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Girls on the Move Program to Increase Physical Activity Participation

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Abstract

Background:

Because physical inactivity poses serious health risks, interventions are urgently needed to reverse the increasingly sedentary lifestyles of adolescent girls.

Objective:

The aim of this study was to determine the feasibility of "Girls on the Move," an individually tailored computerized physical activity (PA) program plus nurse counseling intervention, in increasing PA.

Methods:

A pretest-posttest control group design was used with 77 racially diverse sedentary girls in Grades 6, 7, and 8 from two middle schools. Each of the instructional grades was randomly assigned to either an intervention or control condition. After completing computerized questionnaires, each girl in the control group received a handout listing the PA recommendations. To encourage PA, each girl in the intervention group received computerized, individually tailored feedback messages based on her responses to the questionnaires, individual counseling from the school's pediatric nurse practitioner (PNP), and telephone calls and mailings from a trained research assistant. At 12 weeks, girls in both groups responded to the questionnaires.

Results:

No differences in self-reported PA emerged between the intervention and control groups at Weeks 1 (baseline) and 12 (postintervention). Repeated measures ANOVA showed a significant interaction between group and time for social support for PA, $F(1, 69) = 5.73, p = .019$, indicating that the intervention group had significantly greater social support across time than did the control group. From baseline to postintervention, social support increased for the intervention group but decreased for the control group.

Discussion:

Reasons for the lack of significant differences between the groups on the PA measures were cited. Important information that could inform subsequent studies that test interventions to increase youth PA was acquired from conducting this study. Future efforts to increase PA participation might include this approach for enhancing social support for PA.

Participation in physical activity (PA) decreases markedly among girls across adolescence. This precipitous decline begins at the outset of adolescence (Kimm et al., 2002) or around the time of entrance to middle school. The increasingly sedentary lifestyle of adolescent girls is a major risk factor for becoming overweight (Patrick et al., 2004), the prevalence of which has increased dramatically from 9.7% (1988-1994) to 15.5% (1999-2000) in recent years (Ogden, Flegal, Carroll, & Johnson, 2002). Escalation in the prevalence of obesity is even more striking for ethnic minorities (Ogden et al., 2002) and may be reflected in racial health disparities. Possible consequences of being overweight in adolescence include Type 2 diabetes, hypertension, high cholesterol, and psychosocial problems (Dietz, 1998).

Interventions to increase PA that are culturally sensitive, developmentally appropriate, gender specific, and individually tailored to address unique personal needs are needed to curtail the overweight epidemic (Clemmens & Hayman, 2004; Dowda et al., 2004; Neumark-Sztainer, Story, Hannan, & Rex, 2003; Taylor et al., 1999). For health professionals to achieve this objective, knowledge regarding personal factors influencing PA in certain subgroups is critical (e.g., perceived barriers to PA and feasible strategies for overcoming barriers; Robbins, Pender, & Kazanis, 2003). For this study, the researchers employed a 12-week PA counseling intervention called "Girls on the Move," which was individually tailored to meet the needs of adolescent girls. The purpose was to determine the feasibility of using an individually tailored computer program in combination with pediatric nurse practitioner (PNP) counseling to increase PA among sedentary middle school girls.

The study was designed to determine (a) the feasibility of the intervention specifically related to the willingness of girls to participate in each intervention component and the ability of the nurse to deliver the sessions, and (b)

the level of satisfaction perceived by participants regarding each intervention component. The researchers were also interested in exploring whether the intervention increased PA participation.

Individually tailored interventions provide information and change strategies based on the assessment of an individual's status on determinants identified as influencing a behavior, such as PA (Kreuter, Farrell, Olevitch, & Brennan, 2000). Compared with standard health promotion materials, tailored interventions have a greater probability of addressing the unique needs of individuals (Ryan & Lauver, 2002). Advances in computer technology have created the capacity to generate data-driven messages tailored to the individual on multiple psychosocial factors (Bull, Kreuter, & Scharff, 1999). Computer-based surveys generate data comparable with that obtained with paper and pencil (Norman, Sallis, & Gaskins, 2005). The youth prefer the uniqueness of computer-based administration (Joinson, 1999).

Although the potential to affect behavior change is likely, individually tailored computer programs, which include predetermined assessment questions and related feedback messages, have limits. The assessment-feedback structure that makes the programs interactive cannot fully approximate the immediacy, intimacy, and interactivity of face-to-face communication. Individually tailored programs, therefore, should be viewed as powerful tools to complement, rather than replace, direct health professional counseling (Kreuter et al., 2000).

Evidence regarding the most effective mix and intensity of intervention strategies for maximal effect in different population groups is lacking (United States Preventive Services Task Force, 2002). Only one study that tested the effectiveness of various counseling approaches in increasing PA among adolescents, known as the Patient-Centered Assessment and Counseling for Exercise plus Nutrition (PACE+) trial, was found. Participants recruited from outpatient clinics completed a computerized assessment, created tailored behavior change plans (incorporated goal setting, problem solving, and social support), and received counseling from their care provider. Each participant was assigned randomly to one of four groups: no-further-contact group or one of three extended-contact groups. Extended-contact groups received mail alone (every 2 weeks), infrequent mail and telephone calls (both every 6 weeks), or frequent mail (every 2 weeks) and telephone calls (weekly). All four groups had significant improvements in self-reported moderate PA from baseline to the 4-month follow-up. Vigorous PA did not improve. This finding may have been due to the fact that 74% of the 117 participants self-reported sufficient vigorous PA at baseline (Patrick et al., 2001). Patrick et al. (2001) concluded that combining a computerized behavior change program with provider counseling was feasible for use with adolescents.

Although definitive conclusions regarding the intervention's effectiveness in increasing PA among adolescents cannot be drawn from the Patrick et al. (2001) study, combined approaches are encouraged. Current recommendations to enhance PA among adolescent girls call for multicomponent PA interventions, particularly those that are school-based (Clemmens & Hayman, 2004). Because no single theory can account for all of the complexities associated with behavior change, integration across major theories is recommended in research (Prochaska, Redding, & Evers, 2002).

The Health Promotion Model (HPM; Pender, Murdaugh, & Parsons, 2002) and the Transtheoretical Model (TTM; Prochaska & DiClemente, 1984) were integrated to individually tailor the Girls on the Move intervention (Figure 1). According to the HPM (Pender et al., 2002), prior related behavior and various personal factors (e.g., age and gender) influence behavior-specific cognitions and affect. The behavior-specific cognitions of the HPM include perceived benefits of action, perceived barriers to action, self-efficacy, and interpersonal influences, as well as affect (enjoyment). The constructs represent a critical area to assess and target in an intervention directed at motivating individuals to engage in health-promoting behavior (Pender et al., 2002).

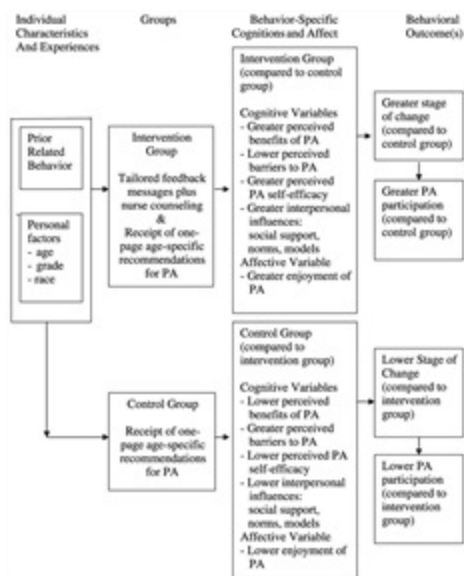


FIGURE 1: Model constructs included in the study. From *Health promotion in nursing practice* (4th ed.) by N. J. Pender, C. L. Murdaugh, and M. A. Parsons, 2002, Upper Saddle River, NJ: Prentice Hall. Adapted with permission.

These HPM constructs are identified as important PA determinants (Sallis, Prochaska, & Taylor, 2000) and are subject to modifications through the actions of health professionals (Pender et al., 2002). Self-efficacy refers to a person's beliefs in his or her capabilities to overcome barriers to action (Bandura, 1986, 1995). Self-efficacy has predicted PA among African American and European American adolescent girls (Bungum, Pate, Dowda, & Vincent, 1999).

Affect or subjective states associated with an activity may determine whether an individual will engage in the activity (Gauvin & Rejeski, 1993). Positive and negative affective responses during PA are associated with high or low self-efficacy in adolescents, respectively (Robbins, Pender, Ronis, Kazanis, & Pis, 2004; Robbins, Pis, Pender, & Pis, Kazanis, 2004). In this study, enjoyment of PA was assessed because it is a perceived reinforcing quality (Sallis, Calfas, Alcaez, Gehrman, & Johnson, 1999). Tailored feedback messages included ideas for enhancing or maintaining PA enjoyment.

The TTM (Prochaska & DiClemente, 1984) is another model that is directly applicable to the work of healthcare professionals. The model implies that the lack of consideration of readiness to alter behavior or the stage of change will decrease intervention effectiveness (Lyznicki, Young, Riggs, & Davis, 2001). Stage of change, as described in the TTM, is a useful starting point when counseling individuals (Prochaska & DiClemente, 1984).

The five stages of change include precontemplation, contemplation, preparation, action, and maintenance. Individuals in *precontemplation* have no intention to change behavior and are characterized as unmotivated. In this study, feedback messages for participants in precontemplation were tailored only to reiterate their most important perceived benefits of PA as a means to underscore problems associated with their current behavior. Enhancing the perceived benefits or pros of changing facilitates progression from earlier stages of change (Prochaska et al., 2002). Individuals in *contemplation* intend to take action within the next 6 months, and those in *preparation* intend to change in the next 30 days. Feedback messages for participants in these two stages were more comprehensive and individually tailored to address their readiness for PA, perceived benefits of PA, perceived barriers to PA, PA self-efficacy, interpersonal influences, and PA enjoyment. *Action* and *maintenance* are characterized by individuals who have made behavior modifications sufficient enough to reduce disease risk, either within the past 6 months or beyond 6 months, respectively (Prochaska et al., 2002). Participants in these final two stages received tailored feedback messages to support

their efforts by enhancing efficacy and assisting them to strengthen their support network. In this study, only girls in contemplation and preparation (Prochaska & DiClemente, 1984) were selected as intervention or control group participants.

Methods

A pretest-posttest control group design was used to examine the feasibility of an individually tailored computerized PA program plus nurse counseling intervention in increasing PA participation among sedentary middle-school girls. The University of Michigan Health Sciences Review Board approved the procedures for protecting the participants. Permission to conduct the study was obtained from the administrators of two middle schools located in low socioeconomic geographic areas in the Midwest. Computer assignment to either an intervention or control group was based upon a numerical code that included the school (1 or 2) and instructional grade (sixth, seventh, or eighth). Flip-of-a-coin randomization identified the grade and school assigned to each condition. The sequence of events experienced by the intervention and control group participants from baseline to postintervention can be found on the editor's Website at <http://www.nursing-research-editor.com>. Research staff and two PNPs (one employed in each middle school) completed tracking sheets to document that each intervention component was delivered as planned.

Participants

Parents or guardians received letters inviting girls who had no health conditions limiting PA and who were inactive most days of the week to participate. One hundred four signed forms indicating parent/guardian consent and assent from girls regarding participation were returned (Figure 2). Seventy-seven girls identified themselves as being in either the contemplation or preparation stage (based on their personal responses to questionnaire items) and were included in the study. Girls who reported being in either the action/maintenance or precontemplation stage received a certificate of participation and age-specific recommendations for PA frequency and intensity (United States Department of Health and Human Services [USDHHS], 2000).

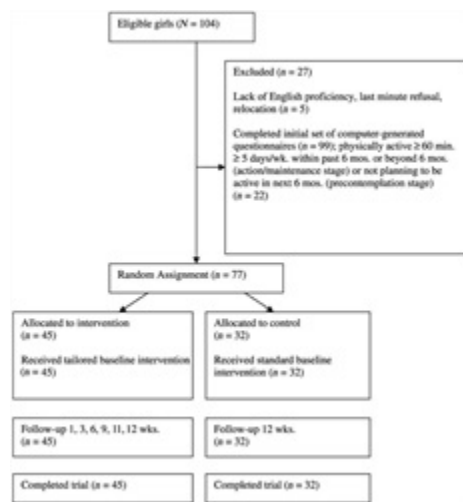


FIGURE 2: Flow diagram showing the retention of study participants.

Procedure

School Wellness Center, PNP Characteristics, and PNP Training

The 12-week study was conducted in each school's wellness center (WC) during advisory periods. Each WC was staffed by a PNP, social worker, and medical assistant.

Before the start of the intervention, the two PNPs received 4 hours of training from the researchers. The training session included didactic information and discussions to develop problem-solving skills that can be employed during PA counseling. Each PNP received a detailed training manual that included written scripts to guide PA counseling sessions with participants. After the intervention, both PNPs indicated that they were adequately trained to conduct the counseling sessions. They stated that the training supplemented their education and experience in the area of health promotion.

Data Collection

After explaining the study, the researcher recorded height, weight, and body mass index (BMI). Each participant responded to questionnaires presented on a laptop computer located in a private section of the WC. The questionnaires elicited demographic information; PA frequency, intensity, duration, and readiness; and information regarding the HPM constructs of interpersonal influences, activity-related affect (PA enjoyment), self-efficacy, and perceived benefits and barriers of PA (Pender et al., 2002). After completing the questionnaire, the girls in the control group received age-specific PA recommendations (USDHHS, 2000). They were asked to return to the WC in 12 weeks to answer questions on their PA.

At three distinct time periods during the 12-week study, each girl assigned to the intervention group received tailored feedback messages and nurse counseling to assist her in increasing her PA. After responding to questionnaires at baseline and at 3 and 9 weeks after the initial visit, each girl received supportive, individually tailored feedback messages presented by a computer and based on personal responses to the questionnaire items. It took the girls 45 min to 1 hr to complete the initial computer program (answer all questionnaires and read tailored feedback messages) and 20 to 30 min to complete each subsequent computer session.

Upon completion of computer program, each girl met for 10 min with the school's PNP in a private area of the WC, such as an examination room, to discuss personal PA goals. Three to 10 min of PA counseling from a healthcare professional is identified as sufficient to produce a significant increase in PA among sedentary individuals (Eakin, Glasgow, & Riley, 2000). In this study, the PNP received a computer-generated, one-page summary highlighting each girl's responses to the questionnaires, such as her readiness to change, current and favorite PAs, top three barriers to PA, top three benefits of PA, self-efficacy, and people who can help her the most to be physically active. The PNP used the summary to guide the counseling session and assist each girl to formulate PA goals. This approach decreased the time that the PNP would have had to spend addressing each construct in the counseling session. After a brief discussion of the summary, both the girl and the PNP signed a form or contract entitled "My Exercise Goals" to indicate mutual agreement regarding the goals to be achieved by the participant. A magnet with the Girls on the Move logo was provided to each girl for them to post the contract in a place where she would see it everyday. All girls assigned to the intervention group completed the first three computer sessions, received computerized tailored feedback messages, and, after each of the three computer sessions, met with the school's PNP for PA counseling.

Immediately following and 6 weeks after each girl's initial visit, the researchers mailed a tip sheet to the parents or guardians specifically to guide them in helping the girls to be active. At 1, 6, and 11 weeks after the initial visit, a trained research assistant, using an individualized communication script created by the researchers, contacted each girl by telephone to assess her progress in achieving the goals. Girls unable to be reached by telephone were mailed a letter listing their previously agreed-upon goals. The girls were encouraged to contact the PNP if they needed to renegotiate their contract.

At 3 and 9 weeks after their initial visit, the girls returned to the WC to complete an abbreviated computer program consisting of questionnaires and tailored feedback messages targeting perceived PA barriers and self-efficacy. After questionnaire completion, each girl met with the PNP to discuss the computer-generated summary of responses and engage in contract renegotiation as necessary.

During the 12th week, girls in the control and intervention groups returned to the WC and completed the posttest consisting of all psychosocial and PA questionnaires. The girls did not receive tailored feedback messages during this final session. Height, weight, and BMI were determined. Each girl received a certificate for participation and a US\$15.00 gift certificate to a store of her choice. All 77 girls completed the entire 12-week study.

Instrumentation

To obtain age-specific information concerning proposed PA determinants identified in the HPM (Pender et al., 2002), four focus groups (5 to 10 girls per group) were conducted with sixth, seventh, and eighth grade girls. The specific goals of the focus groups were to (a) explore the perceptions of middle school girls concerning PA determinants, such as their perceived benefits of and barriers to PA participation, to ensure that questionnaire items were appropriate, and (b) identify feasible strategies for overcoming reported barriers and enhancing PA enjoyment, self-efficacy, and social support among girls to integrate into computerized feedback messages.

To more effectively tailor the intervention to the girls' developmental level, useful comments made by the girls were integrated verbatim into the computer program. Based on suggestions received from the girls, minor modifications were made to enhance the thoroughness and relevance of questionnaires previously used by Garcia et al. (1995) on youth recruited from low socioeconomic geographic areas to measure HPM constructs (with the exception of PA enjoyment, which was not measured by Garcia et al.). In this study, PA enjoyment was assessed using an instrument specifically validated by Motl et al. (2000) for use with adolescent girls. The girls participating in the focus groups did not make any suggestions for modifying the scale measuring PA enjoyment.

Subsequently, experts in health promotion, behavior change, pediatrics, interactive health communications, and adolescent PA and fitness reviewed the instruments and concluded that they were valid for use with this population. Because Garcia et al. (1995) summed rather than averaged questionnaire responses (e.g., perceived benefits, barriers, and PA self-efficacy), and prior to this study, modifications were made to the questionnaires as a result of the focus group discussions, comparisons between the results from this study and the one conducted by Garcia et al. were not possible.

Benefits. A 20-item girls Perceived Benefits Questionnaire was used to identify the girls' reasons for being active (e.g., have more energy). Girls used the following response choices to identify the importance of each benefit to them personally: 1 = *not at all true*, 2 = *not very true*, 3 = *in between*, 4 = *sort of true*, and 5 = *very true*. Cronbach's alpha was .90.

Barriers. Using a 23-item Perceived Barriers Questionnaire, girls rated the frequency of facing each barrier when trying to be active (e.g., I am too busy): 1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often*, and 5 = *very often*. Cronbach's alpha was .86.

Self-efficacy. A 19-item Perceived PA Self-Efficacy Questionnaire determined each girl's confidence in her ability to overcome barriers to PA. Girls used a five-item Likert-type scale, ranging from 1 = *not at all true* to 5 = *very true*, to indicate the degree that they would be active in the presence of certain barriers to PA (e.g., I'm sure that I can still do my exercise even if I am too busy). Cronbach's alpha was .91.

Enjoyment. Motl et al. (2000) modified the original 18-item PA Enjoyment Scale (PACES; Kendzierski & DeCarlo, 1991) based on evaluative feedback from focus groups of eighth grade girls and found that the modified 16-item PACES was a valid measure for use with African American and Caucasian adolescent girls. In this study, the researchers used the modified 16-item PACES (e.g., When I am active, I find it fun) and the following five response choices: 1 = *disagree a lot*, 2 = *disagree a little*, 3 = *neither agree nor disagree*, 4 = *agree a little*, and 5 = *agree a lot*. Cronbach's alpha was .87.

Interpersonal influences. To assess interpersonal influences, the girls first identified three people who could help them the most to be active. Social support was determined by how often the girls indicated that each of the three people did PA-related tasks for them (0 = *never*, 1 = *sometimes*, 2 = *often*). For interpersonal norms, the girls indicated how much each of the three people expected them to participate in PA (0 = *not at all*, 1 = *sort of*, 2 = *a lot*, or 3 = *not sure*). Exposure to models of exercise behavior was determined by how often the three people performed light, medium, or hard exercise (0 = *never*, 1 = *sometimes*, 2 = *often*, or 3 = *not sure*). For interpersonal norms and models, *not sure* was coded as a 0, similar to the response choices *not at all* and *never*, respectively. Responses for social support, interpersonal norms, and exposure to models of exercise behavior were summed to obtain a score for each of the three measures. Cronbach's alpha was .86 and .81 for the Social Support and Exposure to Models of Exercise Behavior Scales, respectively. Because the participants responded to a single item for each helpful person, internal consistency for the Interpersonal Norms Scale was not assessed.

Stage of change. A PA staging questionnaire based on the TTM (Prochaska & DiClemente, 1984) was used to assist the girls in describing their PA and stage of change (PA readiness). Girls described their PA by indicating the number of days in a typical week that they were active for 60 min or more. Girls selecting 0 to 4 days indicated their readiness by answering a question with three response choices (to determine whether they were in Stage 1, precontemplation; Stage 2, contemplation; or Stage 3, preparation). Girls selecting five or more days were directed to a question with two response choices (to determine if they were in Stage 4, action; or Stage 5, maintenance). A previously conducted study involving adolescents supported the construct validity of the PA staging measure (Hagler, Calfas, Norman, Sallis, & Patrick, 2006).

Physical activity. At baseline (Week 1) and postintervention (Week 12), girls responded to the Child and Adolescent Activity Log (CAAL), which was adapted from the instrument used by Garcia et al. (1995), to describe the PAs that they had participated in during the past 2 weekdays and the past weekend (Saturday and Sunday) and to rate the intensity of each activity (medium or hard). A researcher was available at each school at baseline and postintervention to assist the girls in both the intervention and control groups in reporting the number of minutes of PA because preliminary work indicated a tendency for overreporting. Some girls reporting 4 hr of an activity, such as roller skating, initially reported 240 min of vigorous PA but failed to consider the time taken for rest or snack breaks. In this study, the researcher at each school followed a written protocol to assist each girl only by informing her that PA involved time spent moving or being active enough so that she was breathing hard and sweating and her heart was beating fast. The researcher told each girl that time used for rest or snack breaks should not be included in the reported number of minutes of PA. The researchers at each school collaborated daily to ensure consistency between the two schools with regard to conducting the study. Examples of PA were provided via computer to enhance understanding (e.g., biking, swimming, and dancing). Illustrations of young females walking or running were presented in the computer program to help the girls evaluate intensity. Content and criterion validity for the CAAL have been established, and daily test-retest correlations (45-min interval) ranging from .73 to .94 have been reported (Garcia, George, Coviak, Antonakos, & Pender, 1997).

Results

Demographics

Of the 45 girls in the intervention group, 25 were African American, 13 were European American, and 7 represented other races. The racial distribution of the 32 girls in the control group was 12 African American, 15 European American, and 5 from other races (Table 1). The Statistical Package for the Social Sciences (SPSS, 2002) was used. No significant differences occurred between intervention and control group participants regarding any characteristics or between preintervention and postintervention BMI for any subgroup identified in Table 1.

All 77 girls who completed baseline measures returned to complete their subsequent computer and nurse counseling sessions as scheduled. No attrition occurred across the 12-week study period.

TABLE 1: Means, Standard Deviations, and Ranges for Characteristics of Girls by Grade and Group (*N* = 77)

Characteristic	Mean (<i>SD</i>)	Min–Max	Mean (<i>SD</i>)	Min–Max
Sixth grade (<i>n</i> = 30)				
	School 1: Control (<i>n</i> = 8)		School 2: Intervention (<i>n</i> = 22)	
Age (years)	11.25 (0.46)	11Y12	11.45 (0.80)	11Y14
Height (in.)	58.19 (3.63)	51.50Y61.50	60.41 (2.73)	54.50Y64.00
Weight (lb)	115.13 (36.52)	80.00Y174.00	122.12 (34.54)	62.00Y182.00
BMI—Baseline	24.15 (8.22)	16.75Y38.78	23.29 (5.37)	14.71Y33.01
BMI—Postintervention	22.70 (5.94)	16.72Y32.47	23.61 (5.49)	15.58Y33.82
Seventh grade (<i>n</i> = 34)				
	School 1: Intervention (<i>n</i> = 19)		School 2: Control (<i>n</i> = 15)	
Age (years)	12.37 (.50)	12 Y13	12.27 (.59)	11Y13
Height (in.)	62.28 (2.89)	56.00Y67.00	62.30 (2.65)	57.75Y66.00
Weight (lb)	138.03 (65.54)	66.50Y350.00	121.97 (38.40)	82.25Y208.00
BMI—Baseline	24.55 (9.89)	13.93Y57.48	21.88 (5.12)	17.22Y34.27
BMI—Postintervention	24.56 (9.91)	13.93Y57.04	20.64 (4.50)	15.77Y34.08
Eighth grade (<i>n</i> = 13)				
	School 1: Control (<i>n</i> = 9)		School 2: Intervention (<i>n</i> = 4)	
Age (years)	13.44 (.53)	13Y14	13.00 (.00)	13Y13
Height (in.)	63.44 (2.11)	59.75Y67.00	63.06 (1.66)	60.75Y64.50
Weight (lb)	141.00 (32.86)	96.50Y214.00	125.63 (24.39)	101.00Y157.00
BMI—Baseline	24.59 (5.30)	19.04Y37.10	22.26 (4.11)	17.10Y27.01
BMI—Postintervention	25.19 (5.22)	20.28Y36.92	22.55 (4.26)	17.17Y27.52

Evaluation of the program by intervention group participants indicated that more than 95% of the girls would use the program again and recommend the program to their friends. Sixty-three percent of the girls reported that the time spent with the nurse was very helpful. No one in the intervention group made an additional appointment with the PNP for contract renegotiation. Approximately 50% were reached by telephone at each time period. Those unable to be reached by telephone reported to the PNP that they had received the mailed letter identifying their goals. Although tip sheets were mailed home to parents or guardians to encourage them to support the girls in meeting PA goals, only 50% of the girls in the intervention group indicated that the content had helped their parents or guardians to support their PA. Sixty-two percent of the girls reported that their parents or guardians had read the information, 29% were not sure, and 9% indicated that their parents or guardians did not read it. Forty-six percent of the girls counseled reported that they sometimes, often, or very often did not have anyone to do PAs with them and/or did not have a good place to carry out PA. Twenty-nine percent of the girls indicated that they did not always have the right equipment, clothes, or shoes.

Comparison of Intervention and Control Groups Regarding PA Variables

The intervention and control groups were compared across time at baseline (Week 1) and postintervention (Week 12) regarding the (a) number of days per week of PA, (b) stage of change, (c) total number of minutes of moderate plus vigorous PA for 4 days, 2 weekdays, 2 weekend days, yesterday or last weekday, and (d) total number of minutes of either moderate or vigorous PA for 4 days (Table 2). Because skewness was identified for the variables measuring the number of minutes of PA, logarithmic transformations were conducted for these variables.

TABLE 2: Physical Activity by Group and Time

	Mean (SD)	Min-Max	Mean (SD)	Min-Max
PA Variable	Intervention Group (n=45)		Control Group (n=32)	
Number of days per week of PA				
Week 1	2.07 (1.50)	0.00-5.00	2.38 (1.26)	0.00-5.00
Week 12	3.38 (1.44)	0.00-7.00	3.47 (1.65)	1.00-7.00
Stage of change ^a				
Week 1	2.33 (.48)	2.00-3.00	2.38 (.49)	2.00-3.00
Week 12	2.67 (.95)	1.00-5.00	2.91 (1.23)	1.00-5.00
Number of minutes moderate plus vigorous PA—4 days				
Week 1	79.78 (99.22)	0.00-480.00	126.31 (177.01)	0.00-655.00
Week 12	192.40 (190.64)	0.00-910.00	200.66 (205.67)	23.00-1,000.00
Number of minutes moderate plus vigorous PA—2 weekdays				
Week 1	43.09 (62.56)	0.00-300.00	59.63 (85.27)	0.00-380.00
Week 12	123.40 (122.97)	0.00-560.00	121.22 (118.61)	11.00-510.00
Number of minutes moderate plus vigorous PA—2 weekend days				
Week 1	36.69 (55.39)	0.00-240.00	66.69 (127.91)	0.00-600.00
Week 12	69.00 (92.62)	0.00-390.00	79.44 (116.56)	0.00-490.00
Number of minutes of moderate plus vigorous PA—yesterday or last weekday				
Week 1	32.11 (61.47)	0.00-300.00	31.41 (48.22)	0.00-195.00
Week 12	71.16 (75.56)	0.00-340.00	72.28 (78.45)	0.00-330.00
Number of minutes moderate PA—4 days				
Week 1	58.82 (89.13)	0.00-480.00	86.78 (141.95)	0.00-630.00
Week 12	131.87 (142.31)	0.00-670.00	144.66 (139.09)	16.00-630.00
Number of minutes of vigorous PA—4 days				
Week 1	20.96 (44.28)	0.00-220.00	39.53 (70.03)	0.00-260.00
Week 12	59.09 (74.48)	0.00-240.00	56.00 (110.47)	0.00-540.00

^aStage of change: 1 = precontemplation; 2 = contemplation; 3 = preparation; 4 = action; 5 = maintenance.

When the variances of the PA variables at postintervention were tested for homogeneity across groups, the assumption was met for all PA variables except for the total number of minutes of moderate PA for 4 days and the total number of minutes of moderate plus vigorous PA for 4 days. When ANCOVA analysis was conducted for the PA variables having equivalent variances, no significant differences occurred between the intervention and control groups. A significant correlation between baseline and postintervention measurements emerged for total number of minutes of moderate and moderate plus vigorous PA for 4 days. Because the assumption of compound symmetry was also met, repeated measures ANOVA was performed (Munro, 2004), which resulted in no significant differences between the intervention and control groups for either PA variable.

Comparison of Intervention and Control Groups Regarding PA Determinants

Descriptive statistics were calculated for the intervention and control group participants for the proposed PA determinants, which include perceived benefits of PA, perceived barriers to PA, PA self-efficacy, enjoyment of PA, social support, interpersonal norms, and exposure to models of exercise behavior (Table 3). Additional analyses were conducted to explore the differences between the intervention and control groups across time at baseline and postintervention regarding the PA determinants. Skewness was identified for all variables except exposure to models of exercise behavior at baseline and PA self-efficacy at postintervention. Logarithmic transformations were conducted for variables associated with skewed findings.

TABLE 3: Physical Activity Determinants by Group and Time

Variable	Mean (<i>SD</i>)	Min–Max	Mean (<i>SD</i>)	Min–Max
Intervention group (<i>n</i> = 45)				
	Week 1		Week 12	
Perceived benefits of PA	1.40 (.83)	1.40-5.00	3.73 (.66)	2.05-5.00
Perceived barriers to PA	2.28 (.65)	1.17-3.95	2.33 (.61)	1.00-3.63
PA self-efficacy	3.40 (.65)	2.21-5.00	3.30 (.66)	1.84-4.68
Enjoyment of PA	4.12 (.64)	1.31-5.00	4.17 (.59)	2.44-5.00
Social support ^{a,b}	23.29 (9.63)	4.00-38.00	24.98 (7.90)	7.00-40.00
Interpersonal norms ^b	4.11 (1.62)	0.00-6.00	3.94 (1.55)	0.00-6.00
Exposure to models of exercise behavior ^b	7.50 (4.22)	0.00-16.00	10.61 (4.03)	1.00-18.00
Control group (<i>n</i> = 32)				
	Week 1		Week 12	
Perceived benefits of PA	3.60 (.64)	2.60-4.88	3.62 (.54)	2.55-4.80
Perceived barriers to PA	2.18 (.57)	1.09-3.39	2.28 (.62)	1.13-4.00
PA self-efficacy	3.51 (.81)	2.16-5.00	3.59 (.60)	2.26-4.74
Enjoyment of PA	4.27 (.50)	3.38-5.00	4.12 (.54)	2.53-5.00
Social support ^{a,b}	27.38 (7.93)	11.00-39.00	24.10 (8.25)	4.00-38.00
Interpersonal norms ^b	3.69 (1.86)	0.00-6.00	3.42 (1.60)	0.00-6.00
Exposure to models of exercise behavior ^b	8.91 (4.68)	0.00-18.00	10.91 (4.20)	0.00-17.00

^aSignificant interaction between group and time: $F(1, 69) = 5.73, p = .019$.

^bScale score for each participant = sum of the values of individual responses to each item in the questionnaire.

When the variances of the PA determinants at postintervention were tested for homogeneity across groups, this assumption was met for enjoyment of PA only. When ANCOVA analysis was conducted, no significant differences in enjoyment of PA occurred between the intervention and control groups. Correlational analysis indicated a significant relationship between the measurements of all other PA determinants at baseline and postintervention. Repeated measures ANOVA showed a significant interaction between group and time for social support for PA, $F(1, 69) = 5.73, p = .019$, indicating that the intervention group had significantly greater social support across time than did the control group. From baseline to postintervention, social support increased for the intervention group but decreased for the control group. No significant differences emerged between the intervention and control groups for other PA determinants.

Discussion

The aim of this study was to develop and test the feasibility of an individually tailored PA intervention for adolescent girls. The computer program with nurse counseling was found to be feasible for use in a primary care setting within a school. Girls in both the intervention and control groups demonstrated their interest in participating by returning to complete all computer and nurse counseling sessions as scheduled.

Patrick et al. (2001) reported that a tailored intervention used in outpatient clinics was effective in increasing moderate PA among adolescents. In this study, despite encouraging feedback from the girls, no significant differences between the intervention and control groups on any PA measures emerged.

Several factors may have accounted for the lack of significant differences in PA between the intervention and control groups. First, the 12-week intervention period may have been too brief. Recommendations concerning adolescents indicate that interventions lasting longer than one semester or 16 weeks are needed to achieve a significant change in deeply entrenched behaviors (Neumark-Sztainer et al., 2003). A gradual process involving several fluctuations in readiness to change behavior may precede actual enactment (Huddleston, 2002L; Rimer, 2002).

Second, the exclusive use of self-reported PA is a limitation of this investigation. Because PA is considered a socially desirable behavior, girls in both groups may have responded to PA-related questions with the intention of making a favorable impression. Self-report assessments are likely to be less accurate in adolescents than in adults (Welk, Corbin, & Dale, 2000).

Using self-report resulted in high variability in PA measures, especially in the control group (Table 2). Because of the large standard deviations associated with certain measures, the observed effect size was .05. To enhance the accuracy of results, the researchers recommend that objective measures of PA participation (e.g., accelerometer and physical fitness tests) be employed in any future investigations directed at increasing youth PA.

Third, the small sample size may have precluded the ability to detect significant differences between the groups. Post hoc power analysis resulted in a power of .06 for a two-tailed test of group comparison given the sample sizes of 32 in the control group and 45 in the intervention group. The largest value obtained in post hoc power analyses was .15 for comparing stage of change of control and intervention groups at the end of the intervention. A larger sample size could have contributed to a decrease in standard errors of estimates.

Fourth, randomization was used to assign grades rather than individual participants to either intervention or control conditions in each school to avoid contamination from one condition to the other by participants within the same grade. Because each of the two schools had either one or two intervention grades, both PNs counseled the intervention group participants. A particular grade in one school was assigned to the intervention condition and the same grade in the other school served as the control to enable the researchers to compare

intervention and control participants within the same grade. The small sample size, however, precluded these comparisons. Although the researchers and PNPs did not expect the girls to share information across grades, some communication may have occurred, allowing for contamination from intervention to control conditions.

Fifth, although the PNPs received didactic and problem-solving skills training, they were not observed directly nor audiotaped during the counseling sessions. These approaches, as well as the role playing during training sessions, should be considered in future investigations to ensure consistency concerning PA counseling among interventionists.

Although PNPs at both schools reported that they had adhered to training manual protocols and that the training was adequate in preparing them to deliver the intervention, the PNPs experienced difficulty counseling some girls who lacked places, resources, and social support for engaging in PA. Some girls expressed that their parents or guardians discouraged PA in the home because of the noise and the low importance placed on being physically active as compared to doing homework or chores. PNPs did not record the number of girls experiencing these parent-generated barriers because the study protocol did not indicate that this task be performed. Creating accessible, safe environments supportive of PA is just as critical as promoting individual behavior change (Felton et al., 2002; Marcus & Forsyth, 1999). Increasing interpersonal support and access to equipment and facilities are crucial PA intervention components (Brownson et al., 2000; Taylor et al., 1999).

Although the intervention group had significantly greater social support across time than did the control group, social support as provided did not work. Returned postcards would have indicated who had received the information. The researchers concluded that direct contact with parents or guardians via a meeting at school, a telephone call, or both to explain the counseling program and share information may be a more effective approach for increasing parent or guardian support. A more personalized face-to-face approach with specific suggestions (e.g., being active with their daughters) and role-playing demonstrations for parents on how to provide support that actually increases PA is planned in the next test of the intervention. Tailoring parent and guardian information to emphasize the daughter's PA goals or unique needs as noted from certain responses to questionnaire items may be essential for engaging parents and guardians (provided that the adolescent agrees).

Because no other significant differences emerged between the intervention and control groups on PA determinants, a more robust intervention that has a higher probability of changing these determinants has to be developed. According to the HPM (Pender et al., 2002) and TTM (Prochaska & DiClemente, 1984), if the determinants do not change, the target behavior will not change. Schools are ideal places for influencing factors affecting girls' PA because most schools possess the staff and resources to create a comprehensive program that appeals to girls (Clemmens & Hayman, 2004; Felton et al., 2002).

National recommendations call for children and adolescents to engage in at least 60 min of PA on most, preferably all, days of the week. (USDHHS and United States Department of Agriculture, 2005). The ultimate goal of this research program is to develop an effective PA counseling intervention for diverse groups of children and adolescents. Increasing youth PA is a promising approach for decreasing the escalating national overweight epidemic.

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