Published in final edited form as:

J Sch Nurs. 2012 August ; 28(4): 302–315. doi:10.1177/1059840512438777.

Pilot intervention to increase physical activity among sedentary urban middle school girls: a two-group pretest-posttest quasi-experimental design

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Abstract

The primary purpose of the study was to determine if girls in one school receiving nurse counseling plus an after-school Physical Activity Club showed greater improvement in physical activity, cardiovascular fitness, and body composition than girls assigned to an attention control condition in another school ($N = 69$). Linear regressions controlling for baseline measures showed no statistically significant group differences, but directionality of differences was consistent with greater intervention group improvement for minutes of moderate to vigorous physical activity/hour ($t = 0.95, p = .35$), cardiovascular fitness ($t = 1.26, p = .22$), body mass index (BMI; $t = -1.47, p = .15$), BMI z -score ($t = -1.19, p = .24$), BMI percentile ($t = -0.59, p = .56$), percent body fat ($t = -0.86, p = .39$), and waist circumference ($t = -0.19, p = .85$). Findings support testing with a larger sample.

INTRODUCTION

Current United States (U.S.), health-related, youth physical activity recommendations call for at least one hour everyday with most of the time being spent engaging in moderate to vigorous physical activity (MVPA; U.S. Department of Health and Human Services [USDHHS], 2008). Only 3.4% of girls in middle and early high school meet the recommendations (Troiano et al., 2008). MVPA declines 4% among girls between 6th- to 8th-grades, with disadvantaged minorities in urban areas being particularly at risk (Pate et

DECLARATION OF CONFLICTING INTERESTS

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

al., 2009; Wang et al., 2007; Wilson, 2009). Increasing MVPA in this population is a vital public health priority (Eaton et al., 2010).

Adolescent MVPA is negatively associated with girls' body mass index (BMI) and adiposity (Kimm et al., 2005). Overweight or obese adolescent girls are at greater risk for health issues, such as high blood pressure and lipid levels (Freedman, Mei, Srinivasan, Berenson, & Dietz, 2007). Many will become overweight or obese adult women (Serdula et al., 1993) at risk for premature mortality (van Dam, Willett, Manson, & Hu, 2006). Intervention prior to high school is critical because, by 9th-grade, over 25% of adolescent girls are already overweight or obese (Eaton et al., 2010).

Targeted at racially diverse, sedentary, urban middle school girls, the six-month study intervention, called 'Girls on the Move', included three motivational, individually tailored counseling sessions with a school (registered) nurse and an after-school Physical Activity Club. The primary purpose of the study was to determine if girls in one school receiving the intervention showed greater improvement in measures of physical activity, cardiovascular fitness, and body composition than girls assigned to an attention control condition in another school. As a part of this exploration, cognitive and affective variables related to physical activity were also investigated (e.g., perceived benefits of physical activity; perceived barriers to physical activity; physical activity self-efficacy; and interpersonal influences, including social support, interpersonal norms, and exposure to models of exercise; and enjoyment of physical activity).

BACKGROUND

Schools have become the focal point for interventions to increase adolescent physical activity. Although physical activity during the school day is important, students' academic achievement demands limit the amount and quality of physical activity. For example, physical education (PE) class provides only 8 – 11% of students' daily physical activity (Tudor-Locke, Lee, Morgan, Beighle, & Pangrazi, 2006). Clearly, innovative approaches must either minimize school day time requirements or involve after-school programming (Yin et al., 2005). Decreasing negative perceptions regarding physical activity is essential for participation, and after-school physical activity may be a particularly palatable option for girls, some of whom opt out of PE (Schofield, Mummery, & Schofield, 2005) due to concerns about sweating during the school day (Taylor et al., 1999). Although after-school interventions offer a promising approach, evidence supporting their effectiveness for increasing physical activity is mixed (Barbeau et al., 2007; Robinson et al., 2003, 2010; Story et al., 2003), and those designed for girls exclusively remain limited, despite being identified as important for meeting girls' needs (Debate, Pettee Gabriel, Zwald, Huberty, & Zhang, 2009).

Because individual thoughts and feelings about physical activity can influence girls' engagement in the behavior, a group- or environmental-level intervention alone, although important, may be insufficient for addressing unique personal perceptions relative to physical activity or increasing personal motivation to engage in or continue the behavior (Summerbell et al., 2005). This contention is supported by a recent large-scale intervention study linking schools to community organizations that yielded no differences in MVPA between racially diverse girls in middle schools receiving the intervention and those in control schools after two years and only modest between-group differences after three years (Webber et al., 2008).

Attending to individual-level needs may offer a compelling strategy for enhancing intervention efficacy. Individualized counseling has been identified by high school girls in PE classes as necessary for helping them to increase their physical activity (Neumark-

Sztainer, Martin, & Story, 2000). Individualized counseling tailored to personal characteristics, such as those reported on a questionnaire, has been found to be more effective in changing behavior than a “one size fits all” approach (De Bourdeaudhuij et al., 2010; Kreuter, Farrell, Olevitch, & Brennan, 2000). Motivational interviewing, a counseling method that allows for individual tailoring, employs an empathetic communication style supportive of adolescent autonomy (Naar-King & Suarez, 2011). In large-scale investigations, nurse-delivered motivational interviewing during school has been found to be efficacious in improving other adolescent behaviors (Hamilton, Cross, Resnicow, & Hall, 2005; Hamilton, Cross, Resnicow, & Shaw, 2007).

To address girls’ low physical activity levels, school-based interventions that incorporate individual-level theory for promoting positive behavioral change (Marcus et al., 2006) along with opportunities for physical activity enactment appear promising. Yet, a need exists to implement and evaluate these multi-component approaches (Debate et al., 2009). To our knowledge, no other intervention has directly involved school nurses in providing motivational, individually tailored counseling to promote MVPA among middle school girls.

In order to obtain preliminary evidence of efficacy, the study primarily aimed to answer the following research question: Compared to girls assigned to the attention control condition, do girls receiving the ‘Girls on the Move’ intervention show greater improvement in minutes of MVPA per hour, cardiovascular fitness, and body composition measures (e.g., BMI, percent body fat, and waist circumference)? In addition, the study explored the role of cognitive and affective variables related to physical activity by: (a) determining if girls in the intervention group showed greater improvement in these variables than those in the attention control condition; and (b) examining these variables as mediators in the event of a statistically significant intervention effect.

METHOD

Design and Sample

This pilot employed a two-group pretest-posttest quasi-experimental design, with two middle schools from the same urban school district in the Midwestern U.S. randomized to each condition (Killen & Robinson, 1988). The sample size requirement was based on power calculations for school-based research (Murray, 1998) and calculated using MVPA as the primary outcome. Power calculations used estimates of variance components and within groups correlation (ICC) from the Trial of Activity in Adolescent Girls (TAAG; Murray et al., 2006), an intervention study with a similar population. An effect size of 0.5 was chosen. Using an estimate of the variance of MVPA from TAAG ($SD = 11.7$ minutes per day, based on an 18-hour day), this effect size corresponds to 5.85 minutes per day or 0.33 minutes per hour of MVPA, a reasonable estimate given the accumulation of MVPA afforded by the design of the intervention (described below). Sample size requirements allowed for 20% attrition (Luepker et al., 1996; Stevens et al., 2005; Yin et al., 2005) and reflect adjustment for estimated baseline accelerometry measures and race/ethnicity. For power of .8, a two-tailed alpha of .05, and ICC of 0.002, we determined that 35 girls per middle school would be recruited ($N = 70$).

Prior to recruitment, the school district and University Biomedical Institutional Review Board Human Subjects Protection Program provided approval to conduct the study. In spring 2009, 259 girls from 11 elementary schools and two middle schools were invited to participate in the study during the next school year. Researchers and trained research assistants visited girls during their classes or lunch time at school to distribute envelopes containing a flyer about the study, a letter to inform parents/guardians, assent and parent/guardian consent forms, and a screening tool to be used for determining eligibility. The girls

were told if they were interested in participating to return the completed forms in the envelope provided to a box placed in the main school office or to the school nurse.

Girls who met the following inclusion criteria were included: (1) did not meet national MVPA recommendations; (2) were available and willing to participate for 6 months; and (3) were able to read, understand, and speak English. Exclusion criteria included: (1) participating in school or community sports, or other organized physical activities or lessons that involved MVPA and required participation three or more days per week during the school year; and (2) having a health condition limiting safe MVPA. A total of 77 girls, who had planned to enter 6th- or 7th-grade in one of the two middle schools at the start of the next school year, returned completed forms and met eligibility criteria. Seventy-four of the 77 girls completed pre-baseline data collection in the spring 2009. Following the pre-baseline data collection but prior to the summer break, the schools were randomized to treatment status to allow for advance planning by school principals and parents/guardians (Barbeau et al., 2007).

Although all 74 girls indicated on the screening tool that they would be attending one of the two middle schools the following school year, only 57 girls actually attended in the fall 2009. To address this reduction, additional 6th- and 7th-grade girls were invited to participate. The invitation was issued at each middle school as an announcement over the intercom system by the school nurse. Of the 26 girls who responded to the invitation and obtained packets from the school nurse, 16 returned completed forms and met eligibility criteria, resulting in 73 girls providing baseline data in fall 2009. Of these, 69 girls provided post-intervention data (see Figure 1 for recruitment and retention details).

Design of the intervention was based on the Health Promotion Model (Pender, Murdaugh, & Parsons, 2006; 2010). This model indicates that the following cognitive and affective variables can influence physical activity: perceived benefits of physical activity; barriers to physical activity; physical activity self-efficacy; interpersonal influences, including social support, interpersonal norms, and exposure to models of exercise; and enjoyment of physical activity. The intervention involved two components: 1) a 90-minute after-school Physical Activity Club offered at the middle school five days a week for six months (total of 98 sessions) and 2) a face-to-face motivational, individually tailored counseling session with a registered (school) nurse during the school day every other month over the six months (total of three 20-minute sessions were planned). The counseling sessions the girls had with the nurse occurred during the school day to capitalize on required school attendance. The counseling sessions were designed to assist the girls in internalizing the need to increase their MVPA (Resnicow, Davis, & Rollnick, 2006) and overcoming negative issues (e.g., another girl in the Physical Activity Club made rude comment).

The attention control condition involved two components: 1) a 90-minute after-school workshop once a month for six months (total of six workshops) and 2) a face-to-face session with a registered (school) nurse during the school day every other month over the six months (total of three 20-minute sessions were planned). Each workshop focused on one of the following health-promoting topics: 1) caring for my body; 2) fashion, hair and nail tips; 3) sun and food safety; 4) healthy relationships and friendship; 5) building self-esteem; and 6) career exploration. The same workshop was offered on two consecutive days each month to enhance the opportunity for participation. Each session with the nurse included a discussion of two of the six topics.

Measures

Demographic variables—Age, academic grade, and race were measured using single multiple-choice items. SES was coded as ‘1’ if parents/guardians indicated on consent forms that their daughter participated in the free and reduced lunch program and ‘0’ otherwise.

Cognitive and affective variables related to physical activity

Perceived benefits of and barriers to physical activity: Perceived benefits, the personal reasons for being active, were measured as the mean response to the 12-item Perceived Benefits Scale (Robbins, Wu, Sikorskii, & Morley, 2008). Perceived barriers, problems that prevented each girl from engaging in MVPA, were measured as the mean response to the 17-item Perceived Barriers Scale (Robbins et al., 2008). Each item had four response choices ranging from (1) not at all true to (4) very true. Construct validity has been demonstrated with a comparable sample (Robbins et al., 2008). In this study, Cronbach’s alpha coefficient was .85 and .88 at baseline and .84 and .86 at post-intervention for the Perceived Benefits and Barriers Scales, respectively.

Perceived physical activity self-efficacy: Confidence in overcoming barriers to physical activity (e.g., I’m sure that I can still do my exercise even if I am tired) was measured as the mean response to the 17-item Perceived Physical Activity Self-Efficacy Scale. Each item had four response choices ranging from (1) not at all true to (4) very true. Construct validity has been established with a comparable age group (Wu, Robbins, & Hsieh, 2011). In this study, Cronbach’s alpha coefficient was .91 at baseline and .92 at post-intervention.

Interpersonal influences: Girls selected three people (from a list) whom they perceived as helping them the most to be physically active. *Social support* was determined by how often the girls indicated that each of the three people did certain tasks to assist the girls with their physical activity (Robbins, Stommel, & Hamel, 2008). For *interpersonal norms*, each girl reported how often each of the three people let her know in some way that she needs to exercise or be active. *Exposure to models of exercise* was determined by how often each helpful person did MVPA. Responses choices were: (0) not at all, (1) a little, (2) sometimes, or (3) a lot. Scores for each of the three scales were summed. Higher values indicate greater social support, norms, and models. Similar scales have been used in prior studies (Prochaska, Rodgers, & Sallis, 2002; Robbins, Gretebeck, Kazanis, & Pender, 2006) and have shown evidence of reliability and validity.

Enjoyment of physical activity: A 16-item Physical Activity Enjoyment Scale (Kendzierski & DeCarlo, 1991) has demonstrated construct validity for use with adolescent girls (Motl et al., 2001). Enjoyment of physical activity was measured as the mean response to a subset of six items (selected to decrease questionnaire length and eliminate items with double negatives). Response choices for the items ranged from (1) not at all true to (4) very true. Cronbach’s alpha coefficient was .78 at baseline and .81 at post-intervention.

Physical activity, cardiovascular, and body composition

Minutes of MVPA per hour: The Actigraph GT1M, a small, lightweight accelerometer (www.theactigraph.com; Trost, McIver, & Pate, 2005) was used to measure acceleration counts. This instrument has been demonstrated to be reliable and valid for assessing MVPA (Trost et al., 1998). Minutes of MVPA were estimated from the acceleration counts recorded using a procedure developed at the University of North Carolina (Catellier et al., 2005) that was implemented using the Statistical Analysis System (SAS) programming language, Version 9.2, for Windows (SAS Institute Inc., 2009). Data were collected and stored in 30-second intervals (Treuth et al., 2004) to match previous investigations (Webber et al., 2008).

Count thresholds created for use with middle school girls were used for moderate (1500–2600 counts/30 seconds) and vigorous physical activity (>2600 counts/30 seconds). The accelerometry count cut point for moderate intensity physical activity (1500 counts/30 seconds) corresponded to 4.6 metabolic equivalents or METs (1 MET = 3.5 ml of oxygen/kg of body weight/minute or resting metabolic rate), which was used in a previous study and discriminated between slow and brisk walking among middle school girls (Treuth et al., 2004). Thirty-second increments with counts at or above 1500 were summed from 6 A.M. to midnight to determine minutes of MVPA (Treuth et al., 2004). Data were excluded if the monitor was taken off during waking hours as indicated by 20 or more consecutive minutes of continuous zeros (Treuth et al., 2003). Participants with acceptable data from at least eight hours per day on four or more days (including at least one weekend day) were included in the analysis (McMurray et al., 2004). To account for variable wear time, average minutes of MVPA per hour across all valid days were determined.

Cardiovascular fitness: Progressive Aerobic Cardiovascular Endurance Run (PACER), 20-meter shuttle run, was used to evaluate aerobic capacity and cardiovascular endurance. This measure was recorded as the number of 20-meter laps a participant could run from one line to another on a flat surface until she could no longer keep up the pace (Meredith & Welk, 2007).

BMI and percent body fat: Height without shoes was measured to the nearest .1 centimeter (cm) with a Shorr Board (Shorr Productions, Olney, MD). Weight was assessed in kgs to the nearest .1 kg and percent body fat to the nearest .1% was measured using a foot-to-foot bioelectric impedance scale (Tanita Corporation, Tokyo, Japan). BMI was calculated using the averages of two height and weight assessments. Z-scores for BMI and BMI percentiles for age were determined using *A SAS Program for the Centers for Disease Control and Prevention (CDC) Growth Charts*, available online from the National Center for Chronic Disease Prevention and Health Promotion.

Waist circumference: Measurement was performed at the superior border of the iliac crest twice with a tape measure to the nearest .1 cm (National Center for Health Statistics, 1996). If the two measures varied by > 1 cm, the process was repeated. Waist circumference was the average of all measurements (Resnicow, Taylor, Baskin, & McCarty, 2005).

Procedure

Prior to the intervention, school nurses and research staff were trained. School nurses completed two days of training conducted by the first author and a project consultant who was also a member of the Motivational Interviewing Network of Trainers. Training was comprised of didactic contact, demonstrations, and role-playing. Opportunities for the nurse to practice and receive feedback from the first author and consultant continued until both agreed that the nurse satisfactorily addressed all cognitive and affective variables, while demonstrating the motivational interviewing communication style and strategies. All staff members completed two days of training on physical activity, cardiovascular fitness, and body composition measurement.

Assisted by the school nurse at each school, the project manager scheduled data collection times for each girl during the school day. At baseline, trained research assistants escorted small groups of participants in each school from their classrooms to the library, where members of the research team explained the study and related procedures, and each girl completed the questionnaire via paper and pencil. Then, the first author created two identical computer printouts summarizing each intervention school girl's key responses to the baseline questionnaire (e.g., based on mean scores or sums associated with the instruments

measuring cognitive and affective variables). Research assistants placed these printouts into a folder, which was locked in a file cabinet in the school nurse's office for use by the nurse during the initial counseling sessions. The same procedure was followed shortly after the midpoint of the intervention, except girls were escorted to the computer laboratory in each school, and printouts were generated by computer for use by the nurse during the third counseling session. At post-intervention, girls completed the questionnaire via paper and pencil. At baseline and post-intervention, cardiovascular fitness and individual body composition measures were obtained on all participants in the gym or a private area in the nurse's office or school.

Measurement of MVPA via accelerometers was conducted over a week's time at baseline and post-intervention. Accelerometers were initialized and set to begin data collection at 5:00 A.M. on the day after they were distributed to girls at school. Documentation, instruction, and reminders to support the measurement of MVPA were provided at various times during the study. To remind the girls to wear the accelerometers, each received two flyers to display at home with magnets for posting, a luggage tag to put on their backpacks, and a wrist bracelet. Researchers showed the girls an example of output so girls could see that the researchers could tell when the monitor was not being worn. The researchers provided written instructions and told the girls to wear the accelerometer on their right hip (attached to a belt) from the time they got out of bed in the morning to the time they returned to bed to sleep at night for seven consecutive days, but not while bathing or swimming. Girls were told to return the monitors at school during the afternoon after the seventh day of data collection (Troost et al., 2005). The researchers contacted all parents/guardians by phone on the day that each girl received the monitor and again on days three and seven to remind them about the need for their daughter to wear it.

Each Physical Activity Club session was to include a five-minute warm-up including stretching; 60 minutes of MVPA; a five-minute cool-down including stretching; and 20-minute group discussion on healthy eating and physical activity one day per week. After completing the discussion of the week, girls were able to use the 20-minute period for homework. A healthy snack (e.g., fruit, vegetable, smoothie, low-fat cheese or yogurt) was served at each session. The Physical Activity Club instructors encouraged the girls to exercise at their own pace, but to increase the intensity over time, and engage in MVPA on their own outside the club.

Three counseling sessions with the school nurse were scheduled for each girl. During the first and final counseling sessions, the nurse used information gleaned from the questionnaires completed by a girl (assessing MVPA and all cognitive and affective variables) to tailor the counseling and stimulate the discussion with her (baseline measures during the first session; both baseline and post-midpoint-of-the-intervention measures at the final session). During the second session (at three months), the nurse explored each girl's physical activity self-efficacy and perceived importance of increasing her MVPA (motivational interviewing strategy). At the end of the final counseling session, the nurse encouraged each girl to continue her MVPA after the intervention ended and explored ways to accomplish the task.

Data Analysis

Data were analyzed using Statistical Package for Social Sciences (SPSS) Predictive Analytic Software (PASW) Statistics for Windows, Version 18.0.2. (SPSS Inc, Chicago, IL). Data from all participants completing the study were analyzed with an intention to treat approach. The effect introduced by the clustering of girls within schools was examined by estimating population within and between group variances; the estimated between-group variance was a

small negative number (-0.0156) that was subsequently set to zero (Snijders & Bosker, 1999), thus eliminating the need to correct standard errors for clustering.

Pearson chi-square analyses for categorical variables and independent sample t-tests for continuous data were conducted to test for baseline group differences in demographic variables. Independent sample t-tests were used to determine group differences at baseline and six months in measures of physical activity, cardiovascular fitness, and body composition; and cognitive and affective variables related to physical activity. Linear regression analyses were performed to assess intervention effects on these outcome measures at six months. All regression analyses controlled for baseline measures. In the event of a statistically significant intervention effect, the plan was to explore the role of cognitive and affective variables related to physical activity as mediators. Listwise deletion was used to address missing data in all models.

Results

Intervention delivery—The Physical Activity Club was conducted over 24 weeks; but, due to several no-school days, girls had the opportunity to attend on 98 different days, resulting in the club being available on average 4.1 days per week during the intervention. The 37 girls in the intervention group attended an average of 1.6 days per week. Table 1 includes additional information on intervention dose as measured by Physical Activity Club attendance.

All but three girls attended every counseling session. Three girls missed the first counseling session due to low attendance at school or recurring scheduling issues, but attended all remaining sessions. Findings related to treatment fidelity of motivational interviewing delivered by the school nurse are reported elsewhere (Robbins, Pfeiffer, Maier, LaDrig, & Berg-Smith, 2011).

Group comparison on demographic variables at baseline—Intervention and control groups were comparable with regard to all demographic measures except race (see Table 2). The intervention group had fewer White and more Black participants than the control group (Fisher's exact $\chi^2(4) = 12.00$, $p = .01$, Cramer's phi = 0.42). The compositions of the intervention and control groups were comparable for participants of other races.

Group comparison on cognitive and affective variables at baseline and six months—No statistically significant between-group differences were found for any cognitive and affective variables related to physical activity at either baseline or six months (see Table 3).

Group comparison on physical activity, cardiovascular fitness, and body composition at baseline and six months—At baseline, those in the control group had a higher number of minutes of MVPA per hour (measured by accelerometer; 1.08 vs. 0.69; $t[19.71] = 2.24$, $p = .037$, $d = 1.01$) and greater cardiovascular fitness (14.10 vs. 10.50; $t[49.49] = 2.22$, $p = .031$, $d = 0.63$) than those in the intervention group (see Table 4). Analysis of MVPA was limited in that only 18 of 37 (56.3%) participants in the intervention group and 12 of 32 (37.5%) in the control group provided at least four days of complete accelerometer data at both baseline and six months. In the intervention group, seven participants provided only baseline data, one had only six-month data, and 11 failed to provide any data at either time period. Missing data were also problematic in the control group with five participants having only baseline data, six providing only six-month data, and nine having no data at either baseline or six months.

Intervention effect on physical activity, cardiovascular fitness, and body composition at six months—Although no statistically significant between-group differences in primary or secondary outcomes were found, all differences were in the expected direction with the intervention group having slight improvement in minutes of MVPA per hour, cardiovascular fitness, BMI, BMI Z-score, BMI percentile for age, percent body fat, and waist circumference, as compared to the control group (see Table 5). Based on the covariate-adjusted standardized regression coefficients of intervention effect on outcomes, the primary outcome, minutes of MVPA per hour, showed the largest difference. The effect size for the difference in change between the intervention and control groups is 0.34 (effect size is adjusted for the correlation between the baseline and post-intervention MVPA measurements). Because the intervention effect was not statistically significant for any of these outcomes, the mediational role of the cognitive and affective variables was not examined. Missing data levels exceeded the pre-specified 20% estimate, resulting in smaller than anticipated sample sizes. The model for minutes of MVPA per hour had the smallest number of complete cases with 30 girls (intervention $n = 18$; control $n = 12$) providing adequate accelerometer data. Due to the variability of Physical Activity Club attendance, differences in primary and secondary outcomes by dosage were examined. No statistically significant differences were found, but it is important to note that the original study design did not include an examination of dosage effect nor did the intervention group sample size provide adequate power to detect dosage effect on outcome differences.

Intervention effect on cognitive and affective variables at six months—No statistically significant between-group differences occurred. As noted in Table 5, the sample size of girls providing complete data at both baseline and six months for each instrument measuring a cognitive or affective variable varied with a range from only 55 to 67.

DISCUSSION

The study was designed to test a multi-component physical activity intervention with middle school girls. Recruitment goals were met with 38 in the intervention and 35 in the control school completing baseline measures. Only one girl in the intervention school and three girls in the control school were unable to complete the 6-month measures due to family relocation to a different geographical area. Although the intervention group had a greater number of Black girls and fewer White girls than the control group, the sample in each school was racially diverse and of low SES with over 75.0% participating in the free and reduced lunch program.

All three counseling sessions were completed by 91.9% of the girls in the intervention group, but attendance at the Physical Activity Club was less than anticipated. With only seven girls having an average weekly Physical Activity Club attendance of three or more days a week, most girls may have received an inadequate intervention dose, which may have contributed to the lack of significant between-group differences in the outcome variables. The major barrier to attendance reported to the school nurse was lack of transportation home following the club. Lack of transportation has been identified as a “formidable” obstacle that prevents girls from participating in after-school physical activity programs (Robinson et al., 2003, 2008). Robinson and colleagues (2003) found that when transportation was not provided, only 33% of girls attended dance classes two or more days a week, whereas when it was available, the percentage rose to 70%. The need for transportation was addressed in another study, in which school buses transported girls, ages 8 to 12, home following an after-school program. For girls that continued in the program during the summer, buses brought them from their home to the program and then back home after the program. Attendance averaged slightly over 2.5 days per week (Barbeau et al., 2007). This information underscores the need to consider transportation when planning after-school

programs for girls. In this study, transportation home following some after-school activities, including the Physical Activity Club, was supposed to be provided by school district buses. However, this provision never materialized until after the club had ended.

Similar to other study findings related to psychosocial constructs (Robinson et al., 2003; Story et al., 2003; Weintraub et al., 2008), no improvement in the cognitive and affective variables occurred as a result of the intervention, as compared to the control group. Some researchers indicate that simply giving consent or assent to participate in a study may lead to heightened awareness of the targeted behavior and what related survey responses are socially desirable, even when participants are randomized to a control condition (Luepker et al., 1996). Lytle and colleagues (2009) found via mediation analysis that girls involved in a physical activity intervention rated their physical activity self-efficacy and social support to be lower and certain barriers to physical activity to be higher than girls in the control condition. To explain these unanticipated findings, Lytle et al. proposed that, as girls attempted to increase their physical activity, they became more attuned to factors that interfered with their ability to achieve this objective. One problem faced by several girls in the intervention group, similar to what was noted in this study, was a lack of transportation home following the activity. So, even if interested, the girls could not participate. As a result, they may have become more aware of their limited resources, which, in turn, may have negatively influenced their perceptions.

Perhaps, the intervention's inability to attain a sufficient magnitude of desirable change in the cognitive and affective variables limited its capacity to significantly improve MVPA. As noted by several researchers, additional work is needed to develop strategies capable of producing positive change in variables proposed as important mediators of behaviors, such as physical activity (Reynolds, Yaroch, Franklin, & Maloy, 2002; Spruijt-Metz, Nguyen-Michel, Goran, Chou, & Huang, 2008). Findings that the intervention group showed a trend toward greater improvement in the physical activity, cardiovascular fitness, and body composition measures of interest, as compared to the control group, are promising. The lack of significant between-group differences is not surprising in lieu of that fact that no changes first occurred in the cognitive and affective variables. According to the Health Promotion Model (Pender et al., 2006, 2010), improvement in the mediating variables is essential for positive change in the target behavior. Because the intervention was conducted only once, we were not able to use process evaluation information to enhance subsequent program implementation.

To target factors contributing to girls' lower physical activity levels, as compared to boys, after-school programs designed exclusively for girls are recommended (Debate et al., 2009). Because research on these programs is limited, strategies that best promote physical activity among girls still need to be identified in well-controlled studies (Pate & O'Neill, 2009).

Strengths and Limitations

This pilot study successfully demonstrated not only the feasibility of implementing a physical activity program after school but also the value of involving a school nurse in the delivery of motivational interviewing. Efforts to recruit and retain an adequate number of racially diverse girls were successful. The use of accelerometers was another notable strength; however, non-compliance with accelerometer wear resulted in a sample size that was too small for adequate power to detect significant between-group differences. Although our team employed multiple strategies to encourage girls to wear the accelerometers, including asking girls to re-wear them if they did not achieve enough days with acceptable data, non-compliance continued to be a problem for various reasons (e.g., monitor forgotten, misplaced, or uncomfortable around waist). To improve compliance in future investigations,

incorporating separate incentives tied only to monitor wear together with daily reminder phone calls may be warranted.

Besides strengths, some weaknesses were evident. Because the girls volunteered to participate, generalizability of the results is limited. Although promoted for increasing adolescent physical activity (van Sluijs, McMinn, & Griffin, 2007), a multi-component approach interferes with the ability to specifically identify which components are effective. Due to budgetary constraints and our decision to use resources to strengthen the intervention, the attention given to each group did not match. Because many girls in this study expressed their interest in engaging in only fun-filled, non-didactic after-school programs, we expect that matching on attention in a control school offering that does not involve enjoyable physical activity will result in major recruitment, retention, and attendance challenges in future studies.

IMPLICATIONS FOR SCHOOL NURSING PRACTICE

As one means for curtailing the adolescent overweight and obesity problem, comprehensive interventions are needed to assist middle school girls in achieving MVPA recommendations. Because girls of this age spend a substantial portion of their time during the week at school, the setting is optimal for promoting the establishment of behaviors that are consistent with a healthy lifestyle. In fact, several renowned organizations, including the CDC (2008), the Institute of Medicine (2006), and the National Association of School Nurses (2010), have called on schools to intensify their overweight and obesity prevention efforts. In this study, the school provided a safe venue for the girls' physical activity. Process evaluation indicated that a majority of girls found the intervention favorable and helpful. We did not add a major parental component, because, in prior research, we experienced little success trying to engage parents/guardians, even on a minimal basis. However, the school nurse did contact all parents/guardians by phone at the beginning of the intervention to encourage them to support their daughter's physical activity. In future studies, we plan to continue this approach to initiate communication between parents/guardians and the school nurse.

Because school nurses are well-recognized as professionals who deliver the majority of school health services, they are well-positioned for direct involvement in school-based prevention-oriented intervention programs, such as those targeting inadequate MVPA among adolescent girls. School nurses can counsel girls to increase their MVPA by exploring girls' personal perceptions related to MVPA and providing support for behavior change.

To achieve this objective, however, school nurses must be given the opportunity to undertake training to acquire the skills and confidence necessary for motivating girls to change their behavior. Use of a consistent, evidence-based, and empathetic approach, such as motivational interviewing, in counseling sessions is important for establishing trust and promoting open communication so girls will attend and participate, as noted in this study.

Although direct involvement of the school nurse as an interventionist is important, the complexity of the overweight and obesity problem requires the school nurse to assume other prominent roles. The school nurse can lead school-wide intervention programs and model healthy behaviors (e.g., MVPA). To ensure comprehensiveness, the school nurse can coordinate and integrate overweight and obesity prevention programs and collaborate with key individuals, including school administrators; physical education teachers and other school faculty and staff; after-school program coordinators, coaches, and physical activity instructors; parents/guardians; leaders and influential members of the community; policymakers; and other health professionals. The school nurse must be prepared to educate these individuals about the overweight and obesity problem; current policies and practices in

the school district; and student needs, opportunities, and obstacles related to its prevention or management. Advocacy efforts need to be directed toward resource allocation to provide adequate training, time, and staff for delivering a comprehensive, well-coordinated, and high-quality school-based intervention (Morrison-Sandberg, Kubik, & Johnson, 2011).

CONCLUSION

Structured after-school programs conducted in schools afford students an opportunity to engage in enjoyable physical activities with peers in a supportive setting perceived by parents/guardians as being safe and having positive role models (Pate & O'Neill, 2009). While the intervention effect in this pilot study was non-significant in the statistical model, its directionality, along with the positive gain related to the effect size, lends support for continued evaluation of the intervention with a larger sample of girls. Our results are encouraging, but suggest that some refinement in certain areas is needed based on the lessons learned from this small-scale study.

Acknowledgments

The authors would like to thank Dr. Robert McMurray, Professor, University of North Carolina, for conducting two days of training in measuring physical activity, cardiovascular fitness, and body composition. We would also like to acknowledge Mr. Steven Malcolm Berg-Smith, member of the Motivational Interviewing Network of Trainers, for conducting training sessions in motivational interviewing for the project staff and school nurse. The authors appreciate the support received from school administrators, nurses, teachers, after-school program coordinators, and other staff during the time of the research study. We are also grateful for the effort expended by Michigan State University undergraduate and graduate nursing and kinesiology students to assist us with data collection.

FUNDING

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The study was made possible by Grant Number R21HL090705 from the National Heart, Lung, and Blood Institute (NHLBI) at the National Institutes of Health (NIH); PI: L. B. Robbins. The content of this publication is solely the responsibility of the authors and does not necessarily represent the official views of the NHLBI or NIH. The "Middle School Physical Activity Intervention for Girls" study was also funded by the Michigan State University (MSU) College of Nursing and MSU Families and Communities Together Coalition. The funding bodies did not have a role in or influence the various phases of the project, the writing of the manuscript, or the decision to submit it for publication.

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Figure 1.
Flow diagram of participant recruitment and retention

Table 1

Intervention Dose: Number and Percentage of Girls Attending Physical Activity Club Based on Mean Number of Days Per Week (n = 37 in Intervention Group)

Mean Number of Attendance Days Per Week	n (%)
Never Attended	2 (5.4)
Fewer Than 1 Day Per Week	11 (29.7)
1 – 2.99 Days Per Week	17 (46.0)
3 Or More Days Per Week	7 (18.9)

Table 2Frequencies and Means of Baseline Demographic Variables (*N* = 69)

Variable	Control (<i>n</i> = 32)	Intervention (<i>n</i> = 37)	χ^2
	<i>n</i> (%)	<i>n</i> (%)	
Grade			0.15
6 th	23 (71.9)	25 (67.6)	
7 th	9 (28.1)	12 (32.4)	
Race			12.00 **
Non-Hispanic Black	11 (34.4)	24 (64.9)	
Hispanic Black	2 (6.3)	4 (10.8)	
Non-Hispanic White	13 (40.6)	3 (8.1)	
Hispanic White	4 (12.5)	5 (13.5)	
Non-Hispanic Other	2 (6.3)	1 (2.7)	
Hispanic Other	0 (0.00)	0 (0.00)	
Free-reduced lunch			0.00
Yes	25 (78.1)	28 (75.7)	
No	6 (18.8)	7 (18.9)	
Missing	1 (3.1)	2 (5.4)	
Variable	Mean (SD)	Mean (SD)	<i>t</i>
Age (min – max = 10 – 14 years)	11.44 (0.67)	11.49 (0.84)	–0.27

**
p .01.

Table 3

Means of Cognitive and Affective Variables at Baseline and 6 Months

Variable	Baseline				6 Months				Change	
	Control		Intervention		Control		Intervention		Control	Intervention
	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n	Mean (SD)	n		
Benefits of Physical Activity	3.35 (0.47)	n = 31	3.49 (0.47)	n = 37	3.33 (0.65)	n = 32	3.35 (0.55)	n = 36	-0.01 (0.76)	n = 31
Barriers to Physical Activity	2.05 (0.54)	n = 31	2.30 (0.71)	n = 37	2.19 (0.56)	n = 32	2.32 (0.58)	n = 35	0.10 (0.62)	n = 31
Physical Activity Self-Efficacy	3.23 (0.54)	n = 31	3.16 (0.68)	n = 37	3.07 (0.69)	n = 32	2.99 (0.63)	n = 35	-0.11 (0.73)	n = 31
Enjoyment of Physical Activity	3.31 (0.60)	n = 31	3.18 (0.69)	n = 37	3.06 (0.73)	n = 32	2.86 (0.71)	n = 35	-0.21 (0.72)	n = 31
Social Support	33.58 (19.01)	n = 31	41.36 (20.12)	n = 36	39.73 (20.02)	n = 30	39.68 (19.12)	n = 28	6.90 (22.63)	n = 30
Interpersonal Norms	6.23 (2.22)	n = 30	6.73 (1.85)	n = 37	6.71 (2.05)	n = 31	6.46 (2.15)	n = 33	0.62 (2.27)	n = 29
Exposure to Models of Exercise	5.30 (2.67)	n = 27	6.20 (2.36)	n = 35	6.16 (2.68)	n = 32	6.27 (2.03)	n = 30	1.26 (3.01)	n = 27
									-0.18	n = 28

Note. Change was computed for only girls who had both baseline and 6-month measures.

p < .05

Table 4
Means of Physical Activity, Cardiovascular Fitness, and Body Composition Measures at Baseline and 6 Months

Variable	Baseline			6 Months			Change		
	Control		Intervention	Control		Intervention	Control		Intervention
	Mean (SD)	n	Mean (SD)	Mean (SD)	n	Mean (SD)	Mean (SD)	n	Mean (SD)
Minutes of MVPA/hour	1.08 (0.69)	n = 17	0.69 (0.28)	2.24 *	n = 25	1.20 (0.65)	1.05 (0.41)	n = 18	0.43 (0.41)
Cardiovascular fitness	14.10 (7.44)	n = 30	10.50 (4.72)	2.22 *	n = 28	12.73 (7.54)	11.29 (7.28)	n = 30	2.56 (6.59)
BMI (kg/m ²)	24.88 (7.98)	n = 31	25.94 (7.39)	-0.57	n = 37	25.50 (7.90)	26.59 (7.40)	n = 32	0.41 (1.02)
BMI Z-score	1.09 (1.09)	n = 31	1.28 (1.14)	-0.67	n = 37	1.21 (1.08)	1.39 (1.01)	n = 32	0.06 (0.18)
BMI percentile for age	77.03 (26.39)	n = 31	80.03 (26.76)	-0.46	n = 37	80.23 (23.48)	83.26 (22.57)	n = 32	1.94 (4.59)
Percent body fat	31.98 (11.60)	n = 31	34.02 (11.28)	-0.73	n = 37	32.74 (11.25)	34.02 (10.83)	n = 32	0.48 (1.85)
Waist circumference	79.57 (17.80)	n = 32	80.78 (18.45)	-0.27	n = 36	79.10 (15.58)	80.45 (17.17)	n = 32	-0.87 (4.54)

Note. Cardiovascular fitness = number of PACER laps. Waist circumference was measured in cm. Change was computed for only girls who had both baseline and 6-month measures.

* p < .05

Table 5

Linear Regression of Intervention Effect on Physical Activity, Cardiovascular Fitness, Body Composition Measures and Cognitive and Affective Variables at 6 Months— Controlling for Baseline Measure

Variable	Intervention Effect				
	B	SE	β	t	p
Physical Activity, Cardiovascular Fitness, and Body Composition					
Minutes of MVPA per hour (n = 30)	0.16	0.16	.16	0.95	.35
Cardiovascular fitness (number of PACER laps; n = 53)	2.32	1.85	.15	1.26	.22
BMI (kg/m ² ; n = 67)	-0.33	0.22	-.02	-1.47	.15
BMI Z-score (n = 67)	-0.04	0.04	-.02	-1.19	.24
BMI percentile for age (n = 67)	-0.57	0.97	-.01	-0.59	.56
Percent body fat (n = 67)	-0.35	0.41	-.02	-0.86	.39
Waist circumference (cm; n = 67)	-0.19	1.02	-.01	-0.19	.85
Cognitive and Affective Variables					
Benefits of Physical Activity (n = 67)	-0.03	0.14	-.03	-0.23	.82
Barriers to Physical Activity (n = 66)	0.05	0.12	.04	0.40	.69
Physical Activity Self-Efficacy (n = 66)	-0.10	0.16	-.08	-0.64	.52
Enjoyment of Physical Activity (n = 66)	-0.17	0.16	-.12	-1.03	.31
Social Support (n = 57)	-4.20	5.11	-.11	-0.82	.42
Interpersonal Norms (n = 62)	-0.60	0.50	-.16	-1.21	.23
Exposure to Models of Exercise (n = 55)	-0.70	0.60	-.16	-1.17	.25