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Physical Activity Interventions During the School Day: Reviewing Policies, Practices, and Benefits

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Abstract

BACKGROUND: There are many ways to increase physical activity (PA) during the school day as part of a Comprehensive School Physical Activity Plan. This article reviews policies and practices that can be used during the school day to increase PA for students.

METHODS: We searched systematic reviews for articles that met criteria (2010–2018, phase 1), followed by a search for individual articles addressing topics for which we did not identify a sufficiently relevant or recent review or to update an earlier review that concluded insufficient evidence (2010–2020, phase 2). We included 45 articles (45 studies, 54 interventions).

RESULTS: We grouped studies by intervention type: school-wide PA approaches to reach all students within the school setting (17), physical education (PE) interventions (13), and

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

HUMAN SUBJECTS APPROVAL STATEMENT

Preparation of this paper did not involve primary research or data collection involving human subjects, and therefore, no institutional review board examination or approval was required.

SUPPORTING INFORMATION

The following Supporting Information is available for this article:

Supplemental Table 1 Individual articles included in the physical activity interventions during the school day evidence synthesis.

Additional supporting information may be found online in the Supporting Information section at the end of the article.

The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

interventions related to recess (15). Few studies involved secondary schools or rural settings. Among 45 studies reporting PA behavior or fitness outcomes, 37 reported at least 1 improvement.

CONCLUSIONS: PA policies, PE, and recess can help improve school health by increasing the PA levels of students.

Keywords

physical activity; school; students; policies; physical education

Schools are in a unique position to help students attain the nationally recommended 60 minutes or more of moderate to vigorous physical activity (MVPA) daily, and regular physical activity (PA) in childhood and adolescence is important for promoting lifelong health and well-being and preventing various health conditions.[1] To increase PA during the school day, schools need flexibility to choose from a variety of evidence-based approaches. For example, to increase PA and improve educational outcomes, the Community Preventive Services Task Force (CPSTF) recommends PA breaks during classroom time, physically active lessons, and active travel to school.[2–4] Although the recommendations from CPSTF published by The Community Guide found strong evidence in 2013 to recommend "enhanced" physical education (PE), which modifies curricula and/or teaching strategies to increase the amount of time students spend in MVPA,[5] their review does not reflect current standards for PE.[6]

Frameworks such as Whole School, Whole Community, Whole Child[7] and the Comprehensive School Physical Activity Program (CSPAP)[8,9] reflect the associations of school PA with health as well as academic achievement. Using a CSPAP that includes daily PE can increase PA opportunities before, during (recess, classroom PA), and after school, and these student-centered frameworks can guide schools in providing a system-wide approach to include more PA opportunities during the school day.

This systematic review builds upon evidence published by The Community Guide and recommendations from CPSTF within the past decade.[2–5] It summarizes categories of approaches schools can use to increase PA during the school day and serves as an additional important building block for promoting PA in school settings. The purpose of the synthesis is to identify effective policies and practices that schools can use to increase PA throughout the school day as part of a CSPAP by examining evidence from 10 years of intervention studies. Examining evidence-based practices for implementing a variety of CSPAP components during the school day can help schools better support the health- and academic-related needs of their students.[1] This article reviews policies and practices that can be used during the school day to increase PA.

METHODS

The introduction and methods article to this special issue gives more details.[10] We started by searching existing systematic reviews or meta-analyses for individual articles that met our criteria (phase 1), followed by a search for individual articles, excluding topics for which we had identified a sufficiently relevant and recent (2017 or newer) review (phase 2). Research

librarians developed search strategies for each phase. Table 1 presents the search terms and dates for each phase; all searches queried Medline (OVID), PsycInfo (OVID), CINAHL (EBSCO), Scopus, ERIC (ProQuest), Education Database, and Sociological Abstracts.

In phase 2, we did not conduct searches on topics the CPSTF had addressed through recommendations published in 2010 or more recently that aligned with our research questions (eg, classroom PA, active transportation to school). The CPSTF found strong evidence to recommend "enhanced" PE in 2013[5]; however, we included PE studies in subsequent search strategies because more recent studies could have included policies or practices informed by an updated set of PE standards released in 2013.[6]

To be eligible for consideration, articles had to (1) be published during 2010–2018 (phase 1) or 2010–2020 (phase 2); (2) available as a full-text article in English; (3) come from a peer-reviewed publication; (4) discuss studies that took place in the United States; (5) apply an appropriate study design (systematic review/meta-analysis for reviews; controlled trial or quasi-experimental design for individual articles); (6) describe school-based PA interventions for students in grades K-12; (7) describe policy, program, systems, and environmental change interventions; (8) align with a key research question related to improving PA outcomes in youth; (9) and include relevant outcomes (see introduction and methods article in this special issue).

We collected and managed standardized information about each included article using REDCap electronic data capture tools hosted at the Centers for Disease Control and Prevention (CDC).[11,12] Paired reviewers completed practice extractions in REDCap and met as a team to reach consensus. Details about the extraction form can be found in the introduction and methods article of this special issue.[10] Reviewers completed the Effective Public Health Practice Project Risk of Bias (RoB) assessment for any article that did not have an existing RoB.[13] Reviewer pairs met to reconcile any differences in extraction and reached 100% agreement.

Additional details about systematic review methods and documentation can be found in the introduction and methods article at the start of this special issue.[10] In phase 1, we prioritized 5 "Anchor review articles" for PA and identified 21 "Anchor review articles" prioritized for other topics that included articles describing PA interventions. From those, a total of 70 qualifying articles were identified; 18 were excluded for either being out of scope, wrong study design, or reported wrong outcomes, and 32 were moved to a different systematic review in this issue. For example, articles that included PA within a multicomponent intervention but did not specifically evaluate the impact of the PA component were moved to the coordinated approach manuscript.[14] This resulted in 20 total qualifying articles from phase 1 that included and evaluated a school-based PA component. In phase 2, we included a total of 121 articles from searches on PA, nutrition, and health education topics, as described in figure 3 of the introduction and methods article. Of these, 31 were coded as including PE/PA interventions and 3 were identified by SMEs as PE/PA interventions from other topics (Figure 1). Two articles were excluded for being redundant with phase 1, and 7 were moved to a different more relevant systematic review for this special issue.

This process resulted in the extraction of 45 unique articles that contributed evidence about increasing PA during the school day (see Figure 1). We grouped articles by study (n = 45, each article reported on a separate study), identified the total intervention arms (n = 54), and conducted a qualitative synthesis, comparing how many interventions reported statistically significant outcomes in the expected direction, with null findings, or in the unexpected direction (Table 2). Primary outcomes include PA behavior and fitness outcomes (eg, PA minutes, moderate to vigorous PA, physical fitness outcomes (eg, step test, FITNESSGRAM assessment scores), and PA knowledge, attitudes, and perceptions (KAP) outcomes (eg, PA-related self-efficacy and PA-related attitudes or perceptions). Secondary outcomes include sedentary behavior, academic achievement, discipline, classroom behaviors, social behaviors, and anthropometry.

RESULTS

We identified 45 articles describing 45 studies that evaluated a total of 54 interventions. Table 2 presents study design and demographic characteristics (eg, race/ethnicity, school-level) in aggregate by intervention type. The Supplemental Table 1 includes detailed information about each included study, including intervention components and characteristics, population demographics, and risk of bias assessments. Articles are categorized by intervention type—school-wide PA strategy, PE, recess—and include randomized control trials, controlled clinical trials, and quasi-experimental designs.

Interventions Focused on Increasing PA Through a School-Wide Approach

Seventeen studies evaluated 17 interventions involving school-wide PA approaches to reach all students within the school setting. Intervention strategies included implementing all components of a CSPAP for an allocated portion of the school year[15–21] or using school- or district-level policies or initiatives to improve PA and fitness (eg, a district-mandated 20-minute PA policy, a school-wide structured walking program, a district-level fitness assessment policy, an Active School Day policy, or a community readiness assessment completed before implementing a school-wide PA intervention).[22–26] Strategies also included utilizing partnerships to increase opportunities for PA during the school day for all students (eg, establishing school-university partnerships to facilitate more PA or receiving ChildObesity180 or Fuel Up to Play 60 grants),[27,28] using a group of PA leaders (PALs) with goal setting to improve students' cardiorespiratory endurance,[29] or using an electronically facilitated system, such as a web-based, self-regulation system called SWITCH® or providing all students access to an electronic game designed to increase PA.[30,31]

Among the 17 school-wide PA interventions, 15 reported PA behavior and fitness outcomes in the expected direction (Table 2). Two of the interventions reported no change in at least 1 PA behavior or fitness outcome,[17,30] and 1 intervention, using goal setting by school PALs, reported improvements in PA and cardiorespiratory fitness among sixth graders but unexpected declines among third graders.[29] Among the 4 interventions that reported on secondary outcomes, there were improvements in sedentary behavior and sedentary screen time in 3 interventions.[23,27,31] One intervention among majority Latino students

found a significant increase in cardiorespiratory fitness during a 16-week structured walking program but no significant changes in Body Mass Index (BMI) or waist circumference as secondary outcomes.[25]

Several approaches were designed specifically to reach populations facing health disparities. In 1 study, a 12-week CSPAP moderately improved PA and health-related fitness among K-6 children from low-income families.[18] In a primarily rural setting study, findings support the utility of web-based self-regulation for facilitating PA change in youth.[31] In addition, in 1 study that addressed the cost of school-wide implementation, an Active School Day policy that provided equipment, curricular materials, and training to physical educators and school wellness champions to promote 150 weekly minutes of PA during the school day increased student MVPA levels by 24% and decreased sedentary time during school at modest cost among a majority non-White, diverse population.[23] Involving PALs to enhance goal setting also led to greater improvements in PA and cardiorespiratory endurance in sixth graders within a primarily urban, majority Latino population.[29]

Interventions Focused on Increasing PA During PE

Thirteen studies evaluated a total of 15 PE interventions. Specific strategies in this category included using new units or activities during PE (eg, an all-girls PE class supplemented with nutrition and self-empowerment components, a pre-packaged fitness program, a 12-week resistance training program, dance-based video games),[32–35] integrating a sports-focused, activity-specific, or self-regulation-focused curriculum,[36–38] providing teacher training to use the Tactical Games Model to enhance the cognitive components of PE lessons during PE class,[39,40] and implementing a PE policy or requirement (eg, 30-or 45-minute daily PE, allocating time to more PE opportunities, or implementing the 2006 wellness policy requirement of the Child Nutrition and WIC Reauthorization Act).[41–44]

Among the 15 PE interventions reporting PA behavior and fitness outcomes, 11 found at least 1 outcome in the expected direction. Only 1 intervention noted a decrease in leisure-time PA in the unexpected direction of the hypothesis.[36] Of the 6 PE interventions that reported PA knowledge, attitudes, and perceptions outcomes, 5 found improvement in at least 1 KAP outcome, including improvements in body image,[32] enjoyment of PA,[36] intrinsic motivation,[37] self-concept,[35] and self-regulation skills for PA.[38] Of the 8 PE interventions reporting secondary outcomes, 6 found improvement in at least 1 outcome, such as improvements in anthropometry,[42] body composition,[35] and eating behaviors,[32] along with 5 with no change in at least 1 outcome related to dietary intake,[32] anthropometry,[32,33,35,41,42] academic performance,[33] and classroom discipline.[33]

Some of the PE interventions were implemented with an equity lens or with a goal of incorporating student input. In a study to examine the effect of a high school sport education curriculum program on students' motivation for PE and leisure-time PA, autonomous forms of motivation were reported in the sport education curriculum, which facilitated increased internalized forms of student motivation as opposed to external forms of motivation in PE.[36] In another study among a diverse, majority non-White high school population that supplemented an all-girl PE class with nutrition and self-empowerment components, improvements were seen for not only sedentary activity, but also in factors related to body/

self-image when students received support from friends, teachers, and families for healthy eating and PA.[32] In addition, in an intervention that provided 45 minutes of daily PE for a majority Black non-Latino population, elementary and middle school youth experienced improvements on 7 of 16 fitness and body composition measures and on 8 of 26 cognitive measures.[42] At the high school level, a 12-week resistance training program resulted in significant increases in strength, improvements in body composition, and improvements in self-concept among a population of majority Latino adolescents.[35] And finally, highlighting that gender-specific implementation modifications might be needed in PE lessons, a study exploring the use of the Tactical Games Model in basketball lessons showed an inequitable participation pattern with boys having significantly more activity time than girls.[39] This study thus indicates that even if using a prepackaged program in PE, teachers may need to modify lesson activities to enable equitable PA.[39]

Interventions Focused on Increasing PA During Recess

Fifteen studies evaluated a total of 22 interventions related to recess. Specific recess strategies included creating activity zones,[45,46] redesigning the playground,[47] adding greenspace,[48] providing new recess play equipment,[49] enhancing and promoting activities available during recess (eg, a game with an award program, a recess activity of the week, the Ready for Recess program, indoor dance videos, or teacher activity prompts to encourage certain activities),[50–55] or some combination of staff training, equipment, activity zones, and playground design.[56–59]

Findings were mixed among the 22 recess interventions reporting on PA behavior and fitness outcomes, but 16 of the interventions reported improvements in at least 1 outcome. One study reported a decrease in PA, however, during an intervention involving teacher modeling of active recess games.[54] There was also a decrease in walking reported across both genders in an intervention that provided recreational equipment during recess.[58] Among 5 interventions that reported secondary outcomes, however, 4 found improvements in at least 1 outcome, including improvement in PA-related social behaviors, such as fewer antisocial interactions.[48]

Several of the recess interventions were designed to overcome participation barriers or to reach specific populations. An 8-week recess intervention that created activity zones on the playground of an American Indian reservation showed that low-cost strategies increased PA during recess among elementary and middle school female students in a predominately rural setting.[45] Similarly, a study examining the impact from the Ready for Recess intervention reported that relatively simple strategies, such as staff training and recreational equipment, can be a way to increase PA in children of any gender or ethnicity during recess time.[51] One of the playground redesign studies, involving structural and loose play equipment at an intermediate school with a majority Latino population, showed that the percentage of children engaging in MVPA during recess increased by 23.3%, and it also reported that this was a sustainable increase in PA 1 year following the intervention.[47]

DISCUSSION

This systematic review makes an important contribution to understanding the potential impact of school-based PA policies and practices. This review of 45 studies, conducted mainly in elementary schools and urban settings, identifies evidence-based intervention strategies that can be included as part of a CSPAP.[8,9] Our findings show a variety of actions schools can take to increase PA during the school day including school-wide policy and program approaches, PE, and recess.

The findings from this review are consistent with what is known about strategies for increasing school-based PA. School-level PA policy, PE, and recess interventions showed positive impact on PA, and PE interventions also reported positive changes in PA knowledge, attitudes, and perceptions. These school-level PA policy, PE, and recess results complement The Community Guide's recommendations for classroom PA breaks, physically active lessons, and active travel to school interventions.[2–4] Our findings showing favorable outcomes for PE interventions also ultimately did align with The Community Guide's 2013 recommendation for enhanced PE and are consistent with the rationale for CDC and SHAPE America's Essential Components of Physical Education.[5,60] When implemented as part of a CSPAP, PE is key to increasing PA in schools and should ideally include the Essential Components of Physical Education—policy and environment, curriculum, instruction, and assessment.[60] This review also offers a spectrum of school-level strategies for more PA opportunities, such as a district-mandated 20-minute PA policy or establishing school-university partnerships to facilitate more PA, that can also support schools in moving toward daily PE as the norm.[22,27] In addition, consistent with previous CSPAP guidance, the out-of-school time article in this issue describes interventions within the before and after school PA program components of a CSPAP that can be coordinated with community-based organizations (eg, YMCAs, community parks and recreation) and delivered in school settings in addition to the school-based practices included in this review.[61]

Across all studies included in this review, results indicated that PA behaviors or fitness outcomes are likely to either improve or to stay constant. Furthermore, compared to the other intervention categories included in this review, school-level PA policy and program approaches most consistently reported positive impacts on PA behavior and fitness. Findings reinforce the value of both a coordinated approach and the individual components of a CSPAP highlighting that even implementing single components of a CSPAP individually can be beneficial for increasing PA during the school day. This is promising for the field as continued dissemination of the Comprehensive School Physical Activity Programs: A Guide for Schools (CSPAP Guide) can further support implementation and awareness of these practices.[9] Our review also brings the literature about school-based PA up to date, and the results show increased PA reported across a variety of populations and practices. Schools and administrators can use our review to find a menu of options to increase PA during the school day, and this further supports that there are a variety of effective actions schools can include as part of implementing a CSPAP.[8,9]

Several factors not addressed in the studies we reviewed could benefit from further examination. There is limited information on the costs to implement these strategies.

In addition, most interventions occurred in elementary schools, and therefore, less is known about the applicability of the intervention strategies in middle or high schools. Schools' programming and policies can affect adoption and implementation of a CSPAP; as can challenges related to social determinants of health, such as transportation access and neighborhood safety.[62] Given these complexities, flexibility and adaptability during implementation are both important elements of any school PA intervention implementation process. More information, however, on the processes of implementation can help improve adoption, especially in settings with fewer resources and in populations affected by health disparities. Implementation of recess, for example, can involve providing PA-promoting activities or can be infrastructure-based by changing landscapes or upgrading playgrounds.[47,48] It can also be equipment-based by providing new resources for students.[49] Similarly, policies can be fitness-based as a school-level goal, partner-based through collaboration, or CSPAP-based with PA opportunities provided throughout the school day.[15,23,28]

This review summarizes the evidence within broad CSPAP-related categories and includes examples showing how schools are tailoring implementation based on available resources and community capacities. Continuing to evaluate the benefits of PA related to social-emotional learning and emotional well-being can increase the scope of impact from PA interventions. A recent review of recess and social-emotional benefits underscores greater recognition of potential benefits of PA, particularly for elementary school students.[63,64] Only a few studies explored these types of secondary outcomes, so this topic could benefit from further study to outline the multidimensional impact of implementing a CSPAP during the school day.

LIMITATIONS AND STRENGTHS

This review has 4 limitations. First, there is the potential for social desirability bias and detection bias in studies that do not use blinding.[10] Second, the inclusion criteria for this review required that PA interventions report PA as an outcome; therefore, this review does not include emerging interventions, such as yoga or mindfulness interventions, that offer PA as an intervention strategy but do not report PA as an outcome. Studies of these interventions, however, are included in another article in this special issue.[65] Third, focusing on PA interventions during the school day, this review's analysis does not include all factors that can influence the CSPAP model. Other types of PA-related interventions in the school setting, including multicomponent interventions that also include nutrition or health education, are reported elsewhere in the supplement.[14] And finally, more than half of the interventions were rated as having weak design/high risk of bias (n = 31/54) and about half of studies (24 of 45) lacked a comparison group (ie, used a 1-group pre/post design), which prevents us from differentiating the impact of the intervention from secular trends and also may limit generalizability of results. Considering evidence of little to no improvement in youth PA over the past decade,[66] however, improvements in PA regardless of study design are promising.

This review has 3 strengths. First, it provides an updated review of the school-based PA literature using a systematic approach. Second, it provides a Supplemental Table 1

showing the CSPAP-related implementation details from the included studies that can inform implementation strategies for schools. Third, we report the data in this review in outcome categories for PA behavior and fitness and PA knowledge, attitudes, and perceptions along with a secondary outcomes category (eg, sedentary behavior, academic achievement, discipline, classroom behaviors, social behaviors, and anthropometry).

IMPLICATIONS FOR SCHOOL HEALTH POLICY, PRACTICE, AND EQUITY

The results of this review will broadly provide information for the future of CDC's Healthy Schools Branch research, product development, and partnership engagement, and as foundational information to update CDC's CSPAP Guide.[9] Intervention strategies that include school-level PA policies, PE, and recess in the CSPAP model are effective at increasing PA, but further guidance on implementation and examples from the field are needed to better support schools in integrating a multitude of opportunities for students to participate in PA during the school day because recess, for example, may not be feasible for middle and high school students. School administrators can use a variety of strategies to begin CSPAP implementation tailored to their setting based on feasibility and resources they have available. This review also identifies topics related to CSPAP implementation that are infrequently addressed in the literature, such as adapting PA approaches for non-urban and non-White populations and the costs of implementation.

CONCLUSIONS

The findings from this review show there are a variety of effective actions schools can take to increase PA as part of implementing a CSPAP. School-level PA policies, PE, and recess are effective for increasing PA. Schools face barriers to implementation, such as administrator support, scheduling capacity, and cost of resources[67]; however, providing a variety of effective intervention strategies to schools can help guide and encourage CSPAP implementation. Using strategies for implementing school-level PA policies, PE, and recess during the school day can help improve student health by increasing the PA levels of students.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

REFERENCES

1. U.S. Department of Health and Human Services. Physical Activity Guidelines for Americans. 2nd ed. Washington, DC; 2018. Available at: https://health.gov/paguidelines/second-edition/pdf/Physical_Activity_Guidelines_2nd_edition.pdf Accessed August 31, 2022.
2. Guide to Community Preventive Services. Physical activity: classroom-based physical activity break interventions; 2021. Available at: https://www.thecommunityguide.org/findings/nutrition-gardening-interventions-increase-vegetable-consumption-among-children.html. Accessed December 5, 2022.
3. Guide to Community Preventive Services. Physical activity: classroom-based physically active lesson interventions; 2021. Available at: https://www.thecommunityguide.org/findings/physical-activity-classroom-based-physically-active-lesson-interventions.html. Accessed December 2, 2022.

4. Guide to Community Preventive Services. Physical activity: interventions to increase active travel to school; 2021. Available at: https://www.thecommunityguide.org/findings/physical-activity-interventions-increase-active-travel-school.html. Accessed November 18, 2022.
5. Guide to Community Preventive Services. Physical activity: enhanced school-based physical education; 2018. Available at: https://www.thecommunityguide.org/findings/physical-activity-enhanced-school-based-physical-education.html. Accessed October 18, 2022.
6. SHAPE America. Grade-level outcomes for K-12 physical education; 2013. Available at: https://www.shapeamerica.org/standards/pe/upload/Grade-Level-Outcomes-for-K-12-Physical-Education.pdf. Accessed October 9, 2022.
7. Lewallen TC, Hunt H, Potts-Datema W, Zaza S, Giles W. The Whole School, Whole Community, Whole Child model: a new approach for improving educational attainment and healthy development for students. J Sch Health. 2015;85(11):729–739. 10.1111/josh.12310. [PubMed: 26440815]
8. Centers for Disease Control and Prevention. School health guidelines to promote healthy eating and physical activity. MMWR Recomm Rep. 2011;60(RR-5):1–76.
9. Centers for Disease Control and Prevention. Increasing physical education and physical activity: A framework for schools; 2019. Available at: https://www.cdc.gov/healthyschools/physicalactivity/pdf/2019_04_25_PE-PA-Framework_508tagged.pdf. Accessed August 15, 2022.
10. Sliwa SA, Hawkins GT, Lee SM, Hunt H. A Whole School, Whole Community, Whole Child approach to support student physical activity and nutrition: introduction/methods. J School Health. 2023;93(9):750–761. 10.1111/josh.13374. [PubMed: 37670601]
11. Harris PA, Taylor R, Thielke R, Payne J, Gonzalez N, Conde JG. Research electronic data capture (REDCap)—a metadata-driven methodology and workflow process for providing translational research informatics support. J Biomed Inform. 2009;42(2):377–381. 10.1016/j.jbi.2008.08.010. [PubMed: 18929686]
12. Harris PA, Taylor R, Minor BL, et al. The REDCap consortium: building an international community of software platform partners. J Biomed Inform. 2019;95:103208. 10.1016/j.jbi.2019.103208. [PubMed: 31078660]
13. Armijo-Olivo S, Stiles CR, Hagen NA, Biondo PD, Cummings GG. Assessment of study quality for systematic reviews: a comparison of the Cochrane Collaboration Risk of Bias Tool and the Effective Public Health Practice Project Quality Assessment Tool: methodological research. J Eval Clin Pract. 2012;18(1):12–18. 10.1111/j.1365-2753.2010.01516.x. [PubMed: 20698919]
14. Chung C, Sliwa S, Merlo C, Erwin H, Xu Y. Coordinated approach: comprehensive policy and action planning. J School Health. 2023;93(9):853–863. 10.1111/josh.13376. [PubMed: 37670595]
15. Centeio EE, McCaughtry N, Gutuskey L, et al. Physical activity change through comprehensive school physical activity programs in urban elementary schools. J Teach Phys Educ. 2014;33(4):573–591. 10.1123/jtpe.2014-0067.
16. Braun HA, Kay CM, Cheung P, Weiss PS, Gazmararian JA. Impact of an elementary school-based intervention on physical activity time and aerobic capacity, Georgia, 2013–2014. Public Health Rep. 2017;132(2_suppl):24s–32s. 10.1177/0033354917719701. [PubMed: 29136482]
17. Seibert T, Allen DB, Eickhoff JC, Carrel AL. US centers for disease control and prevention-based physical activity recommendations do not improve fitness in real-world settings. J Sch Health. 2019;89(3):159–164. 10.1111/josh.12724. [PubMed: 30632155]
18. Brusseau TA, Hannon J, Burns R. The effect of a comprehensive school physical activity program on physical activity and health-related fitness in children from low-income families. J Phys Act Health. 2016;13(8):888–894. 10.1123/jpah.2016-0028. [PubMed: 27144329]
19. Burns RD, Brusseau TA, Hannon JC. Effect of a comprehensive school physical activity program on school day step counts in children. J Phys Act Health. 2015;12(12):1536–1542. 10.1123/jpah.2014-0578. [PubMed: 25741980]
20. Burns RD, Fu Y, Hannon JC, Brusseau TA. School physical activity programming and gross motor skills in children. Am J Health Behav. 2017;41(5):591–598. 10.5993/AJHB.41.5.8. [PubMed: 28760181]
21. Burns RD, Fu Y, Fang Y, Hannon JC, Brusseau TA. Effect of a 12-week physical activity program on gross motor skills in children. Percept Mot Skills. 2017;124(6):1121–1133. 10.1177/0031512517720566. [PubMed: 28728459]

22. Holt E, Bartee T, Heelan K. Evaluation of a policy to integrate physical activity into the school day. J Phys Act Health. 2013;10(4):480–487. 10.1123/jpah.10.4.480. [PubMed: 22820322]
23. Cradock AL, Barrett JL, Carter J, et al. Impact of the Boston active school day policy to promote physical activity among children. Am J Health Promot. 2014;28(3 suppl):S54–S64. 10.4278/ajhp.130430-QUAN-204. [PubMed: 24380467]
24. Allen R, Tass B, Peterson JR. One school district's strategy to improve fitness levels: a fitness challenge. J Phys Educ Recreat Dance. 2010;81(3):16–23. 10.1080/07303084.2010.10598444.
25. Hawthorne A, Shaibi G, Gance-Cleveland B, McFall S. Grand Canyon Trekkers: school-based lunchtime walking program. J Sch Nurs. 2011;27(1):43–50. 10.1177/1059840510391669. [PubMed: 21123848]
26. Ehlers DK, Huberty JL, Beseler CL. Is school community readiness related to physical activity before and after the ready for recess intervention? Health Educ Res. 2013;28(2):192–204. 10.1093/her/cys102. [PubMed: 23107932]
27. Miller GF, Sliwa S, Michael S, et al. Evaluation of let's move! Active schools activation grants. Prev Med. 2018;108:36–40. 10.1016/j.ypmed.2017.12.024. [PubMed: 29288779]
28. Weaver RG, Webster CA, Egan C, Campos CMC, Michael RD, Vazou S. Partnerships for active children in elementary schools: outcomes of a 2-year pilot study to increase physical activity during the school day. Am J Health Promot. 2018;32(3):621–630. 10.1177/0890117117707289. [PubMed: 28482678]
29. Burns RD, Brusseau TA, Fu Y. Influence of goal setting on physical activity and cardiorespiratory endurance in low-income children enrolled in CSPAP schools. Am J Health Promot. 2018;48(1):32–40. 10.1177/0890117117707289.
30. Pope L, Garnett B, Dibble M. Lessons learned through the implementation of an eHealth physical activity gaming intervention with high school youth. Games Health J. 2018;7(2):136–142. 10.1089/g4h.2017.0164. [PubMed: 29393679]
31. McLoughlin GM, Rosenkranz RR, Lee JA, et al. The importance of self-monitoring for behavior change in youth: findings from the SWITCH® School Wellness Feasibility Study. Int J Environ Res Public Health. 2019;16(20):10. 10.3390/ijerph16203806.
32. Neumark-Sztainer DR, Friend SE, Flattum CF, et al. New moves-preventing weight-related problems in adolescent girls a group-randomized study. Am J Prev Med. 2010;39(5):421–432. 10.1016/j.amepre.2010.07.017. [PubMed: 20965379]
33. Weiss MR, Phillips AC, Kipp LE. Effectiveness of a achool-based fitness program on youths' physical and psychosocial health outcomes. Pediatr Exerc Sci. 2015;27(4):546–557. 10.1123/pes.2015-0011. [PubMed: 26098616]
34. Reynolds C, Benham-Deal T, Jenkins JM, Wilson M. Exergaming: comparison of on-game and off-game physical activity in elementary physical education. Phys Educ. 2018;75(1):64–76. 10.18666/TPE-2018-V75-I1-7533.
35. Velez A, Golem DL, Arent SM. The impact of a 12-week resistance training program on strength, body composition, and self-concept of Hispanic adolescents. J Strength Cond Res. 2010;24(4):1065–1073. 10.1519/JSC.0b013e3181cc230a. [PubMed: 20375719]
36. Wallhead TL, Garn AC, Vidoni C. Effect of a sport education program on motivation for physical education and leisure-time physical activity. Res Q Exerc Sport. 2014;85(4):478–487. 10.1080/02701367.2014.961051. [PubMed: 25412130]
37. Gao Z, Hannon JC, Newton M, Huang C. Effects of curricular activity on students' situational motivation and physical activity levels. Res Q Exerc Sport. 2011;82(3):536–544. 10.1080/02701367.2011.10599786. [PubMed: 21957712]
38. Grim M, Petosa R, Hortz B, Hunt L. Formative evaluation of MyFit: a curriculum to promote self-regulation of physical activity among middle school students. Am J Health Educ. 2013;44(2):81–87. 10.1080/19325037.2013.764238.
39. Harvey S, Smith ML, Song Y, Robertson D, Brown R, Smith LR. Gender and school-level differences in students' moderate and vigorous physical activity levels when taught basketball through the Tactical Games Model. J Teach Phys Educ. 2016;35(4):349–357. 10.1123/jtpe.2016-0089.

40. Hodges M, Wicke J, Flores-Marti I. Tactical Games Model and its effects on student physical activity and gameplay performance in secondary physical education. Phys Educat. 2018;75(1):99–115. 10.18666/TPE-2018-V75-I1-7551.
41. Anderson LM, Aycock KE, Mihalic CA, Kozlowski DJ, Detschner AM. Geographic differences in physical education and adolescent BMI: have legal mandates made a difference? J Sch Nurs. 2013;29(1):52–60. 10.1177/1059840513513155. [PubMed: 22815346]
42. Reed JA, Maslow AL, Long S, Hughey M. Examining the impact of 45 minutes of daily physical education on cognitive ability, fitness performance, and body composition of African American youth. J Phys Act Health. 2013;10(2):185–197. 10.1123/jpah.10.2.185. [PubMed: 22820756]
43. Erfle SE, Gamble A. Effects of daily physical education on physical fitness and weight status in middle school adolescents. J Sch Health. 2015;85(1):27–35. 10.1111/josh.12217. [PubMed: 25440450]
44. Brusseau TA, Kulinna PH. An examination of four traditional school physical activity models on children's step counts and MVPA. Res Q Exerc Sport. 2015;86(1):88–93. 10.1080/02701367.2014.977431. [PubMed: 25402409]
45. Grant V, Brown B, Swaney G, et al. Community-identified strategies to increase physical activity during elementary school recess on an American Indian reservation: a pilot study. Prev Med Rep. 2015;2:658–663. 10.1016/j.pmedr.2015.08.012. [PubMed: 26844133]
46. Barnas J, Wunder C, Ball S. In the zone: an investigation into physical activity during recess on traditional versus zoned playgrounds. Phys Educ. 2018;75(1):116–137. 10.18666/TPE-2018-V75-I1-7594.
47. Frost MC, Kuo ES, Harner LT, Landau KR, Baldassar K. Increase in physical activity sustained 1 year after playground intervention. Am J Prev Med. 2018;54(5 Suppl 2):S124–S129. 10.1016/j.amepre.2018.01.006. [PubMed: 29680110]
48. Raney MA, Hendry CF, Yee SA. Physical activity and social behaviors of urban children in green playgrounds. Am J Prev Med. 2019;56(4):522–529. 10.1016/j.amepre.2018.11.004. [PubMed: 30772148]
49. Behrens TK, Holeva-Eklund WM, Luna C, et al. An evaluation of an unstructured and structured approach to increasing recess physical activity. J Sch Health. 2019;89(8):636–642. 10.1111/josh.12787. [PubMed: 31131456]
50. Galbraith LA, Normand MP. Step it up! Using the good behavior game to increase physical activity with elementary school students at recess. J Appl Behav Anal. 2017;50(4):856–860. 10.1002/jaba.402. [PubMed: 28801941]
51. Siahpush M, Huberty JL, Beighle A. Does the effect of a school recess intervention on physical activity vary by gender or race? Results from the ready for recess pilot study. J Public Health Manag Pract. 2012;18(5):416–422. 10.1097/PHH.0b013e318226ca47. [PubMed: 22836532]
52. Stellino MB, Sinclair CD, Partridge JA, King KM. Differences in children's recess physical activity: recess activity of the week intervention. J Sch Health. 2010;80(9):436–444. 10.1111/j.1746-1561.2010.00525.x. [PubMed: 20690975]
53. Erwin H, Koufoudakis R, Beighle A. Children's physical activity levels during indoor recess dance videos. J Sch Health. 2013;83(5):322–327. 10.1111/josh.12034. [PubMed: 23516999]
54. Efrat MW. Exploring effective strategies for increasing the amount of moderate-to-vigorous physical activity children accumulate during recess: a quasi-experimental intervention study. J Sch Health. 2013;83(4):265–272. 10.1111/josh.12026. [PubMed: 23488887]
55. Mayfield CA, Child S, Weaver RG, Zarrett N, Beets MW, Moore JB. Effectiveness of a playground intervention for antisocial, prosocial, and physical activity behaviors. J Sch Health. 2017;87(5):338–345. 10.1111/josh.12506. [PubMed: 28382669]
56. Huberty JL, Siahpush M, Beighle A, Fuhrmeister E, Silva P, Welk G. Ready for recess: a pilot study to increase physical activity in elementary school children. J Sch Health. 2011;81(5):251–257. 10.1111/j.1746-1561.2011.00591.x. [PubMed: 21517864]
57. Elder JP, McKenzie TL, Arredondo EM, Crespo NC, Ayala GX. Effects of a multi-pronged intervention on children's activity levels at recess: the Aventuras para Ninos study. Adv Nutr. 2011;2(2):171S–176S. 10.3945/an.111.000380. [PubMed: 22332049]

58. Huberty JL, Beets MW, Beighle A, Welk G. Environmental modifications to increase physical activity during recess: preliminary findings from ready for recess. J Phys Act Health. 2011;8(suppl 2):S249–S256. 10.1123/jpah.8.s2.s249.

59. Huberty JL, Beets MW, Beighle A, Saint-Maurice PF, Welk G. Effects of ready for recess, an environmental intervention, on physical activity in third-through sixth-grade children. J Phys Act Health. 2014;11(2):384–395. 10.1123/jpah.2012-0061. [PubMed: 23364349]

60. Bryant L, Burson SL, Fisher J, et al. Evidence supporting the essential components of physical education as a measure of quality. Res Q Exerc Sport. 2021;92(2):259–269. 10.1080/02701367.2021.1883505.

61. Sliwa S, Chang Chusan Y, Dahlstrom C. Opportunities in the extended day: approaches for promoting physical activity and healthy eating during out-of-school time. J School Health. 2023;93(9):813–827. 10.1111/josh.13370. [PubMed: 37670603]

62. Office of Disease Prevention and Health Promotion. Healthy people 2030. U.S. Department of Health and Human Services. Washington, DC; 2022. Available at. https://health.gov/healthypeople/objectives-and-data/social-determinants-health Accessed December 12, 2022.

63. Hodges VC, Centeio EE, Morgan CF. The benefits of school recess: a systematic review. J Sch Health. 2022;92(10):959–967. 10.1111/josh.13230. [PubMed: 35871529]

64. Burson SL, Castelli DM. How elementary in-school play opportunities relate to academic achievement and social-emotional well-being: systematic review. J Sch Health. 2022;92(10):945–958. 10.1111/josh.13217. [PubMed: 35871539]

65. Hawkins GT, Chung C, Hertz M, Antolin N. The school environment and physical and social-emotional well-being: implications for students and school employees. J Sch Health. 2023;93(9):799–812. 10.1111/josh.13375. [PubMed: 37670600]

66. Chen TJ, Watson KB, Michael SL, Carlson SA. Sex-stratified trends in meeting physical activity guidelines, participating in sports, and attending physical education among US adolescents, Youth Risk Behavior Survey 2009–2019. J Phys Act Health. 2021;18(S1):S102–s113. 10.1123/jpah.2021-0263. [PubMed: 34465644]

67. Nathan N, Elton B, Babic M, et al. Barriers and facilitators to the implementation of physical activity policies in schools: a systematic review. Prev Med. 2018;107:45–53. 10.1016/j.ypmed.2017.11.012. [PubMed: 29155228]

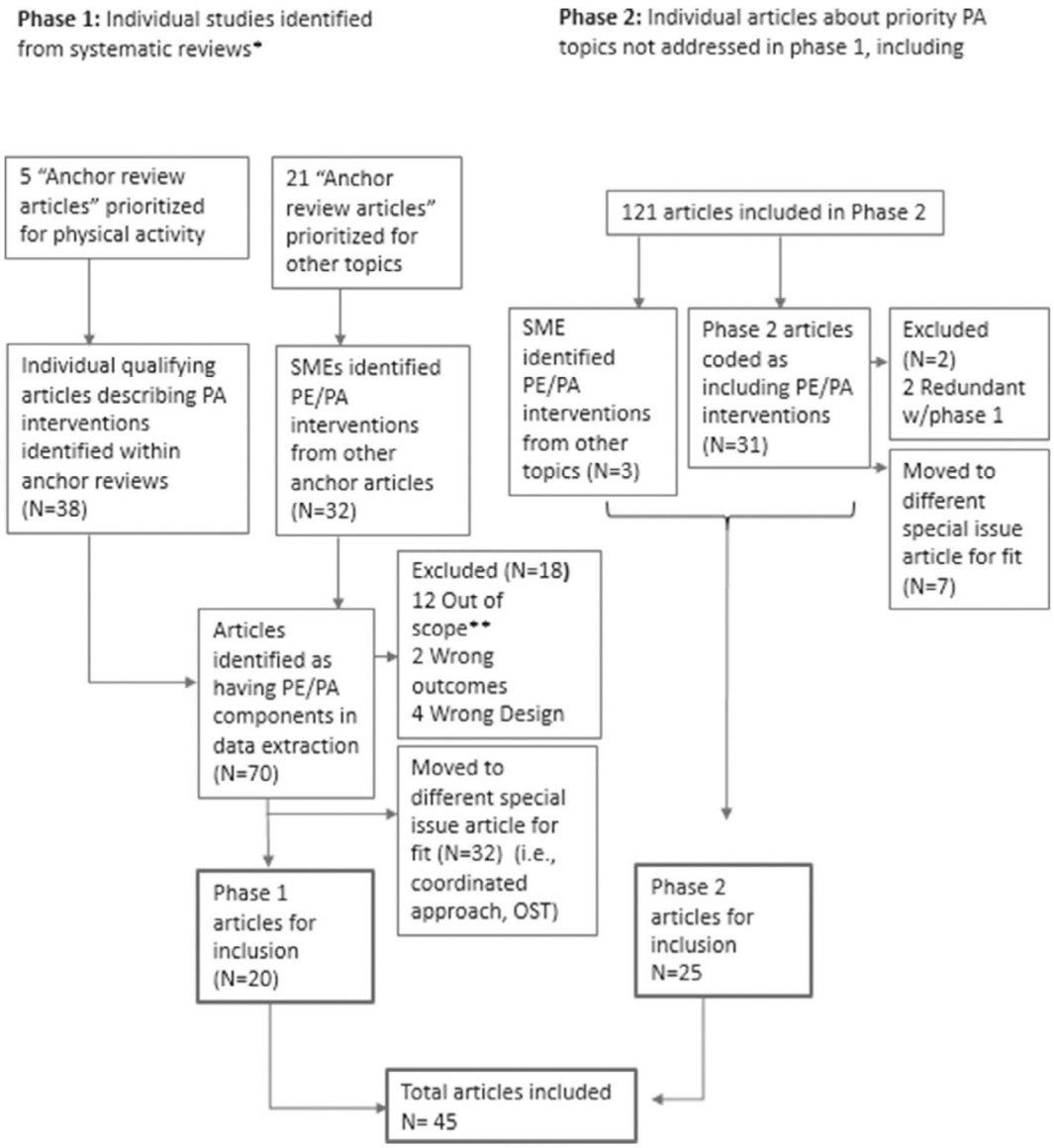

Figure 1.

Identifying Articles Describing School-Based Physical Activity Interventions*

OST, out-of-school time; PE/PA, physical education/physical activity; SME, subject matter expert. *See Intro/Methods paper for full project flow chart. **Out of scope: Wrong date or wrong topic. As an example of a "wrong topic," after the Community Guide issued its recommendation for classroom PA, we excluded classroom PA interventions in phase 1 (after extraction) and in abstract and full-text screening (phase 2).

Table 1.

Search Strategy Used to Identify Peer-Reviewed Publications About Physical Activity and Physical Education

Topic	Medline Strategy*
Phase 1: Physical Activity and Physical Education (June 18, 2018)	Fitness* OR physical activit* OR physically active OR exercis* OR physical education OR sport* OR recreation OR playground* OR gym OR gymnasium* OR walk* OR bike OR biking OR recess OR movement AND Intervention* OR program* OR intramural* AND exp Schools/ OR primary school* OR secondary school* OR high school* OR middle school* OR elementary school* OR K-12 AND Review.pt OR meta analys*.pt OR (Review OR meta analys* OR metaanalys*).ti 2010-current; English
Phase 2: Coordinated approach to supporting wellness, PA, Nutrition (March 10, 2020)	(school* ADJ5 wellness ADJ5 committee*) OR (school* ADJ5 wellness ADJ5 coordinat*) OR (school* ADJ5 wellness ADJ5 mentor*) OR (school* ADJ5 wellness ADJ5 collaborat*) OR (school* ADJ5 wellness ADJ5 council*) OR (school* ADJ5 wellness ADJ5 team*) OR (parent* ADJ5 wellness ADJ5 school*) OR (communit* ADJ5 involvement ADJ5 school*) OR (PTA* ADJ5 wellness) OR (parent teacher association* ADJ5 wellness) OR (district* ADJ5 wellness ADJ5 polic*) OR (wellness ADJ5 champion* ADJ5 school*) OR (district support AND wellness AND school*) OR ((obesity OR weight control OR nutrition OR physical activit* OR wellness) ADJ5 (team* OR collaborat* OR coordinat* OR committee* OR council* OR association* OR communit* OR district* OR leader* OR mentor*) ADJ5 school*) AND Physical activit* OR physical education OR exercis* OR running OR walking OR biking OR body mass index OR BMI OR weight OR obesity OR diet* OR nutrition OR lunch* OR breakfast* OR meal* OR snack* AND Journal article.pt OR review.pt Limit English; 2010

*This Medline search strategy was run first and yielded the largest number of independent citations. It was then modified for subsequent queries in other databases.

Table 2.

Aggregated Description of Study Characteristics and Outcomes From Interventions to Increase Physical Activity During the School Day

	Study Participant Characteristics (n = no. of studies)				Intervention Outcomes*		
Interventions†, N = 54	**Study design‡, N = 45**	**School level**	**Locale**	**Race/ethnicity§**	**# of interventions reporting PA behavior and physical fitness outcomes‖**	**# of interventions reporting KAP outcomes‖**	**# of interventions reporting secondary outcomes‖**
School-wide PA strategy (N = 17)	N = 17 RCT/CCT (n = 2) QED (n = 15)	Elementary (n = 8) Middle (n = 0) High (n = 1) Multiple (n = 7) Not specified (n = 1)	Urban (n = 6) Rural (n = 2) Suburban (n = 0) Not reported (n = 9) Not applicable (n = 0)	Majority White (n = 2) Majority Black (n = 1) Majority Hispanic/Latino (n = 4) Majority racial and ethnic minority groups (n = 6) Not specified (n = 4)	Total interventions: 17 + (n = 15) = (n = 2) − (n = 1)	Total interventions: 0	Total interventions: 4 + (n = 3) = (n = 1) − (n = 0)
Physical education (N = 15)	N = 13 RCT/CCT (n = 2) QED (n = 11)	Elementary (n = 2) Middle (n = 3) High (n = 4) Multiple (n = 4) Not specified (n = 0)	Urban (n = 1) Rural (n = 0) Suburban (n = 1) Not reported (n = 3) Not applicable (n = 8)	Majority White (n = 5) Majority Black (n = 1) Majority Hispanic/Latino (n = 1) Majority racial and ethnicminority groups (n = 2) Not specified (n = 4)	Total interventions: 15 + (n = 11) = (n = 5) − (n = 1)	Total interventions: 6 + (n = 5) = (n = 3) − (n = 1)	Total interventions: 8 + (n = 6) = (n = 5) − (n = 0)
Recess (N = 22)	N = 15 RCT/CCT (n = 3) QED (n = 12)	Elementary (n = 9) Middle (n = 0) High (n = 0) Multiple (n = 5) Not specified (n = 1)	Urban (n = 3) Rural (n = 1) Suburban (n = 2) Not reported (n = 6) Not applicable (n = 3)	Majority White (n = 7) Majority Black (n = 0) Majority Hispanic/Latino (n = 2) Majority racial and ethnicminority groups (n = 1) Not specified (n = 5)	Total interventions: 22 + (n = 16) = (n = 7) − (n = 3)	Total interventions: 0	Total interventions: 5 + (n = 4) = (n = 2) − (n = 2)

KAP, knowledge, attitudes, perceptions; PA, physical activity; RCT/CCT, randomized control trial or controlled clinical trial; QED, quasi-experimental design.

PA behavior and fitness outcomes include PA minutes, moderate to vigorous PA, and physical fitness outcomes (eg, step test, FITNESSGRAM assessment scores). KAP outcomes include PA-related self-efficacy and PA-related attitudes or perceptions. Secondary outcomes include sedentary behavior, academic achievement, discipline, classroom behaviors, social behaviors, and anthropometry. +: supports hypothesis,=: no effect, −: does not support hypothesis ("+" and "−" indicate statistical significance).

*Examples of outcomes that support hypothesis and would be coded (+): increased physical activity, decreased sedentary time, and decreased waist circumference.

†Interventions refers to the set of practices/policies/approaches tested within a study. If a research study included multiple intervention arms, each arm counted separately toward a given outcome in this table. Similarly, the number of interventions may exceed the number of articles since a study may have more than 1 intervention arm.

‡QED could be 2 group cohort, including regression discontinuity; 1 group cohort; interrupted time series; descriptive, repeat cross-sectional.

§Majority defined as >50% of the student population.

‖Totals for measured outcomes may exceed the number of interventions evaluating a given outcome because a single intervention may be counted more than once if it reports mixed findings; for example, an intervention that reported increased time in MVPA but not VPA would count as both a (+) and (=) for PA.