

GENERAL ARTICLE

# Critical Connections: Health and Academics

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## ABSTRACT

**BACKGROUND:** While it is a national priority to support the health and education of students, these sectors must better align, integrate, and collaborate to achieve this priority. This article summarizes the literature on the connection between health and academic achievement using the Whole School, Whole Community, and Whole Child (WSCC) framework as a way to address health-related barriers to learning.

**METHODS:** A literature review was conducted on the association between student health and academic achievement.

**RESULTS:** Most of the evidence examined the association between student health behaviors and academic achievement, with physical activity having the most published studies and consistent findings. The evidence supports the need for school health services by demonstrating the association between chronic conditions and decreased achievement. Safe and positive school environments were associated with improved health behaviors and achievement. Engaging families and community members in schools also had a positive effect on students' health and achievement.

**CONCLUSIONS:** Schools can improve the health and learning of students by supporting opportunities to learn about and practice healthy behaviors, providing school health services, creating safe and positive school environments, and engaging families and community. This evidence supports WSCC as a potential framework for achieving national educational and health goals.

**Keywords:** child and adolescent health; health behaviors; academic achievement; school health programs; Whole School, Whole Community, Whole Child model.

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The fundamental mission of schools is to educate students; however, many national reports have concluded schools are failing. In 2012, nationwide, 19% of students (1 in 5) in the United States did not graduate high school on time; the percentage is higher for Hispanic (24%) and Black (32%) students.<sup>1</sup> There is a significant achievement gap for test scores between students born into low- and high-income families.<sup>2</sup> Compared with other industrialized countries, the United States is not performing as well in math, science, and reading, even though the United States ranks fifth in spending per student.<sup>3</sup> In response to these reports, there have been many efforts over the

past few decades to reform education in the United States, focusing on instructional practices, teacher preparation programs, and education standards meant to ensure students are learning and to hold schools accountable.

Despite these efforts, there has been minimal improvement in student achievement. One reason might be that these education-specific approaches are not addressing health-related barriers to learning. Basch argues that health-related problems greatly limit students' motivation and ability to learn.<sup>4</sup> Furthermore, health problems (eg, asthma and poor vision) and poor health behaviors (eg, physical inactivity and

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poor nutrition) are linked to educational outcomes through 5 causal pathways: sensory perceptions, cognition, connectedness and engagement with school, absenteeism, and dropping out.<sup>4</sup> In support of this conclusion, specific health-related problems and behaviors including vision, asthma, teen pregnancy, aggression and violence, physical activity, breakfast consumption, and inattention and hyperactivity have been shown to have an impact on learning.<sup>5</sup> This important connection between health and education supports the need for a comprehensive school health approach that is strategic, high quality, and coordinated.<sup>6</sup>

For over 25 years, the field of school health has been guided by the Centers for Disease Control's (CDC) coordinated school health approach, which provides a framework for addressing school health policies, practices, and programs.<sup>7</sup> Recently, ASCD (formerly known as the Association for Supervision and Curriculum Development) and CDC, in collaboration with key leaders in the fields of education, health, public health, and school health, developed a new framework called the Whole School, Whole Community, Whole Child (WSCC) model.<sup>8</sup> WSCC combines and builds on elements of the traditional coordinated school health approach and ASCD's whole child framework, and is supported by recent evidence examining the connection between health and educational outcomes showing that healthy students do better in school.<sup>8</sup>

With the continued pressure on schools for students to be successful, WSCC provides school leaders with a new comprehensive approach for addressing the health-related barriers to learning. WSCC also provides the opportunity for health and education professionals to leverage their limited resources and work together to provide more effective and efficient programs and services to students.<sup>8,9</sup> The purpose of this article is to use the WSCC framework to summarize the literature on student health and academic achievement.

## EVIDENCE TO SUPPORT ACADEMIC ACHIEVEMENT AND HEALTH THROUGH THE WSCC MODEL

The Whole School, Whole Community, and Whole Child model is an ecological approach that focuses on the health and education of students through services and programs provided by the school, a supportive school environment, and contributions of family and community. To demonstrate this multilevel approach, the 10 components of WSCC have been organized into 4 categories (Table 1).

For each category, we summarize the evidence between the WSCC components and academic achievement. Academic achievement is defined as including academic performance (eg, test scores and grades), educational behavior (eg, attendance, dropout, and classroom behavior), and cognitive ability

**Table 1. Whole School, Whole Community, and Whole Child (WSCC) Components by Category**

WSCC Components	Categories
<ul style="list-style-type: none"> <li>• Physical education and physical activity</li> <li>• Nutrition environment and services</li> <li>• Health education</li> </ul>	Supporting healthy student behaviors
<ul style="list-style-type: none"> <li>• Health services</li> <li>• Counseling, psychological, and social services</li> <li>• Employee wellness</li> </ul>	Supporting school health services
<ul style="list-style-type: none"> <li>• Social and emotional school climate</li> <li>• Physical environment</li> </ul>	Supporting safe and positive school environments
<ul style="list-style-type: none"> <li>• Family engagement</li> <li>• Community involvement</li> </ul>	Supporting the engagement of family and community

and attitude (eg, attention, memory, and mood).<sup>10</sup> Where possible, we use the specific variable such as grades when describing the findings.

The summaries for each category are based on existing meta-analyses, systematic reviews, and unstructured literature reviews (Table 2). If a review was not available, then the most recent evidence to demonstrate the link between the WSCC component and academic achievement was used. Reviews were not available for employee wellness, physical environment, and community involvement.

Another important aspect of WSCC is the coordination across components. While evidence is not available to examine the association between academic achievement and the WSCC framework as a whole, programs or interventions that include multiple components identified in WSCC can have a positive impact on health and education outcomes.<sup>11</sup>

### Supporting Healthy Student Behaviors

Most of the research that examines the association between health and academic achievement focuses on student health behaviors. Three components in WSCC are believed to directly affect students' knowledge about health and health behaviors—physical education and physical activity (4 meta-analyses, 15 systematic reviews, and 9 unstructured literature reviews), nutrition environment and services (2 meta-analyses, 9 systematic reviews, and 3 unstructured literature reviews), and health education (0 meta-analyses, 6 systematic reviews, and 2 unstructured literature reviews).

**Physical education and physical activity.** Researchers have been examining the association between physical activity and academic achievement for almost 50 years. Twenty-eight review articles have been published on this topic.<sup>9,12-38</sup> Four reviews using meta-analytic techniques consistently showed that

Table 2. Review Articles Cited in the Manuscript

Review Article*	Type of Review and Research Designs Included in Review <sup>†</sup>	Number of Articles <sup>‡</sup>	Years Included in Review <sup>§</sup>	Age/Grade of Students Included	Summary of General Findings <sup>  </sup>
Supporting healthy student behaviors Physical education and physical activity (28 reviews, 410 articles, and 259 unique articles) Keays and Allison <sup>37</sup>	Unstructured literature review; mixed designs	11 counted <sup>#</sup>	Published since 1980; included articles were from 1980 to 1990	School-aged youth K-12	<ul style="list-style-type: none"> <li>• Association between physical activity and fitness, and improved student performance and academic achievement.</li> <li>• Some studies found no associations.</li> <li>• Association between exercise and improved cognition, effect size = 0.32.</li> <li>• Association between physical activity and improved cognition, effect size = 0.25.</li> </ul>
Etnier et al <sup>20</sup>	Meta-analysis; mixed designs	134	Not stated; included articles were from 1927 to 2000	6-17 years	<ul style="list-style-type: none"> <li>• Association between exercise and improved cognition, effect size = 0.32.</li> </ul>
Sibley and Etnier <sup>30</sup>	Meta-analysis; mixed designs	44	Published up to January 2002; included articles were from 1947 to 1999	4-18 years	<ul style="list-style-type: none"> <li>• Association between physical activity and improved cognition, effect size = 0.25.</li> </ul>
Tomporowski <sup>34</sup>	Unstructured literature review; only interventions	4 (of kids without disorders or disabilities)	Published since 1975; included articles were from 1979 to 1999	Not stated	<ul style="list-style-type: none"> <li>• Association between exercise and improved cognitive performance following periods of vigorous exercise.</li> </ul>
Taras and Potts-Datema <sup>33</sup>	Systematic review; mixed designs	14	Published since 1984; included articles were from 1987 to 2003	5-18 years	<ul style="list-style-type: none"> <li>• Association between physical activity level and better academic performance.</li> </ul>
Murray et al <sup>26, #</sup>	Systematic review; only RCTs and quasi-experimental studies	2/17	Published since 1980; include articles were from 1979 to 1999	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• No negative associations between physical education and academic outcomes.</li> </ul>
Tomporowski et al <sup>35</sup>	Unstructured literature review; mixed designs	15	Not stated; included articles were from 1967 to 2007	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between exercise and improved cognition.</li> </ul>
Trudeau and Shephard <sup>36</sup>	Systematic review; mixed designs	17	1966-2007	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between physical activity and improved GPA, concentration, memory, and classroom behavior.</li> <li>• Allocating up to an additional hour per day of curricular time to physical activity programs did not negatively affect the academic performance of students.</li> </ul>
Keeley and Fox <sup>24</sup>	Systematic review; mixed designs	16 (a total of 17 unique studies)	Published up to early 2009; included articles were from 1983 to 2009	4-18 years	<ul style="list-style-type: none"> <li>• Association between physical activity and fitness and improved academic achievement.</li> <li>• Association between physical fitness and improved cognitive performance.</li> </ul>
Rasberry et al <sup>28</sup>	Systematic review; mixed designs	43 (a total of 50 unique studies)	January 1985 to October 2008	5-18 years	<ul style="list-style-type: none"> <li>• Positive association or no association between physical activity and academic performance.</li> <li>• Positive association or no association between physical education and academic performance.</li> <li>• Association between offering physical activity breaks during standard classroom instruction and improved indicators of cognitive functioning; academic behaviors; and/or academic achievement.</li> </ul>

Table 2. Continued

Review Article*	Type of Review and Research Designs Included in Review <sup>†</sup>	Number of Articles <sup>‡</sup>	Years Included in Review <sup>§</sup>	Age/Grade of Students Included	Summary of General Findings <sup>  </sup>
Physical education and physical activity (28 reviews, 410 articles, and 259 unique articles <sup>¶</sup> )					
Basch <sup>12</sup>	Unstructured literature review; mixed designs	14 counted <sup>#</sup>	Not stated; included articles were from 1999 to 2008	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between extracurricular physical activity and decreased high school dropout rates and improved GPA.</li> <li>• Association between physical activity and improved cognition.</li> <li>• Association between consistent participation in interscholastic sports and decreased school dropout.</li> <li>• Association between physical activity and improved academic achievement and cognition, effect size = 0.32.</li> <li>• Association between poorer aerobic fitness and decreased academic achievement in reading and mathematics.</li> <li>• Association between physical activity and improved academic performance, improved cognition, and decreased off-task behaviors.</li> <li>• Association between aerobic fitness and improved cognition.</li> <li>• Association between physical activity and increased academic related outcomes.</li> <li>• Some associations between physical activity and academic-related outcomes were neutral and a couple were weak negative associations.</li> <li>• Association between chronic and acute participation in physical activity and improved brain health and cognition.</li> <li>• Association between participation in a single bout of exercise and improved cognitive function.</li> <li>• Association between physical activity and aerobic fitness and improved cognition (eg, attention) and scholastic performance (eg, standardized test scores, grades).</li> <li>• Association between physical exercise and improved academic performance.</li> <li>• Association between physical activity and improved academic achievement.</li> </ul>
Fedewa and Ahn <sup>21</sup>	Meta-analysis; mixed designs	59	1940-2009	3-18 years	
Chaddock et al <sup>16</sup>	Unstructured literature review; mixed designs	9 counted <sup>#</sup>	Not stated; included articles were from 1999 to 2009	Not stated but focus is school aged youth	
Efrat <sup>18</sup>	Systematic review; mixed designs	7	Published since 1960; included articles were from 1997 to 2008	School-age youth K-12	
Hillman et al <sup>38</sup>	Unstructured literature review; only quasi-experimental and experimental designs	14	Not stated; included articles were from 1979 to 2011	Not stated but focus is school aged youth	
Burkhalter and Hillman <sup>13,##</sup>	Unstructured literature review; mixed designs	13/22 counted <sup>#</sup>	Not stated; included articles were from 2005 to 2011	Not stated but focus is school aged youth	
Suhrcke and de Pa Nieves <sup>32,##</sup>	Systematic review; mixed designs	4/53	January 1995 to June 2008	Not stated but focus is school aged youth	
Howie <sup>22</sup>	Systematic review; mixed designs	125	Published before April 2012; included articles were from 1954 to 2012	6-18 years	
Singh et al <sup>31</sup>	Systematic review; mixed designs	14	1990-2010	0-18 years	
Bradley and Greene <sup>9,##</sup>	Systematic review; mixed designs	13/122	1985-2011	6-18 years	<ul style="list-style-type: none"> <li>• Association between physical activity and improved academic achievement.</li> <li>• Association between physical inactivity and decreased academic achievement, or association between the extent of being physically active and improved academic achievement.</li> </ul>

Table 2. Continued

Review Article*	Type of Review and Research Designs Included in Review†	Number of Articles‡	Years Included in Review§	Age/Grade of Students Included	Summary of General Findings
Physical education and physical activity (28 reviews, 410 articles, and 259 unique articles) <sup>¶</sup> Bird et al <sup>23</sup>	Systematic review; only interventions	6	Not stated; included articles were from 1999 to 2008	0-19 years	<ul style="list-style-type: none"> <li>• Association between organized sports activities and improved numeracy skills.</li> <li>• Association between organized sports linked with extra-curricular activities and improved range of learning outcomes for underachieving students.</li> <li>• Academic performance was maintained when normal academic classes are reduced and replaced by an increase in exercise physical activity or physical education.</li> <li>• Insufficient evidence to conclude that physical education will increase academic performance.</li> <li>• Association between acute physical activity and improved cognition and academic achievement.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> <li>• Positive effects for interventions combining nutrition and physical activity elements on mathematics and language scores.</li> </ul>
Rasmussen and Laumann <sup>29</sup>	Unstructured literature review; only short-term experiments and longitudinal studies	16	Not stated; included articles were from 1952 to 2010	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between physical activity and improved academic performance.</li> <li>• Association between physical activity and improved academic achievement.</li> </ul>
Lees and Hopkins <sup>25</sup>	Systematic review; only RCTs	8	Not stated; included articles were from 1986 to 2011	< 19 years	<ul style="list-style-type: none"> <li>• Association between physical activity and improved academic performance.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> </ul>
Pucher et al <sup>27, #</sup>	Systematic review; only experimental and quasi-experimental designs	4/7	Published up to January 2012; included articles were from 1996 to 2007	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between physical activity and improved academic performance.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> </ul>
Busch et al <sup>14, ##</sup>	Systematic review; mixed designs	9/30	1992-2012	Adolescents	<ul style="list-style-type: none"> <li>• Association between physical activity and improved academic performance.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> <li>• Positive effects for interventions combining nutrition and physical activity elements on mathematics and language scores.</li> <li>• Association between physical activity and improved academic performance.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> </ul>
Esteban-Cornejo et al <sup>19</sup>	Systematic review; mixed designs	20	2000-2013	13-18 years	<ul style="list-style-type: none"> <li>• Association between physical activity and improved academic performance.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> <li>• Positive effects for interventions combining nutrition and physical activity elements on mathematics and language scores.</li> <li>• Association between physical activity and improved academic performance.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> </ul>
Chaddock-Heyman et al <sup>17</sup>	Unstructured literature review; mixed designs	11	Not stated; included articles were from 2008 to 2013	7-10 years	<ul style="list-style-type: none"> <li>• Association between physical activity and improved academic performance.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> <li>• Positive effects for interventions combining nutrition and physical activity elements on mathematics and language scores.</li> <li>• Association between physical activity and improved academic performance.</li> <li>• Positive effects for school physical activity interventions on academic achievement (eg, math and language scores) and no negative effects were reported.</li> </ul>
Castelli et al <sup>15</sup>	Meta-analysis and systematic review; experimental designs for meta-analysis (only 20 articles) and mixed designs for systematic review	215	January 1, 1967 to August 1, 2013	4-18 years	<ul style="list-style-type: none"> <li>• Association between physical activity and improved academic performance including academic achievement and cognitive function, effect size = 0.38.</li> </ul>

Table 2. Continued

Review Article*	Type of Review and Research Designs Included in Review <sup>†</sup>	Number of Articles <sup>‡</sup>	Years Included in Review <sup>§</sup>	Age/Grade of Students Included	Summary of General Findings <sup>  </sup>
Nutrition environment and services (14 reviews, 181 articles, and 134 unique articles) <sup>¶</sup> Cueto and Chimer <sup>41</sup>	Unstructured literature review; mixed designs	9 counted <sup>#</sup>	Not stated; included articles were from 1981 to 2000	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between breakfast consumption and improved cognition (eg, memory).</li> <li>• Association between school breakfast programs and improved school attendance.</li> <li>• Association between food insufficiency and poorer functioning, decreased school attendance, and lower academic achievement.</li> <li>• No association between multivitamin supplementation and intelligence or academic performance.</li> <li>• Association between children with iron-deficiency anemia and poorer cognition and lower academic achievement.</li> <li>• Association between school breakfast programs and improved school attendance and decreased tardiness; and improved academic performance and cognitive functioning (eg, attention and memory) among severely undernourished populations.</li> </ul>
Taras and Potts-Datema <sup>46</sup>	Systematic review; mixed designs	49	Published since 1980; included articles were from 1981 to 2003	5-18 years	<ul style="list-style-type: none"> <li>• Association between school breakfast programs and improved academic performance (eg, increased math grades and standardized test scores) and decreased absences and tardy rates.</li> <li>• Association between breakfast and improved short-term behavioral and cognitive functions.</li> <li>• Inconclusive evidence for sugar consumption, fish oil supplementation, vitamin and mineral supplementation, and "good diets."</li> <li>• Association between school breakfast programs and improved cognitive performance.</li> <li>• Association between breakfast quality and improved school performance.</li> <li>• A significant positive effect between multiple micronutrient supplementation and academic performance; effect size = 0.30.</li> <li>• No significant effects between multiple micronutrient supplementation and fluid intelligence, crystallized intelligence, short-term memory, visual perception, retrieval ability, cognitive processing speed, and sustained attention.</li> </ul>
Murray et al <sup>26, #</sup>	Systematic review; only RCTs and quasi-experimental studies	2/17	Published since 1945; included articles were from 1989 to 1998	Not stated but focus is school aged youth	
Ellis et al <sup>43</sup>	Systematic review; only RCTs	29	Not stated; included articles were from 1976 to 2006	4-18 years	
Hoyland et al <sup>44</sup>	Systematic review; mixed designs	43 (a total of 45 unique studies)	1950-2009	4-18 years	
Eilander et al <sup>42</sup>	Meta-analysis when possible and systematic review; only RCTs	19	1970-2008	0-18 years	

Table 2. Continued

Review Article*	Type of Review and Research Designs Included in Review <sup>†</sup>	Number of Articles <sup>‡</sup>	Years Included in Review <sup>§</sup>	Age/Grade of Students Included	Summary of General Findings <sup>  </sup>
Nutrition environment and services (14 reviews; 181 articles, and 134 unique articles) <sup>¶</sup> Basch <sup>40</sup>	Unstructured literature review; mixed designs	14 counted <sup>¶</sup>	Not stated; included articles were from 1989 to 2009	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between breakfast consumption and lower absenteeism</li> <li>• Association between skipping breakfast and poorer cognitive performance (eg, alertness, attention, memory, problem solving, and mathematics).</li> <li>• Association between skipping breakfast and poorer cognitive performance (eg, standardized test scores).</li> <li>• Association between food insufficiency and lower standardized mathematics scores, and increased likelihood to repeat a grade.</li> <li>• Association between poor nutrition and decreased educational outcomes (eg math scores and repeat grade).</li> <li>• Association between breakfast and improved on-task behavior.</li> <li>• Association between habitual breakfast consumption and school breakfast programs and improved academic performance (eg, standardized test scores).</li> <li>• Association between participation in school breakfast or lunch programs and improved academic performance (eg GPA, grades, standardized test scores).</li> <li>• Inadequate dietary intake (eg, insufficient food or lack of adequate consumption of specific food groups) is associated with poorer academic performance (eg, grades, standardized test scores and grade level retention).</li> <li>• Association between iron supplementation and improved cognitive performance (eg global cognitive scores; intelligent quotients among anemic children; attention and concentration), effect size = 0.50.</li> </ul>
Burkhalter and Hillman <sup>13,##</sup>	Unstructured literature review; mixed designs	2/22 counted <sup>¶</sup>	Not stated; included articles were from 1982 to 2001	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Positive effects for school nutrition interventions on academic achievement (eg math and language scores) and no negative effects were reported.</li> <li>• Slight improvements in language scores were observed for breakfast provision in schools.</li> <li>• Positive effects for interventions combining nutrition and physical activity elements on mathematics and language scores.</li> </ul>
Suhrcke and de Pa Nieves <sup>32,##</sup>	Systematic review; mixed designs	2/53	January 1995 to June 2008	Not stated but focus is school aged youth	
Adolphus et al <sup>39</sup>	Systematic review; mixed designs	36	1950-2013	< 18 years	
Bradley and Greene <sup>9</sup>	Systematic review; mixed designs	9/122	1985-2011	6-18 years	
Low et al <sup>45</sup>	Meta-analysis and systematic review; only RCTs and quasi-experimental studies	42 (a total of 32 studies)	Not stated; included articles were from 1968 to 2012	5-12 years	
Pucher et al <sup>27,##</sup>	Systematic review; only experimental, quasi-experimental, and pre/posttest designs	3/7	Published up to January 2012; included articles were from 1989 to 2010	Not stated but focus is school aged youth	

Table 2. Continued

Review Article*	Type of Review and Research Designs Included in Review <sup>†</sup>	Number of Articles <sup>‡</sup>	Years Included in Review <sup>§</sup>	Age/Grade of Students Included	Summary of General Findings <sup>  </sup>
Nutrition environment and services (14 reviews, 181 articles, and 134 unique articles) <sup>†</sup> Busch et al <sup>14,##</sup>	Systematic review; mixed designs	1/30	1992-2012	Adolescents	<ul style="list-style-type: none"> <li>• Skipping breakfast and having irregular dietary patterns were both associated with poorer grades across a variety of school subjects.</li> </ul>
Health education** Taras and Potts-Datema <sup>55</sup>	Systematic review; mixed designs	21 counted <sup>#</sup>	1994-2004	5-18 years	<ul style="list-style-type: none"> <li>• Association between sleep-related obstructive breathing and reduced attention, memory, and intelligence, and increased problematic behavior.</li> <li>• Positive effect for programs that incorporate health education component on academic achievement (eg, grades and attendance) and health behaviors and outcomes.</li> </ul>
Murray et al <sup>26,##</sup>	Systematic review; only RCTs and quasi-experimental studies	9/17	Published since 1945; included articles were from 1987 to 2004	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between teen pregnancy and lower likelihood of completing high school and lower odds of attending college.</li> </ul>
Basch <sup>52</sup>	Unstructured literature review; mixed designs	10 counted <sup>#</sup>	Not stated; included articles were from 1985 to 2007	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between exposure to violence at school and increased disruptive behaviors.</li> <li>• Association between being a victim of bullying and lower academic achievement.</li> </ul>
Basch <sup>53</sup>	Unstructured literature review; mixed designs	9 counted <sup>#</sup>	Not stated; included articles were from 1996 to 2008	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between alcohol consumption and drug use and decreased educational outcomes.</li> <li>• Association between smoking and decreased educational outcomes.</li> </ul>
Suhricke and de Pa Nieves <sup>32,##</sup>	Systematic review; mixed designs	16 for alcohol and drug use, 4 for smoking, and 5 for sleep/53	January 1995 to June 2008	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between sleeping disorders with poorer academic performance.</li> <li>• Association between engaging in or being victims of violent behaviors and lower academic performance.</li> <li>• Association between tobacco use and lower academic achievement.</li> <li>• Association between alcohol and other drug use and lower academic achievement and educational attainment.</li> <li>• Association between sexual risk behaviors and lower academic achievement.</li> <li>• Association between alcohol use and decreased academic performance.</li> <li>• Association between being bullied and lower school grades.</li> <li>• Association between early intercourse initiation and lower grades.</li> </ul>
Bradley and Greene <sup>9,##</sup>	Systematic review; mixed designs	32 for violence, 28 for tobacco use, 43 for alcohol and drug use, and 22 for sex risk behaviors/122	1985-2011	6-18 years	
Busch et al <sup>14,##</sup>	Systematic review; mixed designs	4 for alcohol, 3 for smoking, and 6 for bullied, and 4 for early intercourse/30	1992-2012	Adolescents	

Table 2. Continued

Review Article*	Type of Review and Research Designs Included in Review <sup>†</sup>	Number of Articles <sup>‡</sup>	Years Included in Review <sup>§</sup>	Age/Grade of Students Included	Summary of General Findings <sup>  </sup>
Nutrition environment and services (14 reviews, 181 articles, and 134 unique articles) Shochat et al <sup>64</sup>	Systematic review; mixed designs	17	Published up to 2012; included articles were from 1998 to 2012	10-19 years	<ul style="list-style-type: none"> <li>• Associations between sleep and school performance differed by study design. Prospective studies had inconsistent associations and cross-sectional studies found consistent associations between sleep loss and sleepiness and lower academic achievement.</li> </ul>
Supporting school services Health services <sup>††</sup> Maughan <sup>65</sup>	Systematic review; mixed designs	15	Published since 1965; included articles were from 1967 to 2002	Not stated but focus is school aged youth	<ul style="list-style-type: none"> <li>• Association between school nurses and increased school attendance.</li> </ul>
Taras and Potts-Datema <sup>59</sup>	Systematic review; mixed designs	78	1984-2004	5-18 years	<ul style="list-style-type: none"> <li>• Association between asthma and decreased school achievement.</li> <li>• Rates of absenteeism are higher among students with asthma.</li> <li>• Association between having diabetes and lower academic achievement.</li> <li>• Association between children having sickle cell anemia and lower cognitive functioning (eg, IQ tests).</li> <li>• Association between having epilepsy and lower academic achievement.</li> <li>• Association between children who are overweight or obese and lower academic achievement.</li> <li>• Association between school-based health clinic and lower absenteeism and improved school graduation or grade promotion.</li> <li>• Association between asthma and lower cognitive performance.</li> <li>• Association between asthma and increased school absenteeism.</li> <li>• Association between vision problems and decreased standardized measures of literacy standardized reading test scores, state basic skills test, reading ability, and spelling.</li> <li>• Association between type I diabetes and lower on full-scale IQ measures, lower scores on measures of abstract reasoning, reduced processing speed and motor responding, poorer performance on tasks requiring focused, selective attention, and behavioral inhibition, and lower scores in reading and math.</li> </ul>
Taras and Potts-Datema <sup>62</sup>	Systematic review; mixed designs	15 for diabetes, 9 for sickle cell, 8 for epilepsy/32	Not stated; included articles were from 1988 to 2003	5-18 years	
Taras and Potts-Datema <sup>60</sup>	Systematic review; mixed designs	10	1994-2004	5-18 years	
Murray et al <sup>26</sup>	Systematic review; only RCTs and quasi-experimental	2/17	Published since 1945; included articles were from 1993 to 2004	Not stated but focus is school aged youth	
Basch <sup>58</sup>	Unstructured literature review; mixed designs	13 counted <sup>#</sup>	Not stated; included articles were from 1998 to 2008	Not stated but focus is school aged youth	
Basch <sup>63</sup>	Unstructured literature review; mixed designs	16 counted <sup>#</sup>	Not stated; included articles were from 1991 to 2008	Not stated but focus is school aged youth	
Kucera and Sullivan <sup>61</sup>	Systematic review; mixed designs	22	1985-2010	<18 years	

Table 2. Continued

Review Article*	Type of Review and Research Designs Included in Review†	Number of Articles‡	Years Included in Review§	Age/Grade of Students Included	Summary of General Findings
Nutrition environment and services (14 reviews, 181 articles, and 134 unique articles) <sup>5</sup> Suhrcke and de Pa Nieves <sup>52</sup> ; # Systematic review; mixed designs		4 for obesity and 4 for asthma/53	January 1995 to June 2008	Not stated but focus is school-aged youth	<ul style="list-style-type: none"> <li>• Association between obesity and overweight and decreased educational outcomes.</li> <li>• Asthma on average has not been shown to affect school performance.</li> <li>• Limited available research indicates inverse relationship between obesity and cognition in children.</li> </ul>
Burkhalter and Hillman <sup>13</sup>	Unstructured literature review, cross-sectional studies, prospective studies	7/22 counted <sup>#</sup>	Not stated; included articles were from 1994 to 2006	Not stated but focus is school-aged youth	<ul style="list-style-type: none"> <li>• Association between counseling programs and improved grades, test scores, school attendance, classroom behavior, and attitudes toward school.</li> <li>• Association between universal approach to mental health promotion and improved cognition, grades, and classroom behavior.</li> </ul>
Counseling, psychological, and social services (5 reviews, 129 articles, and 129 unique articles) <sup>6</sup> Borders and Drury <sup>67</sup>	Systematic review; mixed designs	33 counted <sup>#</sup>	1960 to January 1990	Not stated but focus is school-aged youth	<ul style="list-style-type: none"> <li>• Inconsistent association between mental health and counseling services and decreased absenteeism and tardiness.</li> </ul>
Wells et al <sup>68</sup>	Systematic review; only interventions	17	Not stated; included articles were from 1982 to 1999	Not stated but focus is school-aged youth	<ul style="list-style-type: none"> <li>• Association between hyperactivity and lower reading and mathematics test scores; increased grade repetition, and increased placement in special education.</li> </ul>
Murray et al <sup>26</sup>	Systematic review; only RCTs and quasi-experimental	2/17	Published since 1945; included articles were from 2000 to 2004	Not stated but focus is school-aged youth	<ul style="list-style-type: none"> <li>• Association between ADHD and lower cognition (eg, executive functioning, memory, and understanding causal relations), increased school absenteeism, lower levels of educational attainment, and increased odds of dropping out of school.</li> </ul>
Basch <sup>69</sup>	Unstructured literature review; mixed designs	17 counted <sup>#</sup>	Not stated; included articles were from 1992 to 2009	Not stated but focus is school-aged youth	<ul style="list-style-type: none"> <li>• Association between mental health programs and improved educational outcomes (ie-attendance, behavior, and test scores).</li> </ul>
Becker et al <sup>66</sup>	Systematic review; only RCTs	85 (a total of 88 unique studies)	1966-2011	Not stated but focus is school-aged youth	<ul style="list-style-type: none"> <li>• Association between school climate and improved academic success.</li> <li>• Association between school climate and lower levels of absenteeism and improved academic performance and education behaviors.</li> <li>• Association between school climate and increased self-esteem, lower levels of drug use, fewer psychological well-being, decreased student absenteeism, lower rates of student suspension, and effective risk prevention.</li> </ul>
Supporting safe and positive environment Social and emotional school climate (3 reviews, 260 articles, and 226 unique articles) <sup>7</sup> Anderson <sup>77</sup>	Unstructured literature review; mixed designs	39 counted <sup>#</sup>	Not stated; included articles were from 1961 to 1980	Not stated but focus is school-aged youth	
Cohen et al <sup>78</sup>	Unstructured literature review; mixed designs	51 counted <sup>#</sup>	Not stated; included articles were from 1993 to 2007	Not stated but focus is school-aged youth	
Thapa et al <sup>79</sup>	Systematic review; mixed designs	206	Not stated; included articles were from 1908 to 2013	Not stated but focus is school-aged youth	

Table 2. Continued

Review Article*	Type of Review and Research Designs Included in Review <sup>†</sup>	Number of Articles <sup>‡</sup>	Years Included in Review <sup>§</sup>	Age/Grade of Students Included	Summary of General Findings <sup>  </sup>
Supporting the engagement of family and community Family engagement (5 reviews, 134 articles, and 92 unique articles) <sup>¶</sup> Fan and Chen <sup>93</sup>	Meta-analysis; mixed designs	25	Not stated; included articles were from 1984 to 1997	Not stated but focus is school-aged youth	<ul style="list-style-type: none"> <li>• Association between parental involvement and increased academic achievement, effect size = 0.33.</li> <li>• Association is stronger when academic achievement is represented by a global indicator (eg, GPA) than by a subject-specific indicator (eg, math grade).</li> </ul>
Jeynes <sup>95</sup>	Meta-analysis; mixed designs	20	Not stated; included articles were from 1988 to 1999	School-aged youth in grades K-12	<ul style="list-style-type: none"> <li>• Association between parental involvement and increased academic achievement for minority students; effect size ranged from 0.22 to 0.48 (depended on racial group).</li> </ul>
Jeynes <sup>96</sup>	Meta-analysis; mixed designs	41	Not stated; included articles were from 1969 to 2000	Elementary school students	<ul style="list-style-type: none"> <li>• Association between parental involvement overall and increased academic achievement of urban elementary school children, effect size = 0.74.</li> <li>• Association held for White and minority children and also for boys and girls.</li> </ul>
Jeynes <sup>97</sup>	Meta-analysis; mixed designs	52	Not stated; included articles were from 1972 to 2002	Secondary school students	<ul style="list-style-type: none"> <li>• Association between parental involvement overall and increased academic achievement of urban secondary school children, effect size = 0.46.</li> </ul>
Hill and Tyson <sup>94</sup>	Meta-analysis; mixed designs	50	1985-2006	Middle school students	<ul style="list-style-type: none"> <li>• Association held for both White and minority children.</li> <li>• Association between parental involvement and increased academic achievement in middle school, effect size = 0.18.</li> </ul>

ADHD, attention deficit hyperactivity disorder; RCT, randomized controlled trial; GPA, grade point average.

\*A systematic review was conducted for review articles between 1980 and December 2014 that examined the association between health-related behaviors/topics and academic achievement (ie, physical activity, nutrition, violence, alcohol and other drugs, smoking, sexual health, asthma, other chronic conditions [eg, diabetes and obesity], inattention and hyperactivity, and sleep). A systematic review of reviews was not conducted for employee wellness; counseling, psychological, and social services; school climate; school physical environment; family engagement; and community involvement. However, an extensive search of the literature was conducted, and if reviews were available they were noted in this table. Reviews were not found for employee wellness, physical environment, and community involvement.

†The reviews were defined as *meta-analytic* if they provided effect sizes by combining the findings from the independent studies included in the review and described the search strategy and inclusion/exclusion criteria. The reviews were defined as *unstructured* if the authors stated it was a literature review but did not describe the search strategy and inclusion/exclusion criteria. Meta-analytic reviews were considered the most rigorous, followed by systematic reviews, and then unstructured literature reviews. The design of the studies included in the review also impacts the quality of the review. Experimental designs including randomized controlled trials were considered stronger designs, followed by longitudinal and quasi-experimental, and then correlational.

‡The number provides the total number of articles included in the review that specifically examined health and academic achievement. If the study included multiple behaviors/topics, then the number of articles related to that specific behavior/topic was included as well as the total number of articles (ie-specific #/total #). In some cases, discrepancies were found in the original articles (eg, authors provided a different number of articles in the abstract, methods, and/or results section or the number of articles provided in the results did not match the number of articles in the provided table or references cited). The number of articles included in this table reflects the number of articles the author provided in the "Results" section. If the table or listed references differed from the number in the "Results" section, the number was based on the number of articles listed in the table or cited.

§The years of the review were based on search criteria stated in the article; however, if this was not stated, then the range reflects the actual years of the studies included in the review. In some cases, discrepancies were found in the original articles (eg, the date of an article was before or after the range of dates provided for the search criteria). This table includes the search dates provided by the author.

||The summary of general findings only highlights the main associations found in the articles. It does not provide a detailed description of the findings (eg, control variables and contextual factors). Only the overall effect size was included. ¶Unique articles are nonduplicate articles included across the reviews of a particular health behavior/topic.

#Counted means that the author(s) of the review did not provide the number of articles, so they were counted based on the narrative.

\*\*Topics included in the Health Education section: sleep (3 reviews, 37 articles, and 34 unique articles), sex risk behaviors (3 reviews, 34 articles, and 32 unique articles), violence (2 reviews, 37 articles, and 33 unique articles), alcohol/drug use (3 reviews, 58 articles, and 53 unique articles), and smoking (3 reviews, 32 articles, and 30 unique articles).

††Topics included in the Health Services section: asthma (4 reviews, 91 articles, and 86 unique articles), diabetes (2 reviews, 34 articles, and 31 unique articles), sickle cell anemia (1 review and 9 articles), epilepsy (1 review, 8 articles), obesity (3 reviews, 15 articles, and 10 unique articles), and vision (1 review and 16 articles).

‡‡Study included a review of multiple health behaviors/topics.

physical activity had a significant positive association with students' cognitive functioning (eg, concentration and memory).<sup>15,20,21,30</sup> These findings are also supported in other reviews.<sup>12,16,17,19,22,24,25,34,35,37,38</sup> In addition, a recent review, based on a meta-analysis of 20 experimental studies, concluded that students participating in physical activity had improved academic achievement including better concentration and attention, higher achievement tests scores, and higher math scores compared with students who did not.<sup>15</sup>

Across these reviews, associations between opportunities for students to be physically active in school and academic achievement were also examined. In general, studies have shown that more participation in physical education class is associated with better grades, standardized test scores, and classroom behavior.<sup>12,15,19,21,26,29,33,36</sup> In addition, time spent in recess that encourages pro-social behaviors has been positively associated with cognitive performance and positive classroom behaviors.<sup>28,36</sup> Similarly, brief classroom physical activity breaks (ie-5-10 minutes) have been associated with improved cognitive performance, classroom behavior, and educational outcomes including standardized test scores, reading scores, and math scores.<sup>28</sup> Finally, participation in extracurricular physical activities has been associated with higher grade point averages (GPAs), lower dropout rates, and fewer disciplinary problems.<sup>14,19,23,28,33,36</sup>

**Nutrition environment and services.** The school nutrition environment and services provides students with opportunities to learn about and practice healthy eating through available foods and beverages, nutrition education, and messages about food in the cafeteria and throughout the school campus. Fourteen review articles examined the association between nutrition and academic achievement.<sup>9,13,14,26,27,32,39-46</sup>

Two of the reviews were meta-analyses—with 1 including only randomized control trials and the other including randomized control trials and quasi-experimental designs.<sup>42,45</sup> One of the studies found that supplements and foods fortified with  $\geq 3$  micronutrients (eg, iron and zinc) were associated with improved cognitive performance.<sup>42</sup> Similarly, the other review found that iron intake was associated with improved cognitive performance.<sup>45</sup>

Nine of the reviews examined the relationship between breakfast consumption and academic performance.<sup>14,26,27,39-41,43,44,46</sup> These reviews generally found small, positive associations between breakfast consumption and different academic outcomes including cognitive performance and attendance. In particular, student participation in school breakfast programs such as the US Department of Agriculture's School Breakfast Program has been shown to be associated with increased academic grades and standardized

test scores, reduced absenteeism, and improved cognitive function,<sup>26,39,41,44,46</sup> whereas skipping breakfast has been associated with decreased cognitive performance among students.<sup>14,40</sup> One review examined the association between food insufficiency (ie-the limited availability of nutritionally adequate and safe foods) and academic performance, finding that food insufficiency is associated with decreased school attendance and diminished academic achievement.<sup>9,13,46</sup>

School meal programs including the National School Lunch Program and School Breakfast Program play an important role in helping students learn about and practice healthy habits such as consuming breakfast. Additionally, these programs provide nutritious meals to students who may not otherwise have access to food at home. Participation in school meal programs is associated with increased consumption of key micronutrients and important foods including fruits, vegetables, and low-fat milk.<sup>47,48</sup>

Other aspects of the school nutrition environment can help support health and academic success. For example, access to drinking water helps students increase water consumption and maintain adequate hydration, which is associated with improved cognitive functioning.<sup>49-51</sup>

**Health education.** Health education consists of planned learning experiences on a variety of topics such as nutrition, physical activity, alcohol and other drug use and abuse, sexual health, tobacco use, violence prevention, sleep, and mental and emotional health. These planned experiences provide students with the opportunity to acquire information and the skills they need to make informed health decisions.

Studies have not yet examined how health education curricula and instruction alone are directly associated with academic achievement. However, 9 programs that included a health education component increased academic grades and test scores, decreased school absences, improved student behavior, and reduced school dropout.<sup>26</sup> These results are supported by evidence from experimental longitudinal or quasi-experimental intervention studies.

Another way to understand the contribution of health education on academic achievement is to examine the association between specific student health behaviors and academic achievement.<sup>9,14,26,32,52-55</sup> For example, research has shown that students engaging in violent behaviors have lower grades and test scores.<sup>9,53</sup> Lack of sleep, which is pervasive, has been associated with reduced cognitive functioning and adverse effects on emotional and physical health.<sup>54-56</sup> Instructing students on a variety of health behaviors will not only increase their health literacy but also impact their health and academic outcomes.

Health education also allows students to learn and practice communication and social skills, such as resisting social pressures, which can reduce risk for

smoking, alcohol and other drug use, and unintended pregnancy. Studies have shown that smoking has a negative effect on grades.<sup>9,14,32</sup> Longitudinal studies have demonstrated the association between drug use and lower educational attainment.<sup>9,14,32</sup> There is also a consistent inverse association between sexual risk behaviors and academic achievement. For example, studies have shown an association between early intercourse initiation and lower school grades.<sup>9,14</sup> Findings also show that teen mothers are less likely to complete high school and have lower odds of attending college.<sup>52</sup>

### Supporting School Health Services

Schools can provide services to support the health and learning of students and staff. Three components of WSCC address school services—health services (0 meta-analyses, 7 systematic reviews, and 3 unstructured literature reviews); counseling, psychological, and social services (0 meta-analyses, 4 systematic reviews, and 1 unstructured literature review); and employee wellness (0 reviews).

**Health services.** School health services include first aid, emergency care and assessment, and planning for the management of chronic conditions (eg, asthma and diabetes). Nationally, about 25% of children and adolescents in the United States are estimated to suffer from chronic conditions such as asthma, diabetes, food allergies, epilepsy, and obesity.<sup>57</sup> Helping students manage chronic conditions will decrease the amount of time they spend out of the classroom or away from school.

Four review articles examined the association between asthma and academic achievement.<sup>26,32,58,59</sup> Students with asthma have been shown to have lower cognitive performance and increased school absenteeism.<sup>26,32,58,59</sup> Other chronic conditions also have been associated with academic achievement. Specifically, research has shown a negative association between being overweight or obese and school attendance and decreased test scores but more research is needed to clearly determine whether this is due to social factors, behaviors related to obesity, or the condition itself.<sup>13,32,60</sup> In addition, research has shown that diabetes is linked to decreased attention and lower test scores,<sup>61,62</sup> epilepsy to lower intelligence,<sup>62</sup> and sickle cell anemia to lower cognitive functioning.<sup>62</sup>

School health services might also include vision screenings. One review concluded that vision problems are associated with decreased standardized measures of literacy, standardized reading test scores, state basic skills test scores, reading ability, and spelling.<sup>63</sup> In addition, children with poor oral health status are more likely to miss more days of school because of dental pain, and these absences are associated with lower grades.<sup>64</sup>

Further, school nurses play a vital role in helping students do better in school by assisting them in addressing health problems. Findings from one review found that school nurses can have an influence on student absenteeism by targeting students with a history of high rates of absenteeism.<sup>65</sup> In addition, schools with smaller school nurse-to-student ratios were associated with lower absenteeism rates and higher graduation rates.<sup>65</sup>

**Counseling, psychological, and social services.** Counseling, psychological, and social services offered in school help support the mental, behavioral, and social-emotional health of students and promote success in learning. Counseling interventions in schools cover a wide range of topics including school behaviors, peer relationships, study skills, career planning, death of a family member, divorce, substance use, family abuse, and sexuality.

In one review, school-based mental health programs were shown to be beneficial by improving attendance, student behavior, and test scores.<sup>66</sup> These findings are also supported in a previous review.<sup>26</sup> Research has also shown that specific counseling approaches such as motivational interviewing are associated with increased GPA and classroom behavior.<sup>67</sup> In addition, studies have examined universal approaches to mental health promotion that focus on the underlying social and emotional factors that are integral to learning including self-management, relationship skills, and responsible decision making. One review concluded that universal mental health promotion programs can be effective at decreasing suspension rates, increasing positive classroom behaviors, and increasing attendance rates.<sup>68</sup>

Schools also can provide services to students with attention and hyperactivity problems. One review found that hyperactivity has been associated with greater risk for lower reading and mathematics test scores and grade repetition.<sup>69</sup> In addition, attention deficit hyperactivity disorder has been associated with decreased cognitive functioning, increased school absenteeism, lower levels of educational attainment, and increased odds of dropping out of school.<sup>69</sup>

**Employee wellness.** Investing in the physical and mental health of school staff can support students' health and academic success. Employee wellness programs address multiple risk factors and health conditions to meet the health needs of employees.<sup>70-72</sup> Studies have shown that wellness programs can increase employees' ability to focus, reduce absenteeism, improve employee morale, and prevent chronic diseases.<sup>73,74</sup>

Healthy school staff are a critical component of a high achieving school. While few studies have examined how the health of school staff directly impacts students' learning, research has shown that unhealthy behaviors and health problems can directly

affect teachers' productivity, classroom effectiveness, and absenteeism, which could in turn affect students' learning.<sup>71,73,75</sup> School staff are also powerful role models and can help engage students in healthy behaviors and practices.<sup>70,76</sup>

### Supporting Safe and Positive School Environments

Both the physical and social and emotional environment of the school can influence the health and learning of students. Two components of WSCC support a safe and positive school environment—social and emotional school climate (0 meta-analyses, 1 systematic review, and 2 unstructured literature reviews) and physical environment (0 reviews).

**Social and emotional school climate.** The social and emotional development of students is affected by the psychosocial aspects of students' educational experience (ie-school climate). Three review articles examined the association between school climate and academic achievement.<sup>77-79</sup>

One important aspect of school climate is student safety. Researchers have shown that being a victim of bullying is associated with feeling unsafe at school, lower connectedness with school, and lower grades.<sup>79</sup> Additionally, a positive and safe school climate is associated with reduced aggression and violence, peer victimization, and punitive disciplinary actions, which has also been associated with decreased absenteeism and increased academic achievement.<sup>78,79</sup>

Another aspect of school climate is relationships—that is, how engaged students, school staff, families, and the broader school community feel to one another. A positive and safe school climate has been shown to be associated with increased attachment to school.<sup>77-79</sup> Students who are more attached to school have been shown to have better attendance, grades, and classroom behavior.<sup>79</sup> Student-teacher relationships influence academic success and behavioral outcomes for students.<sup>77-79</sup>

One important casual pathway described by Basch is school connectedness—he explains that if the school climate is poor, there will likely be a decrease in school connectedness and engagement, which in turn will negatively affect both students' health and learning.<sup>5</sup> In 2009, CDC developed strategies for increasing school connectedness, which is defined as the belief by students that adults and peers in the school care about their learning and about them as individuals.<sup>80</sup> School connectedness has been shown to be a strong protective factor in decreasing risky health behaviors such as substance use, early sexual initiation, violence, and risk of unintentional injury (eg, drinking and driving).<sup>79-81</sup> Research has demonstrated an association between school connectedness and academic achievement, including school attendance, staying in school longer, and higher grades and classroom test scores.<sup>79-80</sup>

A positive school climate is also conducive to effective teaching and learning. Studies have shown that school climate is directly related to academic achievement for elementary school, middle school, and high school.<sup>79</sup> These findings are based on correlational and longitudinal studies. Cooperative learning, group cohesion, respect, and mutual trust have been shown to directly improve the learning environment and more distally the school climate.<sup>77-79</sup>

**Physical environment.** The physical school environment encompasses the school building and its contents, the land on which the school is located, and the area surrounding it. The school's physical condition (eg, ventilation, temperature, noise, and lighting) has been shown to be associated with student learning. For example, when allergens are not effectively removed from the air in the classroom, these ventilation problems can trigger asthma, lethargy, an inability to concentrate, and drowsiness in students.<sup>82-84</sup> Such consequences have been associated with a negative impact on learning.<sup>82,84</sup>

In addition, high temperatures or inconsistent temperatures can make students drowsy and not feel well, which can affect their ability to learn.<sup>83,85,86</sup> Poor acoustics also interferes with learning; when acoustic quality in the classroom is poor, students may not be able to completely understand instructions from the teacher, which might lead to poor performance.<sup>87</sup> Schools with full-spectrum light or full-spectrum with ultraviolet enhancement (that emulates natural light) have been associated with increased attendance and academic achievement.<sup>83,88,89</sup>

One other aspect of the physical school environment includes the biological and chemical agents in the air, water, or soil such as pollution, mold, hazardous materials, pesticides, and cleaning agents. Often these are triggers for students with asthma or allergies. These indoor air quality problems have been associated with increased student absences.<sup>82-84,90</sup>

The school's physical environment also includes addressing physical threats (eg, crime, violence, and injuries) that make students feel safe, which in turn has been shown to be associated with decreased absenteeism and increased academic achievement.<sup>53,79,91</sup> Research has shown that the physical school environment indirectly influences academic achievement through the school climate.<sup>91,92</sup>

### Supporting the Engagement of Family and Community

Family engagement and community involvement help schools foster partnerships to support, share, and maximize resources. Two components of WSCC support involving the family and community—family engagement (5 meta-analyses, 0 systematic reviews, and 0 unstructured literature reviews) and community involvement (0 reviews).

**Family engagement.** Families and school staff can work together to support and improve the learning, development, and health of students. Five review articles examined the association between family engagement and academic achievement.<sup>93-97</sup> Research has shown that students who have parents engaged in their school lives are more likely to have increased attendance, higher grades and test scores, better social skills, improved classroom behavior, and graduated high school.<sup>93-97</sup> These positive effects have been shown for elementary school, middle school, and high school students.

Although most of the literature for parent engagement has focused on improving academic achievement, research also has shown that students who have parents engaged in their school lives are less likely to smoke cigarettes, drink alcohol, become pregnant, be physically inactive, and be emotionally distressed.<sup>98</sup> In addition, research has shown that parents involved in school health activities will not only impact their children's health behaviors but also their academic achievement.<sup>98</sup>

Parents are also affected by the school's social and emotional climate. Parents are more likely to be engaged if the school has a welcoming environment (eg, friendly school office staff and readily available information for parents) and if they perceive school staff and students want and expect their involvement.<sup>98,99</sup> Research has shown that providing a variety of activities including educating parents on available health care services at the school, volunteering in the classroom, and attending a parent-teacher organization meeting and frequent opportunities will help increase parent engagement.<sup>98,99</sup> This will also increase parents' belief that their engagement will improve their children's learning and well-being, which in turn will improve their children's academic performance.<sup>98,99</sup>

**Community involvement.** Schools that partner with community groups (eg, community-based organizations, businesses, cultural and civic organizations, social service agencies, faith-based organizations, health clinics, and colleges and universities) to provide additional services, share resources, and volunteer in the school can help students receive the care, skills, and knowledge they need to learn and increase their academic achievement. Community involvement is associated with increased grades and test scores, improved school attendance, and improved student behavior.<sup>99-102</sup>

Research also has shown that schools are more likely to improve student achievement when they have positive social relationships with community members and groups.<sup>103,104</sup> In addition, student learning opportunities beyond the classroom such as service-learning opportunities and civic engagement have been associated with improved school-related

behaviors, decreased school suspension rates, and increased academic achievement.<sup>79,99</sup>

## DISCUSSION

The Whole School, Whole Community, and Whole Child model is a framework that highlights the critical connection between health and academic achievement. As such, it provides guidance for supporting healthy student behaviors, school health services, safe and positive school environments, and family and community involvement. It also addresses the underlying health problems described by Basch that affect students' motivation and ability to learn.<sup>4</sup>

There is value in addressing more than one component of WSCC, especially components that cut across multiple layers (eg, school, home, and community). For example, Seattle's Social Development Program included child social and emotional skill development, professional development for teachers, and parent workshops (3 of the 10 components of WSCC).<sup>11</sup> This program positively affected student's health behaviors and educational outcomes, and even 15 years after the intervention, showed positive effects on the participants' mental health, sexual health, and educational outcomes. Similarly, a recent review of obesity prevention programs demonstrates that diet and physical activity interventions in a school-based setting with family and community components have the most evidence for effectiveness.<sup>105</sup>

Across the 10 components of the WSCC model, 6 clearly address the health needs of students (physical education and physical activity; nutrition environment and services; health education; health services; counseling, psychological, and social services; and employee wellness), while 4 are cross-cutting and help support student healthy behavior (social and emotional school climate, physical environment, family engagement, and community involvement).

Evidence described in this article demonstrates that the 6 health-related components can impact educational outcomes, and inform policy and program changes at the local level. For example, in the most recent and comprehensive review, Castelli et al found that 79% of the 218 articles included in their review reported positive associations between physical activity/physical fitness and academic achievement, and the other 21% found null or neutral findings.<sup>15</sup> This evidence supports the national recommendation for a comprehensive school physical activity approach, which includes providing opportunities for students to be physically active before, during, and after school.<sup>106-108</sup>

The cross-cutting components (social and emotional school climate, physical environment, family engagement, and community involvement) are essential to support healthy behaviors among students.

School climate and family engagement have received attention from the US Department of Education and have been targets of educational reform. However, these components implemented independently cannot move the needle for academic achievement. Researchers have found that programs that address multiple characteristics of the individual, family, school, and community are more likely to positively impact student learning and health behaviors.<sup>11,99</sup> The Whole School, Whole Community, and Whole Child model addresses these ecological layers.<sup>8</sup>

Dr Lloyd Kolbe stated that “school health programs are essential if we are to attain both National Education Goals and National Health Objectives by the year 2000.”<sup>109(p545)</sup> This statement still holds true today; school health programs must be an integral part of education if we want healthy and successful students, and if as a nation we want to attain both National Education and Health Objectives by 2020 and beyond. The WSCC model provides public schools with a framework to address these objectives.

### Limitations

There are a few limitations that need to be considered. First, the quality of the research related to health and academic achievement outcomes varies across the 10 different components of WSCC. Therefore, when a limited number of systematic reviews was available, as is the case with the Supporting Safe and Positive School Environments category, the authors included, when possible, quantitative studies that contain robust study designs. Second, this article did not assess relative contribution of implementing different combinations or all the WSCC components on student outcomes; however, it did demonstrate that each component has a positive impact on health and academic outcomes and that some of the components have more robust research findings (eg, physical activity and physical education). Last, this article cannot determine where particular school districts or schools should invest their limited resources.

### IMPLICATIONS FOR SCHOOL HEALTH

School health and education professionals can use WSCC as a framework to promote the health and success of students. While the goal is to implement all the components of WSCC, the evidence in this article demonstrates that each component positively influences the health and academic achievement of students. To support the implementation of WSCC, districts and schools can ensure their health-related policies (eg, local school wellness policies) and practices address the components of WSCC. Districts and schools can refer to national guidelines and strategies documents such as CDC’s School

Health Guidelines for Promoting Healthy Eating and Physical Activity, School Connectedness: Strategies for Increasing Protective Factors Among Youth, and Parent Engagement: Strategies for Involving Parents in School Health for guidance on evidence-based policies and practices.<sup>80,98,106</sup>

In addition, at the school level, there needs to be a school health group such as a school health council, school health team, or wellness committee to implement the evidence-based policies and practices. If one does not exist, the first step for a school would be to form one. The second step would be to assess what components of WSCC they are or are not implementing using CDC’s School Health Index.<sup>110,111</sup> The School Health Index helps school leaders determine the extent to which schools are implementing evidence-based health policies and practices, and identify weaknesses and develop plans for improvement while engaging key stakeholders. This assessment process will not only help schools decide how to invest limited resources, but also will help schools discuss and determine how to coordinate policies, processes, and practices across components of WSCC.

### Human Subjects Approval Statement

Preparation of this article did not involve original research with human subjects.

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