



Review article

Do Health and Education Agencies in the United States Share Responsibility for Academic Achievement and Health? A Review of 25 Years of Evidence About the Relationship of Adolescents' Academic Achievement and Health Behaviors

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 A B S T R A C T

Purpose: The United States Centers for Disease Control and Prevention monitors health-risk behaviors of adolescents in United States, which include (1) violence; (2) tobacco use; (3) alcohol and other drug use; (4) sexual behaviors contributing to unintended pregnancy and sexually transmitted diseases; (5) inadequate physical activity; and (6) unhealthy dietary behaviors. We reviewed original research published in peer-reviewed journals between 1985 and 2010 to synthesize evidence about the association of adolescent health-risk behaviors and academic achievement.

Methods: Using predetermined selection criteria, 122 articles were included that used at least one variable for health-risk behaviors and also for academic achievement.

Results: For all six health-risk behaviors, 96.6% of the studies reported statistically significant inverse relationships between health-risk behaviors and academic achievement.

Conclusions: With this persuasive evidence about the interrelationship of health-risk behaviors and academic achievement, it is imperative that leaders in education and health act together to make wise investments in our nation's school-age youth that will benefit the entire population. A unified system that addresses both health behavior and academic achievement would have reciprocal and synergistic effects on the health and academic achievement not only of children and adolescents, but also of adults in the United States.

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 IMPLICATIONS AND
 CONTRIBUTION

Among adolescents, health-risk behaviors are inversely related to academic achievement. While this inverse relationship is not new information, the reported strength of the interrelationship is compelling and suggests that a unified system that addresses both health behavior and academic achievement would have reciprocal and synergistic effects.

Historically, the United States (U.S.) has turned its focus to the health of students in response to crises, such as inadequate nutrition, outbreaks of communicable diseases (e.g., polio in the 1950s), drug abuse, teen pregnancy, sexually transmitted infections, and unmet mental health needs. In 1988, with cases of acquired immunodeficiency syndrome

emerging in the U.S. population, the Centers for Disease Control (now the U.S. Centers for Disease Control and Prevention [CDC]) focused on the potential of schools in the nation to prevent the spread of human immunodeficiency virus (HIV) infection.

From surveillance conducted by CDC, six health-risk behaviors of adolescents emerged that contribute to the leading causes of death, disability, and social problems among youth and adults in the U.S. [1]: tobacco use, alcohol and other drug use, sexual behaviors that contribute to unintended pregnancy and sexually

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transmitted diseases (STDs) (including HIV infection), behaviors that contribute to unintentional injury and violence, unhealthy dietary behaviors, and physical inactivity. The CDC created a national surveillance system, the Youth Risk Behavior Surveillance System, to collect data about health-risk behaviors of school-age youth [2].

The purpose of this study was to determine the extent, if any, to which there is published evidence of statistically significant relationships among the six identified health-risk behaviors and academic achievement of school-age youth in the U.S.

Review of Literature

For decades, researchers have suggested that efforts designed to promote academic success among youth may also reduce the students' health-risk behaviors [3]. In 1990, in a report titled *Code Blue*, the National Commission on the Role of the School and the Community in Improving Adolescent Health stated, "Efforts to improve school performance that ignore health are ill-conceived, as are health improvement efforts that ignore education" (p.9) [4]. In 1992, the relationship between substance use and low academic performance was described in the literature as "mutually reinforcing" [5]. In 1997, a task force convened by the Institute of Medicine of the National Academy of Sciences concluded, "Schooling is the only universal entitlement for children in the United States. The committee believes that students, as a part of this entitlement, should receive the health-related programs and services necessary for them to derive maximum benefit from their education and to enable them to become healthy, productive adults" (p. 14) [6].

Although other reviews have been published about the relationship of health and academic achievement, none have included all six health-risk behaviors. In 2005, Taras published a two-part review of research about the relationship of two health-risk behaviors—physical inactivity and unhealthy dietary behaviors—and academic achievement [7,8]. In 2007, a review of primary research by Murray and colleagues [9] focused on specific school health interventions and their effects on academic achievement; the interventions targeted some but not all of the six health-risk behaviors.

Methods

We conducted scientific literature searches through PubMed, ERIC, and Ovid (PsychInfo), using MeSH subject headings and related thesaurus index terms (Table 1). Only publications meeting the following criteria were included for review: (1) study subjects were school-aged children (6–18 years) in the U.S. or Canada enrolled in school; (2) the article was published between 1985 and before 2011 (a 25-year span) in a peer-reviewed journal; (3) research included at least one of the following educational outcomes: grade point average (GPA), academic grades in specific subjects, performance on standardized tests (in a variety of subjects such as math, reading, etc.), years of schooling completed, high school graduation or passing the General Educational Development Test, and grade-level retention; (4) the sample size was at least 100 students; (5) relationships were reported to be statistically significant, whether positive or inverse, or reported as insignificant; and (6) meta-analyses were excluded.

After applying the criteria, there were not enough studies available about the relationship of academic achievement with

unintentional injuries or suicide to include them with other violence-related risk behaviors. We included a total of 122 publications in peer-reviewed journals in this review; 26 studies addressed more than one health-risk behavior and the applicable results appear in the summaries for more than one health-risk behavior. Information about the, study design, population, sample size, health-risk behaviors, education variables, and academic outcome(s) for all research publications included in this review are available in the online-only appendices of this article on the Journal's website.

Results

The results are summarized for each health-risk behavior, including the extent to which the research findings are consistent or different. When an association or inverse association was not determined or not statistically significant, those findings are included in the behavior-specific sections below. Table 2 presents the number of studies included for each health-risk behavior, measures used for the variable of academic achievement, number of cross-sectional and longitudinal studies, and percentage of studies in each category that reported an inverse association between specified health-risk behaviors and one or more measure of academic achievement.

Violence-related risk behaviors and academic achievement

Using the criteria described above, we selected 32 publications that examined the association between violence-related behaviors and academic performance. One of the 32 studies about the relationship of violent behaviors and academic achievement had both longitudinal and cross-sectional components (14 longitudinal plus 19 cross-sectional).

Without exception, the cross-sectional studies (100%) revealed that students with higher academic performance (indicated by GPA, academic grades, standardized test scores, grade retention, or years of education completed) were significantly less likely to engage in or be victims of violent behaviors, compared with those with poorer academic performance [10–27]. All but one of the longitudinal studies (92.9%) also reported an inverse association between academic performance and being either the victim or perpetrator of violence [28–40]. The longitudinal study that was an exception to this pattern of findings reported that standardized test scores (the variable the researchers used for academic achievement) were not associated with victimization [41].

Among the 32 selected publications related to violence, five specifically studied nonconsensual sexual activity and violence between consenting sexual partners [11,13,22,27,30]. Those studies consistently found an inverse association with academic achievement (measured by academic grades or GPA) for those being forced to engage in sexual activity and also for those who forced someone to engage in sexual activity.

The longitudinal studies ranged in length from 1 to 10 years and provided the researchers with information about what might be antecedent behaviors. With data from an 8-year longitudinal study, researchers reported that low academic performance at ages 10, 14, and 16 years predicted violent behaviors at age 18 [36]. In a 10-year longitudinal study with subjects between the ages of 11 and 27 years, victimization during adolescence had a negative effect on GPA at age 18, and also a negative effect on the highest level of education completed as adults [37].

Table 1
Publication selection criteria and search terms

Publication selection criteria		
1. Article was published in a peer-reviewed journal between 1985 and before 2011 (25-year span)		
2. Study subjects were school-aged children (6–18 years) in the United States or Canada.		
3. Research included at least one of the following educational outcomes:		
a. Grade point average		
b. Academic grades in specific subjects		
c. Performance on standardized tests (in a variety of subjects such as math, reading, etc.)		
d. Years of schooling completed		
e. Grade-level retention.		
4. The sample size was at least 100 students. ^a		
5. The publication reported results of statistical analysis of the relationship of one or more of the health-related behaviors and one or more of the variables used for educational outcomes. Publications were included when the relationships were reported to statistically significant (whether positive or inverse) or reported as insignificant.		
6. Meta analyses were excluded		
Primary Search Terms	Secondary Search Terms	Tertiary Search Terms
1. Academic achievement	Academic achievement Academic problems Educational status Education measurement	
2. Health-risk behaviors	Risk-taking Adolescent behavior Health behavior Health status	
3. Tobacco use	Smoking Tobacco use disorder Tobacco, smokeless	
4. Substance use	Alcohol Use Marijuana Use Substance Use	Alcohol drinking Alcoholic intoxication Marijuana abuse Marijuana smoking Crack cocaine Heroin dependence Cocaine-related disorders Substance abuse, intravenous Designer drugs Substance-related disorders
5. Sexual behaviors	Sexual Behaviors Pregnancy Contraception Use	Sexual partners Sexual behavior Pregnancy in adolescents Unsafe sex Safe sex Contraception Contraception, barrier Ovulation inhibition Contraception behavior Condoms Condoms, female Seat belts Head protective devices Bicycling Automobile driving Safety Crime victims Wounds, stab Wounds, gunshot Wounds and injuries
6. Violence	Unintentional Injuries Victimization/ Harassment	

Table 1
Continued

Publication selection criteria		
	Violence Perpetration	Crime Social problems Dangerous behavior Violence
	Weapon Carrying and Theft	Firearms Theft
	Dating Violence	Rape Sex offenses
	Suicide Ideation/ Attempts	Suicide Suicide, attempted
7. Physical activity	Exercise/Physical Activity	Exercise Physical Education Physical Fitness Fitness Centers
	Sedentary Activity	Internet Television Videogames
8. Nutrition	Dietary Behaviors	Bulimia Weight loss Body weight changes Fasting Eating disorders Diet Child nutrition Adolescent nutrition Food habits Food preferences Child nutrition disorders Milk Fruit Vegetables Food service Nutrition policy
	Nutrition	

^a An exception was made to the sample size criterion; one study of nutrition and dietary behaviors had a sample of 97 and not 100, a 3% variation.

Tobacco use—related risk behaviors and academic achievement

In all 28 studies (100%), an inverse association between tobacco use and one or more of the variables used for academic achievement was reported [5,17,25,42–66]. The variables used for academic achievement in the tobacco use—related papers were GPA, standardized test scores, or grade-level retention. Researchers consistently reported that students with higher academic achievement were significantly less likely to use tobacco, compared with their peers with lower grades or standardized test scores.

All 10 of the longitudinal studies (ranging from 10 months to 17 years in length) reported that those who used tobacco performed less well academically in school than their non—tobacco-using peers [42,44–47,49,51,53,60,61]. Data were collected in three of the longitudinal studies about years of education completed; results of all three indicated that cigarette users completed fewer years of education than nonusers [49,51,61].

Alcohol and other drug-related behaviors and academic achievement

A total of 44 studies about the association of alcohol and other drug-related behaviors and academic achievement were included [5,17,25,42,45,46,48,50,51,54,55,57,59–61,67–94]. The variables used for academic achievement in these studies were GPA, grades,

Table 2

Summary of published research (1985–2010) association of health-risk behaviors and academic achievement of school-aged youth

Health-risk behaviors	Number of published studies	Measures for academic achievement matching selection criteria	Other measures for academic achievement included in studies	Longitudinal studies reporting an inverse association	Cross-sectional studies reporting an inverse association
1. Violence	32^a	GPA, grades, standardized test scores, grade-level retention, and years of school completed	Teacher-rated educational engagement and educational aspirations	13 of 14^a (92.9%) Range of length of studies: 1–10 years	19 of 19^a (100%)
2. Tobacco use	28	GPA, grades, standardized test scores, and grade-level retention	Teacher-rated educational engagement, academic stream in high school, and college intentions	10 of 10 (100%) Range of length of studies: 10 months to 17 years	18 of 18 (100%)
3. Alcohol and other drug use	44	GPA, grades, standardized test scores, grade-level retention, high school graduation or GED and attainment of a college degree	High school class rank, academic stream in high school, on time/late high school graduation, college plans, and college entry	20 of 21 (95.2%) Range of length of studies: 2–23 years	23 of 23 (100%)
4. Sexual risk	22	GPA, grades, standardized test scores, grade-level retention, high school graduation, and years of school completed	High school class rank, plans for future schooling, school involvement, initiating college, and/or attending college	12 of 12 (100%) Range of length of studies: 1 month to 11 years	10 of 10 (100%)
5. Inadequate physical activity	13	GPA, grades, and standardized test scores	Self-reported chances of attending and/or graduating from college	5 of 7 (71.4%) Range of length of studies: 3 months to 10 years	4 of 6 (66.7%)
6. Inadequate nutrition	9	GPA, grades, and standardized test scores	School attendance and tardiness	4 of 4 (100%) Range of length of studies: 4 months to 10 years	5 of 5 (100%)
Total	148 ^b			65 of 68 (95.6%)	80 of 83 (96.4%)

GPA = grade point average.

^a One published study was both cross-sectional and longitudinal.^b While 122 publications in peer reviewed journals were included, 26 of the studies addressed more than one health-risk behavior.

standardized test scores, grade-level retention, and years of schooling (high school graduation or passing the General Educational Development Test).

Of the 44 studies, 23 were cross-sectional [5,17,48,50,54,55–57,59,67,69,78–80,84–86,88–91,93,94]. All of the cross-sectional studies reported an inverse association between academic achievement and binge drinking; drinking to get drunk; using inhalants, marijuana, or other illicit drugs; or misusing prescription medications. Among the studies about alcohol use, six cross-sectional studies [48,57,67,83,84,86] and three, longitudinal studies [46,70,74] differentiated drinking alcohol from heavy drinking, binge drinking and drinking to get drunk. Analyses in all nine of those studies demonstrated that binge drinking and drinking to get drunk were associated with lower academic achievement, whereas the achievement of those who drank alcohol (but did not binge or drink to get drunk) was not significantly lower than the achievement of those who abstained from drinking alcohol.

Among the 44 studies about alcohol and other drug use and academic achievement, there were 21 longitudinal studies ranging from 2 to 23 years in length; five of the longitudinal studies spanned 10–23 years. One study found that 10th-grade students who reported being heavy drinkers (five or more drinks in a row in the past month) were 5 percentage points less likely

to enter college, while seniors who were heavy drinkers were 7–9 percentage points less likely to enter college, compared with their counterparts who were not heavy drinkers [73]. One of the 21 longitudinal studies did not report a statistically significant inverse association between use of alcohol or other drugs and academic achievement. That study focused primarily on determining differences between the alcohol consumption of students involved in athletic extracurricular activities and those involved in other school activities. For both groups of students (those participating in athletic and non-athletic extracurricular activities), the author(s) reported that alcohol use among students earning As and Bs was slightly less (but not at a statistically significant level) than use among students with academic grades of C or below [94].

Results of longitudinal studies provided information about the reciprocal effects of alcohol and other drug use on years of education completed, and also identified health-risk behaviors that might be considered antecedent. For example, in one study, researchers reported that higher levels of drug use at age 13 were negatively related to both college attendance and college degree completion reported at age 25 [81]. In another study, adults in the last wave of a 10-year longitudinal study who reported cannabis use only during adolescence had completed .72 years less of education, compared with nonusers; those who reported

use of cannabis in both adolescence and adulthood completed 1.16 years less education compared with their counterparts who did not use cannabis [51]. A 23-year longitudinal study about marijuana use provided information about the long-term association of marijuana use with years of educational attainment. Data were collected from 1979 until 2002, beginning when the subjects were 14–22 years of age. When subjects were 37–45 years of age, those who persisted using from adolescence into adulthood reported significantly fewer years of education completed (11.9 years), compared with nonusers (13.1 years). Furthermore, higher frequency of marijuana use was associated with fewer years of education completed for both those whose use was limited to adolescence (12.4 years) and those whose use persisted with high frequency into adulthood (11.9 years) [89].

Sexual behaviors increasing risk of pregnancy and STD, and academic achievement

In 22 publications with research about the relationship of academic achievement and sexual risk behaviors, more than half (12) were longitudinal studies [61,95–99,101–106]. The remaining 10 studies were cross-sectional [25,50,54,100,107–112].

All of the cross-sectional and longitudinal studies reported an inverse relationship between sexual risk behaviors and academic achievement. Measures used for academic achievement required to be included in this review were GPA and standardized test scores, grade-level retention, and high school graduation.

Data about sexual debut (age of first sexual intercourse or loss of virginity) were collected and used as a variable in 10 of the studies [25,95,98,100–102,104–107]; only one of those studies specified opposite or same-sex intercourse [95]. In all 10 studies, earlier age of sexual debut was inversely associated with academic achievement, measured by grades, grade-level retention, or standardized test scores; in three of the studies, analyses also showed that increases in years of educational attainment (graduating from high school or attending college) were positively associated with delaying first sexual intercourse [101,104,105].

Four of the 22 studies addressed the extent to which other health-risk behaviors such as tobacco, alcohol, and other drug use were correlated with risky sexual behaviors [25,50,54,61]. Those multiple-risk studies provided information about patterns of behavior, trajectories of behavior during adolescence, and clustering of risk behaviors that negatively affect academic achievement.

Physical inactivity–related risk behaviors

Using the selection criteria, we included in this review 13 studies published in peer-reviewed journals about the relationship of physical inactivity and academic achievement. Of the 13, seven were longitudinal studies [72,113–118], whereas the remaining six studies were cross-sectional [80,119–123]. Review of these studies indicated that 71.4% of the longitudinal and 66.7% of the cross-sectional studies reported an inverse relationship between physical inactivity and academic achievement, or a positive association between the extent of being physically active and academic achievement. In all the studies, the data collected about time spent being physically active were limited to school activities (i.e., during the instructional day or while participating on school athletic teams). Measures of academic achievement used in the selected studies were GPA, grades, and standardized test scores.

Four of the research studies were designed to determine whether grades or standardized test scores were negatively affected by using additional time during the instructional day for physical education. Results of those four studies showed that there was no negative impact on standardized test scores when additional instructional time was spent on physical education [113,116–118].

The relationship of GPA with the time spent in moderate to vigorous physical activity during the school day was reported in a cross-sectional study among 4,746 middle and high school students. Moderate to vigorous physical activity was positively associated with higher GPAs of both males and females [122]. However, another cross-sectional study failed to find a statistically significant relationship between physical activity during the school day and academic performance measured by standardized test scores in reading and mathematics [123].

The results of four studies about whether participation in competitive athletics has a positive effect on academic performance were mixed [72,114,121,122]. One study reported no significant association between academic grades and participation in school-sponsored sports [121]. A 3-year longitudinal study reported little change in GPAs of both male and female athletes; however, the GPAs of male non-athletes decreased during the same period [72]. In a sample of 4,746 students in grades 7–12, researchers found that middle school boys and high school boys and girls who participated in sports teams had higher GPAs than their counterparts who did not participate in sports teams [122]. In longitudinal research involving more than 40,000 eighth and 10th graders, students involved in competitive sports had significantly higher grades compared with students not involved in sports teams [114].

Nutrition-related risk behaviors and academic achievement

All of the nine studies included in this review reported an inverse relationship between inadequate nutrition and academic achievement [115,124–131]. One of the studies conducted by Kleinman and team [125] used a sample of 97, and not 100.

The effect of participation in school breakfast or lunch programs on academic achievement was analyzed in four studies ranging from 4 months to 10 years in length [115,125,128,129]. All four studies demonstrated significant improvement in one or more of the following: GPA, academic grades, or standardized test scores.

The remaining five studies were cross-sectional and examined the relationship of hunger, insufficient food, or lack of adequate consumption of specific foods such as fruits, vegetables, or dairy products [124,126,127,130,131]. In all five studies, inadequate dietary intake was associated with at least one or more of the following: lower grades, lower standardized test scores, or increased likelihood of grade level retention.

Discussion

For all six health-risk behaviors identified to be leading causes of death, disability, and social problems among youth and adults in the U.S., 96.6% of the articles included in this review that were published in peer-reviewed journals from 1985 until the end of 2010 (a 25-year span) reported statistically significant inverse relationships between health-risk behaviors and academic achievement among school-aged populations. The results of the research reviewed are not evidence of cause and effect; the data

do not indicate that poor grades cause health-risk behaviors, nor do they indicate that health-risk behaviors cause poor grades. However, the results support strong positive associations between six health-risk behaviors and poor academic achievement, and inverse associations between six health-risk behaviors and academic achievement.

Longitudinal studies in this review provided information about the reciprocal effects of health-risk behaviors and academic achievement, and also identified health-risk behaviors that might be considered antecedent. Analysis of those results supported the hypothesis of Henry [76], that the process of academic disengagement and drug use have reciprocal effects and patterns of growth trajectories during adolescence. Longitudinal studies in our review confirmed the description by Allison [5] of the relationship between health-risk behaviors and low academic performance as “mutually reinforcing.”

The results of this review are consistent with data from the 2009 National Youth Risk Behavior Survey that was reported in 2010. Students completing the national Youth Risk Behavior Survey were asked about academic grades mostly earned in school, and given seven response options: mostly As, mostly Bs, mostly Cs, mostly Ds, mostly Fs, none of these grades, or not sure. Those findings indicate a negative association between all six health-risk behaviors and academic achievement after controlling for sex, race/ethnicity, and grade level [132–136].

The synthesis of the relationship of physical activity and academic achievement in this review is similar to the results of a more extensive review conducted by the CDC and published in 2010 [137]. However, the CDC review differed in that it included studies with a wider range of contexts for being physically active at schools, and included many studies conducted outside the U.S. and Canada because researchers included original research published in English, not limited to students in the U.S. and Canada. The results of the review confirmed that providing physical education classes as part of the instructional day do not reduce academic achievement, and being physically active at school is positively correlated with improved performance of specific cognitive tasks [137]. It is noteworthy that the inverse association between being physically active and academic achievement in the studies included in this review (71.4% for longitudinal studies and 66.7% for cross-sectional studies) was much lower than that reported for the other five behaviors (Table 2). This suggests that future research using variables of physical activity, both in and out of school, and academic achievement is needed to determine that interrelationship.

Some of the research in this review included measures of academic achievement in addition to those required. The additional measures in the studies were school attendance, teacher-rated educational engagement, school involvement, academic stream in high school, high school class rank, on time/late high school graduation, and self-reported chances of attending and/or graduating from college (Table 2). Although we did not include those measures of academic achievement in the discussion of this review, some may be interesting to policy and program planners. For example, the effect of participation in school breakfast or lunch programs on school attendance was analyzed in three longitudinal studies ranging from 4 months to 10 years in length [125,128,129]. All three studies reported not only significant improvement in grades and standardized test scores, but also fewer school absences.

The results of this review suggest that improving health and increasing academic achievement of children and youth in the

U.S. need to be viewed as a composite goal rather than separate goals that are responsibilities of different agencies. Furthermore, the results of this review suggest that the practice of providing programs that focus exclusively on school performance, health behavior, or health care need to be jointly evaluated by agencies responsible for children and youth.

In 2010, Basch [138] coined the term “educationally relevant health disparities” in reporting the results of a meta-analysis of research about health and academic achievement. The health disparities he reported to be related to academic achievement were vision, asthma, teen pregnancy, aggression and violence, physical activity, breakfast, and inattention and hyperactivity. In like manner, the results of this review of 25 years of research affirm that health-risk behaviors and academic achievement are highly interrelated, which highlights the need and the potential of decision makers in agencies responsible for both education and health to work together in a less fragmented and more synergistic manner.

Having information about groups of adolescents who are most vulnerable to both health-risk behaviors and academic failure can help in planning both prevention and intervention programs in the arenas of education and health. The results of this review support the assertion by Hawkins [3] that the promotion of academic success in youth susceptible to health-risk behaviors may reduce the likelihood of them engaging in behaviors that threaten not only their health, but also their performance at school.

The findings of this review highlight the importance of relevant public health objectives in *Healthy People 2020* (<http://www.healthypeople.gov>), which are specifically about improving academic achievement. As stated in *Healthy People 2020*, those objectives are:

Objective AH-5: Increase educational achievement of adolescents and young adults.

Sub-objective AH-5.1: Increase the proportion of students who graduate with a regular high school diploma 4 years after starting ninth grade [139].

Objective ECBP-6: Increase the proportion of the population that completes high school education [139].

These public health objectives about increasing high school graduation rates are forward-reaching acknowledgements that educational attainment is interrelated with health behaviors. The baselines and data sources for these objectives in *Healthy People 2020* can be accessed at: <http://www.healthypeople.gov/2020/topicsobjectives2020/default.aspx>.

Implications

The results of this review of 25 years of research published in peer-reviewed journals provide clear evidence of the extent to which health-risk behaviors and academic achievement are interrelated and have long-term consequences for youth, adults, and society. These results could be used to inform coaction led by national leaders in health and education to address “educationally relevant health disparities” [138].

In *Healthy People 2020*, there is an objective that would have reciprocal effects and could serve as the basis for the initial focus of interagency coaction:

Objective ECBP-2: Increase the proportion of elementary, middle, and senior high schools that provide comprehensive

school health education to prevent health problems in the following areas: unintentional injury; violence; suicide; tobacco use and addiction; alcohol or other drug use, unintended pregnancy, HIV/AIDS, and STD infection; unhealthy dietary patterns; and inadequate physical activity [139].

The baseline of 25.6% for objective ECBP-2 was provided by data from CDC's 2006 School Health Policies and Practices Study. The School Health Policies and Practices Study is a well-established system for collecting data from state departments of education and schools across the nation about the status of health programs in schools including school health education programs; the system has the capacity to track progress of mutual interagency (education and public health) goals and objectives [140]. School Health Policies and Practices Study data can be accessed at www.cdc.gov/HealthyYouth/shpps/index.htm. Another surveillance system, Youth Risk Behavior Surveillance System, was designed to track health-risk behaviors of school-age youth using data obtained from the Youth Risk Behavior Survey. The data can be accessed at www.cdc.gov/yrbs. Actions to improve school health education were addressed in the *National Action Plan to Improve Health Literacy*, which was created in 2010 by the U.S. Department of Health and Human Services [141]. Examples of action steps to improve health literacy through schools include:

- Promote federal, state, and district policies to provide annual comprehensive school health education for all K–12 students
- Promote federal, state, and county policies to provide health education in preschools and Early Head Start programs
- Implement proven strategies to help all students graduate with a regular diploma in 4 years
- Implement proven strategies to help all students develop proficient reading and math skills
- Create a periodic assessment of and report on K–12 students' health literacy skills as defined in the National Health Education Standards [142].

In addition to providing school-based and age-appropriate health education to reduce health-risk behaviors, other observable and measurable outcomes of interagency coaction supported by the results of this review are:

- A comprehensive national interagency action plan with measurable outcomes
- Dissemination of model policies that promote interagency coaction with incentives for agencies to implement the policies
- Standards of practice for health care professionals who serve children and adolescents, including asking questions about academic achievement (such as grades and attendance) as a routine part of health histories.

It is unlikely that the outcomes suggested could be realized without dedicated staff assigned to accomplish the coactions and placed in the lead agencies at national and state levels such as the U.S. Department of Education, U.S. Department of Health and Human Services, and the corresponding state-level departments in health and education or without a national steering committee composed of key stakeholders.

The ideal long-range outcome of interagency coaction to address educationally relevant health disparities would be a unified system to improve educational outcomes and, at the same

time, promote health-enhancing behaviors among school-aged youth. Addressing both health behavior and academic achievement in a unified system would have reciprocal and synergistic effects on the health not only of children and adolescents, but also of adults in the U.S. In 2003, a guide for those who work outside of schools and share the composite goal of improving both health and education outcomes for children and youth was created by an interdisciplinary team convened by the National Association of State Boards of Education [143].

In May of 2012, *Health in Mind*, an initiative of the Healthy Schools Campaign and Trust for America's Health to improve education through wellness, presented actionable policy recommendations to the U.S. Secretary of Health and Human Services and the U.S. Secretary of Education. "These recommendations represent a major culture shift in how the nation views health and education—health and education will no longer be separated from one another ..." (p. 1) [144].

In 1994, a committee of experts was convened by the Institute of Medicine of the National Academy of Sciences to address the health of students in U.S. That committee published the statement that students "should receive the health-related programs and services necessary for them to derive maximum benefit from their education and to enable them to become healthy, productive adults" (p. 14) [6]. The title chosen for the report of that committee was *Schools and Health: Our Nation's Investment* [6]. Because of persuasive evidence about the interrelationship of health-risk behaviors and academic achievement, it is imperative that leaders in education and health act together to make wise investments in our nation's school-aged youth that will be beneficial for the entire population.

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Supplementary Data

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