneider et al. 2008; Saraf et al. 2012	Soole et al. 2008
	School-based clinics	None	None	Sussman et al. 2006
	Changes to school policy	Coppo et al. 2014	None	None

condom use. The CBA reported reductions in female adolescent marriage and increased contraceptive use. Of the evaluations of interventions combining health education with school health services, a CBA conducted in Brazil found no increase in contraceptive use whereas an Indian CBA reported nonsignificant increases in age at marriage and first conception.

Evidence on violence

Multicomponent interventions. Four reviews examined the effects of multicomponent interventions on violence [28–31]. One was high quality [29], including only high-quality evaluations. Another review was low quality but included high-quality evaluations [28]. Two reviews were low quality and provided limited information on the effectiveness of interventions [30,31]. The high-quality review reported that multicomponent interventions, for example, including school policy changes, parent involvement and work with local communities, reduce bullying victimization, and show promise in reducing bullying perpetration. This review suggested that multicomponent interventions simultaneously addressing violence and substance use may be effective in tackling violence. Other reviews are broadly supportive but provide lower-quality evidence. Most studies were conducted in the United States with African-American populations.

Table 4
Summary of the effectiveness of school environment interventions from systematic review of reviews

	Outcomes				
	Sexual health	Violence	Tobacco	Alcohol	Drugs
Interventions					
Multicomponent interventions	√√	√√	√√	0	0
Economic incentives	√√	0	0	0	0
Social work/counselling	0	0	0	0	0
School-based clinics	X	0	√	0	0
Targeted interventions	0	XX	0	0	0
Peer led interventions	0	0	0	0	0
School rules/policies	0	0	0	0	0

√√ = Rigorous evidence of benefits; √ = Limited evidence of benefits; 0 = No or inconsistent evidence; XX = Rigorous evidence of ineffectiveness or harms; X = Limited evidence of ineffectiveness or harms.

We prioritized one review based on quality and recentness [29]. This focused on interventions combining health education, school ethos/environment, and family/community components. Meta-analysis of four high-quality studies on self-reported violence found no evidence that interventions addressing multiple risk behaviors were effective in reducing violence. However, meta-analysis of a subgroup of three of these interventions that addressed multiple risk behaviors including substance use as well as violence reported a larger effect of borderline significance. This finding, although supported by information from primary studies, should be treated cautiously given the small number of studies and post hoc analysis. This review also meta-analyzed data from five RCTs, reporting significant effects on bullying victimization of multicomponent interventions specifically addressing bullying. Meta-analyses focused on the same outcome but including interventions addressing multiple risk behaviors and focused on emotional wellbeing reported nonsignificant reductions. These results must be interpreted cautiously since they each draw on a single RCT. This review also meta-analyzed data from six RCTs, reporting reductions of borderline significance in bullying perpetration of multicomponent interventions specifically addressing bullying. A meta-analysis focused on the same outcome but focusing on multiple risk behavior intervention reported a significant reduction, but this drew on a single RCT.

A low-quality review [28] narratively synthesized four RCTs of whole-school interventions that included parent-training/education. The review did not conclude whether these interventions were effective but reviewers suggested that parental involvement in whole-school interventions may be beneficial. The review provided little information on interventions so it is unclear whether these targeted multiple outcomes and impossible to judge whether we agree with review-level findings. Two low-quality reviews also provided limited information on multicomponent interventions [30,31]. Neither reported on the quality or size of primary studies. One was prioritized based on recentness [31]. This assessed the effectiveness of specific intervention components in reducing bullying and victimization based on analysis of 41 interventions, reporting that the most important components for tackling bullying and victimization were changes to the school environment (such as improved playground supervision; whole-school antibullying policy) and parental involvement.

The other review [30] only reported the proportion of interventions effective in tackling violent behaviors. This found mixed evidence for the effectiveness of multicomponent interventions. Two of five multicomponent interventions were reported as effective. Two of three universal school and community interventions were reported as effective in reducing violence. There was no effect of one universal school and home intervention or of one school and community intervention aimed at youths already engaging in violence. This information is of little value, however, without being able to assess the quality of the subgroup of included primary studies that were within the remit of this RoR.

Targeted interventions. Three reviews focused on interventions targeting those at risk of violence [32–34] and one reported the characteristics of interventions most likely to be effective in tackling problem behavior [35]. Overall, there was little evidence that targeted interventions providing training in social skills, school-based mentoring, or most forms of therapeutic intervention are effective for reducing violence. One review was prioritized based on recentness and quality [34]. This examined the effects of school-based adult mentors supporting at-risk youth. Meta-analysis of four high-quality RCTs (n = 4,347) found no effects on problem behaviors but did not separate out effects for violence. Only one of the two intervention studies that considered longer-term outcomes reported significant effects. Based on the information provided about the primary studies, we agree with the reviewers' conclusions and find no evidence to support the use of school-based mentoring.

Two reviews examined social-skills training [32,33]. The more informative, medium-quality review [33] reported a meta-analysis for aggressive/disruptive behaviors of targeted social information–processing training (aiming to improve students' understanding of social processes). Meta-analysis combined outcomes from 47 studies and reported reductions in aggressive/disruptive behaviors. We agree with the review interpretations but note the small, albeit significant effect and limited generalizability from largely US studies conducted >30 years ago. A second, low-quality review [32] of interventions addressing social-skills training narratively synthesized four studies (one RCT, two CBA, and one BA, n = 981). This review reported that such training did not reduce bullying or victimization. A low-quality review examined the features of effective school-level prevention of problem behaviors including aggressive behavior [33]. This included 206 studies (of which 42 were RCTs) and reported that effect sizes were generally larger for interventions targeting at-risk populations but that counseling (other than cognitive-behavioral therapy), social work, and other therapeutic interventions tended to increase problem behaviors.

Peer mediation. One low-quality review [28] narratively synthesized six peer mediation/education intervention studies to prevent bullying/disruptive behaviors. The review reported mixed evidence and could not identify factors which moderated effects. Four studies (including two RCTs) suggested that peer mediators are helpful in preventing bullying. However, a further two studies (designs not stated) described peer-mediation interventions that were not effective in reducing bullying. The primary studies did not provide enough information to assess whether we agreed with reviews.

Evidence on smoking

Multicomponent intervention. Overall, there is good evidence from two high-quality [29,36] and two medium-quality [37,38] reviews that multicomponent interventions are effective reducing smoking, regardless of whether the intervention focuses specifically on smoking or multiple risk behaviors. However, multicomponent interventions may be less effective for preventing smoking initiation.

We prioritize the more recent high-quality review which also contained more relevant studies [29]. This included RCTs of interventions that included health education, ethos/environment, and family/community engagement elements. Meta-analysis suggested that interventions focused on tobacco (three trials, n = 4,747 participants) and those focused on multiple risk behaviors (five trials, n = 9,992 participants) were both effective in reducing smoking. Additionally, one trial (n = 1,901 participants) suggested that an intervention aimed at alcohol use could reduce smoking, whereas a trial (n = 630 participants) of an intervention focused on well-being had effects of borderline significance reducing smoking.

The other high-quality review [36] examined multimodal interventions reducing smoking initiation. These were defined as programs combining health education with wider initiatives addressing parents, schools, local communities, or school policies. Despite including many of the same interventions as the previously mentioned review, meta-analysis of seven RCTs (n = 31,325) suggested these were ineffective in preventing smoking initiation. The information presented on primary studies supports the conclusions of both reviews. Hence, such interventions appear effective in reducing smoking rates but not preventing initiation.

We prioritized the more recent of the two medium-quality reviews [38]. Narrative synthesis suggested the effectiveness of school-based interventions which included family or community engagement. This was supported by the information presented on the seven included RCTs, with six of the seven interventions showing statistically significant effects on smoking behaviors. The other medium-quality review [37] provided a narrative synthesis (11 RCT, n = 48,850) which suggested that school-based interventions which also include family or community components exert long-term effects reducing smoking. Meta-analyses suggest reductions in lifetime smoking and regular smoking but only borderline effects on 30-day smoking. The results for 30-day and regular smoking should be interpreted cautiously because these drew on a single trial, whereas that for lifetime smoking drew on three studies. The review concluded there was good evidence for the effectiveness of multisectoral interventions on reducing smoking, and we judge that this is supported by the evidence presented.

School policy change. There is insufficient evidence on the effects of school tobacco policies on student smoking. One high-quality review [39] found only one RCT (n = 1,807) from China. This study was of low quality with high risk of bias. The authors also discussed the results of 24 observational studies. There were no significant differences for students' smoking between schools with and without a school tobacco policy. We agree with the reviewers' conclusions that currently there is insufficient evidence from rigorous studies to judge the effects of such policies.

School-based clinics. There is some evidence albeit from a low-quality review that school clinics are effective in increasing

smoking quit rates. One review [40] examined the effects of school-based cessation clinics. Meta-analysis of 25 trials reported overall increases in quit rates, effects being larger than for classroom-based education. The review provides no information on primary studies so we cannot assess the veracity of the review-level conclusions.

Evidence on alcohol and drug use

Multicomponent interventions. The highest quality review on this topic reported meta-analysis of seven high-quality studies (n = 11,497) on alcohol use and six high-quality studies (n = 15,127) reporting on drug use, finding no evidence that multicomponent interventions were effective in reducing alcohol intake or substance use [29]. There was some evidence that multicomponent interventions addressing multiple risk behaviors produced effects of borderline significance reducing alcohol use, but we agree with the authors that this should be treated cautiously because it is a post hoc analysis of four RCTs. Also drawing on post hoc meta-analyses of few trials, there was no evidence that intervention focused solely on alcohol or on well-being were associated with reduced alcohol use.

Two medium-quality reviews also found evidence for inconsistent effects of multicomponent interventions on alcohol and drug use [10,41]. The more recent review [10] included more trials of relevance. Eighteen of the 20 included studies included a school component. Narrative synthesis concluded there was some evidence that multicomponent interventions for alcohol misuse prevention can be effective, but there was little evidence that these were more effective than interventions with single components. We agree with these conclusions but caution that only 12 of the 20 multicomponent interventions (n = 57,545 participants in total), were effective in reducing alcohol use. The other review [41] focused on whole-school interventions involving changes to schools' overall organization, policies, working practices, culture, or environment. Narrative synthesis of four intervention studies suggests that interventions which increase student participation, improve relationships, promote a positive school ethos, and address disaffection and truancy might be effective in reducing drug use, especially for boys. The evidence presented from the primary studies supports these conclusions. Of the four included studies (three RCT, one CBA, n = 9,356 participants), two interventions were effective for boys but not girls whereas another suggested positive effects for cannabis use of borderline significance.

Finally, a low-quality review [42] focused on school-level "system-wide" drug-prevention interventions, defined as those also involving family, community, and/or media participation. Narrative synthesis reports that such interventions may be more effective reducing drug use for those initially at a lower risk of using illicit substances. No information is provided on primary studies so it is not possible to assess these conclusions.

Discussion

Summary of key findings

Overall, there is good evidence that multicomponent school interventions, for example, including school policy changes, parent involvement, and work with local communities, are effective for promoting sexual health and preventing bullying and smoking (Table 4). There is less evidence that such intervention can reduce alcohol and drug use. Economic incentives to keep girls in school can reduce teenage pregnancies. School clinics can promote smoking cessation. There is little evidence that on their own sexual-health clinics, antismoking policies, and various approaches targeting at-risk students are effective.

For sexual health, there is good evidence that multicomponent interventions prevent teenage pregnancy and risky sexual behaviors. However, evidence is drawn exclusively from United States and particular ethnic populations so generalizability is uncertain. There is strong evidence that economic incentives for adolescents to stay in school may reduce adolescent marriages, total fertility rates, and the prevalence of teenage pregnancy in LMIC. There is not clear evidence for the effectiveness of social work interventions in schools improving sexual health or good evidence that school clinics and condom-availability programs produce consistent increases in contraceptive use.

Multicomponent interventions appear to reduce bullying victimization and show promise in reducing bullying perpetration and violence. There is some evidence that multicomponent interventions simultaneously addressing violence and substance use show promise in tackling violence but more research is needed. There is little evidence that targeted interventions involving social-skills training, school-based mentoring, or most forms of therapeutic intervention are effective in reducing violence. Social information–processing programs may reduce violence, but effects are small and evidence is now quite old. There is insufficient review evidence to assess the effectiveness of peer mediation in reducing violence.

There is good evidence that multicomponent interventions comprising health education, environmental actions, and family/community outreach are effective in reducing smoking, regardless of whether intervention specifically targets smoking or broader risk behaviors. However, such interventions may be less effective for preventing smoking initiation. There is insufficient evidence on the effects of school tobacco policies. The evidence that multicomponent school interventions are effective in reducing alcohol, and drug use is somewhat less clear than is the case for smoking, although some interventions appear to be effective and interventions which address multiple risk behaviors show most promise. School clinics look promising in increasing smoking quit rates.

That multicomponent interventions appear effective across sexual health, bullying victimization, and smoking may reflect that these outcomes are subject to multiple social determinants so that multiple components are needed [12]. The evidence is less convincing for the effects of such interventions on other forms of violence, alcohol, and drugs. This may be because these behaviors mostly occur outside schools or simply reflect the paucity of relevant studies. Our syntheses suggest that targeted approaches may be insufficient for substantial behavior change within schools. This may reflect the paucity of research or challenges implementing such interventions in schools where students may be reluctant to admit participation in risk behaviors or such interventions not reaching most students who are at low or medium risk but who nonetheless may account for a majority of risk taking [43].

Limitations

RoRs are in an early stage of development. Although quality assessment tools have been developed, agreed methods of

synthesis have not. RoRs are only as good as the reviews included. There are topics, such as sexual-health clinics and peer mediation, where high-quality reviews are lacking. In these cases, our findings of a lack of evidence may reflect the interventions chosen for evaluation and the limitations of existing evaluations and syntheses. A necessary further limitation of all RoRs is that these may not represent the most up-to-date research in the field [44].

Implications for policy and research

Our syntheses suggest that there is good evidence for investments in school-based multicomponent interventions to address sexual health, bullying victimization, and smoking although this evidence is dominated by US studies and generalizability is uncertain. There is also good evidence that economic incentives for adolescent girls to stay in school reduce adolescent marriages and pregnancies in LMIC.

More rigorous evaluations are required, particularly of school sexual-health clinics, condom-availability programs and peer mediation in reducing violence. These should involve random allocation at a level appropriate for the intervention. Although there is a paucity of rigorous evaluations of school tobacco policies, the existing nonexperimental evaluations do not suggest that school tobacco-control policies are likely to be effective at least on their own, so future studies might focus on interventions which combine changes to tobacco and broader school policies, for example, on student participation and engagement.

Acknowledgments

The authors thank the other members of the Lancet Commission on Adolescent Health and Wellbeing for their support in undertaking this work. The authors thank the other members of the Lancet Commission on Young People's Health and Wellbeing for their contribution to the work. The funder played no role in study design, or data collection, analysis or interpretation.

Author contributions: C.B. codirected the review and led the planning and drafting of this article. N.S. codesigned the study and led the conduct of the review. F.J. contributed to synthesis and drafting the article. K.D. undertook data extraction and quality assessment on the review and contributed to drafting the article. R.V. and G.P. oversaw the design of the research and contributed to planning and drafting the article. All authors have read the final draft of the manuscript, approve of its submission and are willing to take responsibility for it in its entirety.

Funding Sources

This project is funded from a grant by the Bill and Melinda Gates Foundation (OPP1117498).

Supplementary Data

Supplementary data related to this article can be found at http://dx.doi.org/10.1016/j.jadohealth.2015.12.017.

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