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ABSTRACT

BACKGROUND: Children from disadvantaged backgrounds are more apt to experience lower availability of nutritious foods, lack opportunities to exercise, and lack access to recreational facilities, and thus are more likely to be obese and at greater risk for developing chronic diseases. The current study provided a review of school health education programs' impact on physical activity behaviors among disadvantaged students.

METHODS: The inclusion criteria of the study were articles: 1) published in English with full text between 2011-2017, 2) focused on school health education programs for disadvantaged school-aged students, 3) assessed programs including a physical activity component, 4) examined school-aged children and adolescents' physical activity behaviors, and 5) assessed programs with comparison groups.

RESULTS: There were 13 studies matching inclusion criteria in this review. The results of this review indicated that school-based health education programs which included culturally appropriate physical activity, parent involvement, and enhanced student motivation and choice of activities appeared to increase physical activity levels among disadvantaged school-aged students. Health education programs should also emphasize behavioral change skills, such as goal setting and self-motivation, to positively impact on students' physical activity behaviors.

CONCLUSIONS: School-based health education programs may help increase access to physical activity among disadvantaged populations.

Keywords:

Physical activity; school health education program; children/adolescent in low-income families; disadvantaged students; systematic review.

Children from disadvantaged backgrounds are more apt to experience lower availability of nutritious foods, lack opportunities to exercise, and lack access to recreational facilities.[1,2] In light of these findings, perhaps it should be unsurprising that low income children are more likely to be obese and at greater risk for developing chronic diseases.[3-5] The school setting provides a positive environment for implementing health education programs and providing children from disadvantaged backgrounds with access to resources that enhance healthy lifestyle.[6] However, as schools face increased pressure to ensure students succeed standardized tests, time allotted for physical activity and leisure is becoming increasingly scarce.[7] Increased support for health education programs that prevent obesity in children and youth is needed to improve health outcomes for children from disadvantaged backgrounds.

Stemming from the above, this review paper has three objectives. The first objective is to present information about risk and protective factors related to physical activity for students in low-income families. The second objective is to review school-based physical activity programs for students residing in low-income families. The third is to suggest ideas for future school-based health education programs with a focus on impacting physical activity levels among advantaged students.

Correlates of Physical Activity for Children in Low-Income Families

Physical activity involves any bodily activity that enhances or maintains physical fitness and overall wellness. Engagement in physical activity benefits the school achievement, cognitive function, and chronical diseases prevention of children.[8] However, several factors serve to enhance or create barriers for engaging in physical activity. For example, a study examined perceived barriers to physical

activity among fifth to seventh grades urban girls, the findings indicated that girls of low socioeconomic status reported greater perceived barriers to physical activity than those who were not residing in low socioeconomic status. The top five perceived barriers by girls were lack of skills, hating to sweat, difficulty finding programs, being tired, and having pain. Girls' who perceived higher barriers to physical activity were involved in lower moderate to vigorous physical activity - MVPA.[9] Researchers reported that the cost of sport activities has been identified as a barrier to participation among some students and may be particularly challenging for students from low-income families.[10] For children from low-income families exhibited lower desires to engage in physical activity due to parents' work commitments and a lack of transport that resulted in engagement in sedentary alternatives.[11]

Also, safety issues in low-income neighborhoods may be related to low involvement in physical activity.[12] A study compared accessibility to outdoor spaces for physical activity between neighborhoods with different incomes. Results showed that the physical environments were less safe, less comfortable, and less pleasurable for outdoor physical activity in neighborhoods with high poverty.[13] Researchers reported that a lack of safety reduced child involvement in physical activity, even though there were recreational facilities in the neighborhood.[14]

A protective factor was adult supervision. Specifically, researchers reported children accompanied by an adult were more likely to engage in physical activity in impoverished neighborhoods. Researchers reported that parents' support for participating in physical activities also improved child participation in physical activity. In addition, encouragement from friends for involvement in physical activity and supervision of sports by coaches or instructors also facilitated engagement in physical activity.[15] Another study indicated that reducing "screen time" may also

enhance child involvement in physical activity, and children from low-income families may be at risk for spending too much time in front of the television or computers.[16]

Being highly motivated to exercise and enjoying exercise are protective factors for engaging in physical activity. Research has indicated that motivation-related constructs positively predicted physical activity behaviors.[17] For example, researchers surveyed 114 sixth to eighth grade students and found that participants' perceptions of the learning climate being positive in physical education classes were positively related to both the usefulness and enjoyment of physical education and higher levels of motivation in physical activity.[18] Another study indicated that students' leisure-time physical activity was linked to enjoyment of physical education classes as well as being influenced by the activities they engaged in during physical education classes.[19] Students' perceived competence, autonomy, relatedness, and enjoyment of activities in physical education also were positively associated with motivation to exercise.[20]

In a study, results indicated that significant annual declines were observed in protective factors, including students' report of feeling safe, caring adults at school, and problem solving skills since 2001.[21] Thus, it is critical to explore the impact of school health program on physical activity behaviors among disadvantaged students. The next section of this paper reviews school-based interventions to improve involvement in physical activity for children from disadvantaged backgrounds.

METHODS

The author conducted literature searches using several databases: EBSCOhost (including Education Resources Information Center – Eric, Academic Search Premier,

CINAHL, SPORTDiscus), ProQuest, Web of Science, and PubMed. A combination of the following search terms were used: physical activity/exercise, disadvantaged/ low-income/underserved students, children, youth, adolescent, and school health education intervention.

The inclusion criteria of the study were peer-reviewed articles that: 1) were published in English with full text between 2011-2017, 2) targeted school-based health education programs for disadvantaged school-aged children and adolescent, 3) assessed programs including a physical activity component, 4) examined school-aged children and adolescent's physical activity behaviors, and 5) assessed programs with comparison groups.

Articles excluded from this study including physical activity programs for preschoolers, programs of process evaluation, study protocol, program design, needs assessment, review articles, and cross-sectional or longitudinal studies.

RESULTS

There were 13 studies matching inclusion criteria in this review. For nine of the programs were conducted in the U.S.A., three in Australia, and one in Sweden. Among these studies, six of them were multiple-component school level intervention; five were implemented during after-school programs, one in regular classes, and one during recess periods. Table 1 presents an overview of those school-based health education programs targeting physical activity behaviors among school-aged students residing in disadvantaged socioeconomic areas.

--Insert Table 1 about here—

Lindgren and colleagues implemented the Exercise Intervention Program, a six-month empowerment-based exercise intervention, for non-physically active adolescent girls. Although both groups increased their level of physical fitness, participants in intervention increased their general self-efficacy. This program highlighted the importance of empowering adolescent girls' ability via physical activity education to deal with stressful situations.[22]

Another program, Physical Activity Leaders program, including physical activity and leadership sessions was designed for low-active adolescent boys from disadvantaged schools. Significant effects were found for Body Mass Index - BMI among participants in the intervention group. However, participants' waist circumference, muscular fitness or physical activity levels did not yield significant change after completion of the intervention.[10]

The Active by Choice Today - ACT program was a school-based randomized controlled trial with twelve schools in intervention and comparison groups. Participants exercised in an after-school program three days per week. The intervention also promoted the development of behavioral skills for improving physical activity at home. Results indicated that participants in intervention group engaged in more minutes of MVPA per day than those in comparison group during the program time periods. Moreover, participants in the intervention group reported higher levels of program enjoyment than students in the comparison program. Participants in the intervention group also reported having greater choice of activities than comparison group.[23]

Another study conducted by Wright and colleagues was Kids-N-Fitness Program. Participants were ninety-seven Mexican-American youth at risk for Type 2 Diabetes, enrolled in inner-city elementary schools in Los Angeles County. The Kids-

N-Fitness Program is a six-week after-school program with 90-minute sessions every week. Sessions include physical activity, nutrition education/behavior modification, and family involvement. Family involvement sessions included parental education classes on physical activity and nutrition as well as a parent support group in which parents discussed factors that challenged and facilitated positive dietary choices and exercise. There were significant increases from baseline to four-month assessment for vigorous physical activity in the intervention group and the effect was sustained at twelve months for vigorous physical activity. As compared to English speakers, Spanish-speaking students had significant increases from baseline to twelve months in vigorous physical activity.[24]

Next, the Dance Dance Revolution Program was implemented for 126 nine- to eleven-year-old children for nine months. The majority of the participants were from Latino immigrant families and came from economically disadvantaged families. The fourth graders were assigned to the intervention group, while the fifth graders were placed in the comparison group. The program was offered during three, 30-minute recess periods every week. The intervention was an interactive game; during this game participants moved their feet to a set pattern and step in time to the beat of a song. Findings indicated that the participants in the intervention reported significantly greater increases in self-efficacy for exercise, social support for engaging in exercise, and daily physical activity levels than the participants in the comparison group.[25]

To investigate the impact of Sports, Play, and Active Recreation for Kids - SPARK program on physical activity levels, Herrick and colleagues delivered the program for fifth grade students during after-school sessions. Results showed no difference between groups in change in minutes of MVPA. However, intervention

group perceived greater physical activity levels relative to their peers. The study also found that a lower physical activity levels among girls than boys.[26]

Kulinna and colleagues conducted a one-year comprehensive program involving classroom and physical education teachers to improve indigenous students' physical activity. Classroom teachers in the intervention group taught ten lessons that integrate physical activity - activity breaks for 3-10 minutes with academic content. The program resulted in physical activity increases for both intervention and comparison groups; no significant BMI changes were found. However, at post-test assessment, participants were approaching the minimum recommendation of 60 minutes of daily physical activity for youth.[27]

America SCORES, an after-school soccer program, was implemented for students (mean age of nine-years-old) during one academic year. The program used soccer games to engage youth in physical activity as well as promote youth positive development. Participants attended soccer practices for two hours on two weekdays. Additionally, soccer game days were organized on Saturdays for one hour each week. Results indicated that intervention group was involved in more MVPA during after-school sessions than comparison group. Overweight and obese participants were involved in less MVPA than non-overweight participants. However, among participants with a BMI at or above the 85th percentile at baseline participating in the program significantly increased MVPA after school and on Saturdays.[28]

Catch Kids Club Curriculum: an after-school enrichment program was developed with the support of National Heart, Lung, and Blood Institute focusing on nutrition and physical activity lessons. Results indicated that the proportion of participants who were overweight or obese showed a significantly greater decrease among the intervention group compared with the comparison group. However, there

were no significant differences between the intervention and comparison regarding physical activity outcomes.[29]

Dai and colleagues delivered Children's Healthy Eating and Exercise - CHEE program in an after-school program of elementary school. Participants in the intervention group attended 18 sessions, twice per week, during one semester. Every session contains forty minutes physical activity. Multiple physical activity components were utilized in the program, including soccer, jump rope, dance, basketball, and other interactive fun games. Results indicated that physical activity increases for both intervention and comparison groups. Most participants reported learned about new physical activity and the importance of regular physical activity engagement from the program.[30]

Project FIT, a social marketing program was implemented by Paek and colleagues to promote physical activity for primary school students and their parents. Social marketing components including branding - a Project FIT logo was used across all events and promotional items, price strategy, and promotion strategy - water bottles, stickers, jump ropes and so on were applied. Results suggest that Project FIT positively impacted participants' physical activity behaviors. A noteworthy finding was that without intervention provided during summer break, the regression effect occurred during time 2 and time 3. This indicated the importance of consistent intervention efforts in program to maintain participants' attention or interest in physical activity involvement.[31]

Sutherland and colleagues implemented a multicomponent intervention, guided by social cognitive and social-ecologic theories and utilized Health Promoting Schools Framework, consisted of seven physical activity strategies targeting curriculum, school environment, parents, and community. For example, teaching

student physical activity plans, and modifying school sport program, delivering recess/lunchtime activities, and disseminating parent newsletters etc. Participants in the intervention group demonstrated statistically significant increase for daily minutes of MVPA at 24-month follow-up assessment.[32]

Last, Okely and colleagues conducted, the Physical Activity among Linguistically Diverse Communities - PALDC study, a whole-of-school health promotion program for classroom teachers on improving primary students' fundamental motor skill. Results indicated that there was a significantly greater increase in total motor skill proficiency among participants in the intervention schools at follow-up assessment. The researchers suggested that classroom teachers can be trained to successfully impact their school's curriculum and environment to improve student physical activity levels.[33]

DISCUSSION

The purpose of this study was to examine the impact of school-based health education programs aiming to improve physical activity behaviors among school-aged students residing in low socioeconomic areas. Results presented in the review were selected to highlight interventions and findings from efficient programs. Specifically, findings suggest that school-based health education programs including components of culturally appropriate physical activity, parent involvement, and enhancing student motivation and choice of activities were potential factors that were related to higher physical activity levels among students from disadvantaged background. The programs reviewed implemented various activities of differing intensity levels that resulted in increased physical activity or improved BMI for participants, providing a

wealth of resources for health professionals interested in implementing evidence-based programs in schools.

Researchers found that school health programs implemented for students residing in disadvantaged neighborhoods reduced inequalities in physical activity.[34] However, improving knowledge of how programs work for females is another area for research. One program reviewed indicated that girls were less active in the beginning and in the end of the program compared to boys.[26] Among these thirteen studies, there was one program designed and implemented for girls only.[22] Female students often are involved in lower levels of physical activity compared to males.[35] Studies indicated that frequent neighborhood violent crime may reduce outdoor physical activity for adolescent living in urban areas.[36] Given that, being female, and residing in the disadvantaged area, may be at risk for becoming overweight or obese.[37] Another program indicated that boys tended to prefer involving in competitive games, while girls preferred other types of activities such as jump rope and dance.[30] Voskuil and colleagues reported that increase intervention attendance rates for girls should be of a focus to future physical activity intervention research.[38] Those findings highlighted the importance of providing the program with sex-appropriate physical activity components to ensure female involvement and retention.

Interestingly, three programs applied student input to design the intervention and/or allowed participants to choose the activities or sports equipment they prefer to engage in during program periods.[22,23.30] Participants in the aforementioned programs demonstrated improved physical activity behaviors or motivation to become involved in physical activity. Chen suggested that identifying aspects of physical activity that motivate children is a key factor in building an effective program.[17] Thus, we

conceptualized a “student-centered” approach in program design to be a protective factor leading to improved student involvement in physical activity.

Most programs reviewed were led or co-led by teachers or staffs in schools that provided positive personnel and adult supervision in physical activity. There are two programs included teacher input in program development.[27,33] Physical activity behavior modification takes time. Program involving school staffs may provide a positive impact on students’ levels of physical activity and continuous motivation to be physically active.

Another factor for an effective program may be parent involvement in the program. Four of the programs involved family members to reinforce lessons taught.[24,30-32] In these programs, physical activity behaviors for participants were increased. Another study reviewed,[31] researchers utilized social marketing components, for instance, branding and promotion strategies to promote physical activity for primary school students and their parents. This program demonstrated its positive impact on participants’ physical activity behaviors. This highlighted the importance of creating a culture of regular physical activity involvement to students’ health in future studies. Other ideas for improving knowledge about program impact including implemented for longer durations and with more frequent sessions for future programs.[39] Researchers and program leaders also should include behavior modification components, such as goal setting and self-motivation, to positively impact participants’ physical activity behaviors.[23,24]

IMPLICATIONS FOR SCHOOL HEALTH

Health education programs promoting physical activity are urgently needed in urban, low SES, minority communities. School involvement in physical education can

have a positive influence on physical activity for low-income children. For disadvantaged populations who are lacking resources to engage in physical activities or sports, school-based health education programs may increase access to physical activity. Family involvement in the intervention, in which parent and child exercise together or parents join classes, may improve children's motivation in physical activity behaviors. Engaging students in their preferred fun activities/sports may enhance their engagement in physical activity. Behavior change theories and strategies, such as goal setting and self-control, should be incorporated to the program to enhance physical activity behaviors. Finally, school-based health education programs aiming to improve physical activity levels of school-aged students should be of significant implementation duration and intensity to influence changes in students' physical activity behaviors.

To promote continuous motivation to be physically active among disadvantaged students, future school-based health education program targeting physical activity behaviors among disadvantaged students may include:

- Adopting comprehensive school health education program to create an environment promoting the importance of physical activity involvement
- Involving school staffs to provide a positive impact on students' physical activity involvement
- Engaging parent involvement in the program to reinforce lessons taught during the program
- Allowing students to choose the activities or sports equipment they prefer to engage in or including student input during program planning stage
- Including behavior modification components, such as goal setting and self-motivation to facilitate physical activity behavior change

- Providing consistent efforts in physical activity program implementation to maintain students' attention or interest in physical activity involvement

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Appendix

Table 1. School-Based Health Education Programs Impacting Physical Activity Behaviors for Disadvantaged Students

Author/ Years	Participants	Interventions/ Designs	Comparison Group	Outcomes
Lindgren et al., 2011	110 students aged 13-19 years (mean age = 15 years); enrolled in low socioeconomic status schools in Sweden.	The Exercise Intervention Program provided sessions twice weekly for 26 weeks (six months), and included exercise (45 minutes at a moderate level) and discussion (15 minutes). Cluster randomized controlled trial.	Did not participate in the intervention.	Both groups increased their level of physical fitness. Participants in intervention group had significant increase in general perceived self-efficacy.
Lubans et al., 2011	100 adolescent boys (mean age = 14 years); enrolled in low socioeconomic status schools in Australia.	Physical Activity Leaders program: a multi-component school-based intervention, and included school sport sessions, interactive seminars, lunch-time activities, physical activity, and leadership sessions for six months. Cluster randomized controlled trial.	Did not participate in the intervention.	For intervention group, significant effects were found for BMI and body fat, but not for waist circumference, muscular fitness or physical activity.
Wilson et al., 2011	1,563 six grade students (mean age = 11 years); majority of students were qualified for free or reduced lunch and enrolled in	Active by Choice Today Afterschool Program: basketball was played for three days a week for seventeen weeks. Each session	Participated in general education without a specific PA component.	Participants in the intervention group engaged in more moderate to vigorous PA per day.

	schools in the U.S.A.	lasted ninety minutes. Cluster randomized controlled trial.		
Wright et al., 2012	97 Mexican-American students aged 8-12 years with a BMI $\geq 85^{th}$ percentile; residing in low-income families in the U.S.A.	Kids-N-Fitness: included PA, nutrition education and family involvement and was implemented for six weeks (90 min / week) during afterschool sessions. Cluster randomized controlled trial.	Participated in general education.	There were significant increases from baseline to 4 months and at 12 months for vigorous daily PA in the intervention group. Spanish-speaking participants had significant increases from baseline to 12 months in vigorous daily PA as compared to English-speaking participants.
Gao et al., 2012	126 students aged 9-11 years; majority of students were from Latino immigrant families and from economically disadvantaged familie in the U.S.A.	Dance Dance Revolution: focused on body movement with the beat of song was implemented during three, thirty-minute recess periods weekly for nine months. Quasi-experiment design: - Intervention: Fourth grade - Comparison: Fifth grade	Participated in a conventional unstructured recess.	Participants in the intervention group reported significantly greater daily PA levels.
Herrick et al., 2012	100 fifth grade students; majority of students were	Sports, Play, and Active Recreation for Kids (SPARK)	Did not participate in the intervention	There was no difference between groups in mean change

	qualified for free or reduced lunch and enrolled in schools in the U.S.A.	program: 200 pieces of standard SPARK physical activity equipment was offered and implemented five days a week over 5 months during afterschool sessions. Quasi-experiment design: - Intervention: fifth graders from three schools selected by district - Comparison: fifth graders from other three schools (on waiting list) who will receive SPARK program until after the study period	(Students who were on the waiting list).	in MVPA. Participants' self-perceived physical activity levels relative to their peers did increase.
Kulinna et al., 2012	320 boys and girls aged 7-20 years (mean age = 10 years) from a single indigenous community in the USA.	Physical activities (activity breaks for 3-10 minutes) were infused into regular class: class teachers were provided with the Activity and Healthy Schools® classroom physical activity break cards. Quasi-experiment design: Participants were assigned into	Did not participate in the intervention.	Physical activity increases for both intervention and comparison groups. No significant BMI changes were found.

		intervention or comparison groups according to their teachers' interests in participating or not.		
Madsen et al., 2013	150 students aged 9-10 years; majority of students were eligible for free or reduced price meals from an urban school district in the U.S.A.	SCORES: a soccer program that was implemented three days per week during an afterschool program. Each lesson lasted for two hours. Cluster randomized controlled trial.	Did not participate in the intervention.	Participants in the intervention involved in more moderate to vigorous PA during afterschool.
Slusser et al., 2013	137 third to fifth grade students; enrolled in a school majority of students are from low-income families in the USA.	Catch Kids Club Curriculum: a 32-lesson after-school enrichment program focusing on nutrition and physical activity. Quasi-experiment design: Schools were assigned into intervention or comparison groups according to their after-school staffs' interests in participating or not.	Did not participate in the intervention.	The proportion of participants who were overweight or obese showed a significantly greater decrease among the intervention group compared with the comparison group. However, there were no significant differences between the intervention and comparison regarding physical activity outcomes.
Dai et al., 2014	57 students aged 5-10 years; enrolled in a school	Children's Healthy Eating and Exercise - CHEE program:	Participated in an afterschool art program.	Participants in the intervention did not show significant

	majority of students are from low-income families in the USA.	a variety of physical activities were provided for 18 sessions (twice a week) during afterschool sessions. Each session lasted 40 minutes. Quasi-experiment design: - Intervention: students who chose to participate in CHEE -Comparison: students who chose to participate in Art program provided by school		increase in physical activity compared to comparison. However, participants indicated new exercise learned and the importance of involvement in physical activity at the end of intervention.
Paek et al., 2015	664 third to fifth grades students; enrolled in low-income, urban and ethnically diverse elementary schools in the USA.	Project FIT: social marketing promotional items were distributed at school events at least twice per semester and cross local community for 2-year intervention period. Quasi-experiment design: -Intervention: four schools that participated for 2-year intervention period -Comparison: two schools that	With similar demographics without participating in the program for whole intervention period.	Project FIT awareness significantly and positively predicted total physical activity, percent achieving five days or more of physical activity/week.

		participated in the program for only one year		
Sutherland et al., 2016	1,150 seventh to ninth grades students; enrolled in schools located in disadvantaged communities in Australia.	The program, a multicomponent intervention, was guided by social cognitive and social-ecologic theories and utilized Health Promoting Schools Framework: seven physical activity strategies targeting curriculum, school environment, parents, and community. Cluster randomized controlled trial.	Participated in regular physical activity according to the school PE curriculum.	At 24-month follow-up assessment, participants in the intervention group demonstrated statistically significant increase for daily minutes of MVPA.
Okely et al., 2017	1,053 first to sixth grades students; enrolled in disadvantaged and culturally diverse areas in Australia.	Action learning framework - whole-of-school health promotion program for classroom teachers with each school developing and implementing an action plan for enhancing the teaching of fundamental motor skill. Quasi-experiment design: School allocation to intervention or control was done by the New South Wales	Continue with current PE programs.	There was a significantly greater increase in total motor skill proficiency among participants in the intervention schools at follow-up.

		Department of Education and Communities, independent of the research team, based on matched demographic variables between intervention and comparison schools.		