

2011-04-20

# Results from a Pilot Translational Health and Wellness Based Summer Program in Minority Adolescents

Elizabeth Skidmore Edwards  
*University of Miami*, [esedwards@me.com](mailto:esedwards@me.com)

Follow this and additional works at: [https://scholarlyrepository.miami.edu/oa\\_dissertations](https://scholarlyrepository.miami.edu/oa_dissertations)

---

## Recommended Citation

Edwards, Elizabeth Skidmore, "Results from a Pilot Translational Health and Wellness Based Summer Program in Minority Adolescents" (2011). *Open Access Dissertations*. 557.  
[https://scholarlyrepository.miami.edu/oa\\_dissertations/557](https://scholarlyrepository.miami.edu/oa_dissertations/557)

This Open access is brought to you for free and open access by the Electronic Theses and Dissertations at Scholarly Repository. It has been accepted for inclusion in Open Access Dissertations by an authorized administrator of Scholarly Repository. For more information, please contact [repository.library@miami.edu](mailto:repository.library@miami.edu).

UNIVERSITY OF MIAMI

RESULTS FROM A PILOT TRANSLATIONAL HEALTH AND WELLNESS BASED  
SUMMER PROGRAM IN MINORITY ADOLESCENTS

By

Elizabeth Skidmore Edwards

A DISSERTATION

Submitted to the Faculty  
of the University of Miami  
in partial fulfillment of the requirements for  
the degree of Doctor of Philosophy

Coral Gables, Florida

May 2011

©2011  
Elizabeth Skidmore Edwards  
All Rights Reserved

UNIVERSITY OF MIAMI

A dissertation submitted in partial fulfillment of  
the requirements for the degree of  
Doctor of Philosophy

RESULTS FROM A PILOT TRANSLATIONAL HEALTH AND WELLNESS BASED  
SUMMER PROGRAM IN MINORITY ADOLESCENTS

Elizabeth Skidmore Edwards

Approved:

---

Arlette C. Perry, Ph.D.  
Professor and Chairperson, Department of  
Kinesiology and Sport Sciences

---

Terri A. Scandura, Ph.D.  
Dean of the Graduate School

---

Joseph Signorile, Ph.D.  
Professor of Exercise Physiology

---

Kevin Jacobs, Ph.D.  
Associate Professor of Exercise  
Physiology

---

Nicholas Myers, Ph.D.  
Assistant Professor of Research,  
Measurement, and Evaluation

---

Mark Stoutenberg, Ph.D.  
Research Assistant Professor of  
Epidemiology and Public Health

EDWARDS, ELIZABETH SKIDMORE  
Results From a Pilot Translational Health and  
Wellness Based Summer Program in Minority  
Adolescents.

(Ph.D., Exercise Physiology)

Abstract of a dissertation at the University of Miami.

Dissertation supervised by Professor Arlette Perry.  
No. of pages in text (35)

The Healthy Start Summer Program (HSSP) is a seven-week summer program that strives to provide health and wellness education in a manner that is applicable to everyday living. The primary goal of the HSSP is to improve physical fitness levels and the psychosocial variables associated with exercise in a minority adolescent population, while providing the tools necessary for students to maintain these changes for four months after the program. Participants and control subjects were evaluated at the beginning and end of their respective summer programs, then followed up four months post-program to evaluate the maintenance of these changes. The students who participated in both the HSSP and the control summer programs were primarily of Hispanic, African-American, or Haitian descent and were recruited from high schools that serve low socioeconomic areas. Participation in the HSSP was associated with improved physical fitness levels that remained elevated at the follow-up evaluation; however, physical fitness improvement during the program was negatively associated with maintenance after the program. In general, the expected associations between physical fitness and psychosocial variables were not found in our population, nor did psychosocial variables change significantly during or following the program. Findings indicate that the expected associations between physical and psychosocial variables are either not present or that the tools used to measure them were not sufficiently sensitive in

this minority population. However, the fact that cardiovascular fitness remained elevated above baseline four months after the program represents an improvement from interventions previously reported in the literature. Future research should be conducted to more fully understand the factors related to the maintenance of physical fitness.

## TABLE OF CONTENTS

	Page
List of Figures .....	iv
List of Tables .....	v
List of Abbreviations .....	vi
Chapter	
Introduction .....	1
Methods .....	6
Results .....	13
Discussion .....	15
Figures .....	20
Tables .....	25
Bibliography .....	31

## LIST OF FIGURES

	Page
Figure 1. Changes in Waist Circumference across Time for Participant and Control Subjects .....	20
Figure 2. Changes in Push-ups Performed across Time for Participant and Control Subjects .....	21
Figure 3. Changes in Wall-Sit Performance Time across Time Collapsed across Groups .....	22
Figure 4. Changes in PACER Laps Performed across Time Collapsed across Groups....	23
Figure 5. Changes in PACER Laps Performed across Time for Participant and Control Subjects.....	24

## LIST OF TABLES

	Page
Table 1. Demographic Information for Initial Subjects and for Subjects who Completed All Evaluations .....	25
Table 2. Baseline Bivariate Correlations for Physical Variables .....	26
Table 3. Baseline Bivariate Correlations for Psychosocial and Habit Variables .....	27
Table 4. Bivariate Correlations among Changes in Psychosocial Variables from Baseline to Post-Program Evaluations .....	28
Table 5. Bivariate Correlations among Changes in Psychosocial Variables from the Post-Program to Follow-Up Evaluations .....	29
Table 6. Bivariate Correlations among Changes in Psychosocial Variables from the Baseline to Follow-Up Evaluations .....	30

## **LIST OF ABBREVIATIONS**

BMI: Body Mass Index

Change<sub>Pre-Post</sub>: Difference between the PRE and POST score; Negative indicates a decline from PRE to POST

Change<sub>Post-Follow</sub>: Difference between the POST and FOLLOW score; Negative indicates a decline from POST to FOLLOW

Change<sub>Pre-Follow</sub>: Difference between the PRE and FOLLOW score; Negative indicates a decline from PRE to FOLLOW

CON: Control group

FOLLOW: Follow-up evaluation four months post-program

HSSP: Healthy Start Summer Program participant group

PACER: Progressive Aerobic Cardiovascular Endurance Run

PART: Subjects who participated in the Healthy Start Summer Program

POST: Immediately post-program evaluation

PRE: Baseline or pre-program evaluation

PUSH: Push-up test

WC: Waist circumference

WALL: Wall-sit test

## **Chapter 1**

### **Introduction**

There is strong empirical evidence supporting the health, psychological, and cognitive benefits of physical activity and fitness in children and adolescents. In addition to helping prevent hypertension, coronary artery disease, atherosclerosis, Type II diabetes, and hypercholesterolemia (Hallal, Kuramoto, Schulzer, & Retallack, 2006; Sothorn, Loftin, Suskind, Udall, & Blecker, 1999b; Warburton, Nicol, & Bredin, 2006), physical activity and a healthy body weight positively benefit mental health, specifically depression and mood states (Altıntaş & Aşçi, 2008; Hallal et al., 2006; R. W. Motl, Birnbaum, Kubik, & Dishman, 2004; Ortega, Ruiz, Castillo, & Sjostrom, 2008; Sallis, Prochaska, & Taylor, 2000; Sharma et al., 2009; Swallen, Reither, Haas, & Meier, 2005; Warburton et al., 2006), self-esteem and self-efficacy (DeBate, Gabriel, Huberty, Huberty, & Zhang, 2009; Ortega et al., 2008; Sothorn, Loftin, Suskind, Udall, & Blecker, 1999a), and quality of life (Schwimmer, Burwinkle, & Varni, 2003; Swallen et al., 2005; Wallander et al., 2009). Additionally, there is evidence that physical activity and a healthy weight status in children and adolescents each positively impact academic achievement and cognitive abilities (Castelli, Hillman, Buck, & Erwin, 2007; Crosnoe & Muller, 2004; Roberts, Freed, & McCarthy, 2010; Schwimmer et al., 2003; Sibley & Etnier, 2003; Swallen et al., 2005; Wallander et al., 2009). Furthermore, physically active adolescents exhibit a lower incidence of risk-taking behaviors (Taras, 2005).

Despite the well-documented health benefits of physical activity in children and adolescents, only 38% of high school students grades 9-12 meet current physical activity recommendations of at least 60 minutes of moderate to vigorous activity on 5 or more

days per week (United States Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health, 2008). Significantly fewer students (32.4%) in Miami-Dade County meet these standards (USDHHS, 2008). Hispanic and African American children and adolescents are less physically active than their White peers, spending more time watching TV and movies and playing video games (Burton & VanHeest, 2007; Sallis et al., 2000). Given the increased screen time and lower rates of physical activity, it's not surprising that the prevalence of overweight and obesity is higher in both African American and Hispanic children (Ogden, Carroll, Curtin, Lamb, & Flegal, 2010; Singh, Kogan, & Yu, 2009). Furthermore, research shows that in minority adolescents as physical activity levels increase, the prevalence of overweight and obesity decreases (Burton & VanHeest, 2007; Sallis et al., 2000;).

Previous interventions targeting physical activity in children and adolescents have utilized a variety of models, which incorporate a range of timelines, theoretical bases, and age ranges. Many programs have focused on targeting the mediating variables supported by previous literature (Lewis, Marcus, Pate, & Dunn, 2002), specifically self-efficacy, enjoyment, perceived behavioral control, and social support (Dishman et al., 2004; R. W. Motl et al., 2005; Nader et al., 1999). Studies have also used a multi-modal approach, which addresses a combination of physical education, health education, and school lunch as three separate modules (Edmundson et al., 1996; Parcel, Simons-Morton, O'Hara, Baranowski, & Wilson, 1989). In children and adolescents, physical activity interventions averaged moderate levels of improvement of physical activity and physical fitness at the end of the intervention ( $r=0.38$ ,  $95\%CI=0.21-0.52$ ), however these effects

varied markedly (Dishman & Buckworth, 1996). Long-term maintenance of fitness, psychosocial, and habit changes has ranged from a complete return to baseline (Carrel, Clark, Peterson, Eickhoff, & Allen, 2007) or a level similar to the control group (Gutin, Yin, Johnson, & Barbeau, 2008) to a modest retention of fitness and knowledge gains over the control group (Nader et al., 1999). Finally, most programs have focused on the school-year months, either as an addition to the normal school curriculum (Carrel et al., 2005; Edmundson et al., 1996; Parcel et al., 1987) or as an after-school program (Gutin et al., 2008), without any summer intervention. Fitness levels have been shown to either stagnate (Christodoulos, Flouris, & Tokmakidis, 2006) or decline (Carrel et al., 2007; Gutin et al., 2008) during the summer months, which suggests a need for quality summer programming.

Previous research indicates that physical activity interventions can positively affect physical activity, self-efficacy, and physical activity enjoyment and that physical activity enjoyment and self-efficacy may mediate the changes in physical activity and healthy behaviors (Dishman et al., 2002; Edmundson et al., 1996; Sharma et al., 2009). Evidence suggests that self-efficacy associated with physical activity does not predict physical activity levels across a one year post-intervention, but that perceived behavioral control is an independent predictor of vigorous physical activity (Motl et al., 2005). Self-efficacy associated with exercise refers to one's feelings about their intrinsic ability to exercise and be an active person, whereas perceived behavioral control refers to their ability to actually perform exercise within the context of their daily life (Motl et al., 2000). While intervention studies in adolescents have primarily targeted the relationship between physical activity and psychosocial affect, no studies have evaluated the

relationship between physical fitness and psychosocial affect. Physical fitness is a much more robust measure than self-reported physical activity, which the majority of previous studies have utilized. Furthermore, a twelve-week intervention in adults demonstrated that improvements in cardiovascular fitness, as well as physical activity, were associated with positive psychological benefits that lasted at least one-year post intervention (DiLorenzo et al., 1999).

The present study examined the effects of HSSP on physical fitness and psychosocial variables in a minority adolescent population. The present study is intended as a pilot study to attain preliminary evidence as to the effectiveness of the HSSP curriculum in affecting physical fitness and psychosocial affect. The HSSP is unique in three key aspects: 1) It is an intensive experience with approximately 40 contact-hours per week, 2) The program directly applies topics learned in the classroom periods with meaningful hands-on laboratory experiences and reinforces these lessons with exercise periods, and 3) The HSSP integrates translational health education with physical activity participation into one cohesive curriculum. Translational health integrates education with hands-on clinical experiences that can be easily applied to one's everyday life. The reinforcement of educational concepts with applied physical activities is expected to produce positive health-related behavioral changes. The goals of the HSSP included improving physical fitness and related psychosocial variables, as well as affecting the maintenance of these improvements over four months.

Investigators hypothesized that there would be significant associations between physical fitness and psychosocial variables and that participation in the HSSP would be associated with improvements in both. At four months following the intervention,

investigators anticipated a significant regression toward baseline values. Furthermore, it was hypothesized that changes in psychosocial variables that occurred during the program would be significantly associated with the retention in physical fitness. Since retention of physical fitness following physical activity interventions is such a critical problem, our secondary goal was to derive a more thorough understanding of what constructs could predict maintenance of cardiovascular fitness following the physical activity intervention.

## **Chapter 2**

### **Methods**

#### **Study Design**

The HSSP was a seven-week health and wellness based summer program that served approximately 100 minority adolescents from local high schools in low socioeconomic status neighborhoods. Field tests were used to measure cardiovascular fitness, as well as upper and lower body muscular endurance. Assessment of the HSSP's impact on psychosocial affect utilized several evaluation tools designed to capture the psychosocial constructs of physical activity enjoyment and self-efficacy of exercise. Evaluations occurred at three time points: 1) Within the first week of the respective summer programs (PRE), 2) At the end of the respective summer programs (POST), and 3) At the end of the fall semester, approximately four months after the end of the summer programs (FOLLOW). The PRE and POST measurements served to evaluate baseline values and the immediate impact of the intervention, respectively. The four-month FOLLOW was chosen to observe retention of the effects of the HSSP across an entire academic semester, while avoiding the confounding influences of the holiday season and exam stress on dependent variables.

#### **Subjects**

Subjects were students entering the 9<sup>th</sup> or 10<sup>th</sup> grade and currently enrolled in either the HSSP (PART) or an academically focused summer program with no formal physical activity (CON). Programs were of similar overall duration (HSSP: 7 weeks; control program: 6 weeks), day length (8 hrs.), and participant demographics. Both programs targeted low socioeconomic status minority groups and recruited from areas

and schools representative of this population. Neither program, however, screened students on an individual basis for socioeconomic status. The initial PART sample included 50 females and 32 males, while the initial CON sample included 22 females and 16 males (Table 1).

### **Intervention**

The HSSP was seven weeks long, five days per week, lasting eight hours each day. Each day consisted of one learning seminar that incorporated a topic from that week's theme. Themes were: Introduction to Exercise and Muscle Contraction, Advanced Exercise Techniques, Cardiovascular and Pulmonary Systems, Exercise Testing and Physiology, Concepts in Nutrition, Body Composition and Energy Expenditure, and Incorporating Healthy Habits into Everyday Life. Each learning seminar was followed by a laboratory experience that directly reinforced and expanded upon the topic from that day. Themes were reinforced, via discussion, movies, and other activities, throughout other periods of the day. Students participated in an average of 1.5-2 hours of physical activity per day, which included cardiovascular exercise, resistance training, functional training, plyometrics, and team sports. Exercise periods were designed to reinforce the topics being covered during the program, as well as to progressively increase in intensity as the students made gains in fitness. Students were also exposed to professional development, which included resume building, interviewing skills, and computer skills, as well as being exposed to the college admissions and financial aid processes.

The HSSP curriculum sought to specifically improve self-efficacy, within the larger framework of the Social Cognitive Theory, by targeting the four domains proposed

by Bandura: mastery experiences, vicarious experiences, social persuasion, and somatic and emotional change (Bandura, 1989):

1. **Mastery Experiences:** The HSSP aimed to create an environment where the participants experience success through sustained effort. Specifically, individual feedback was given to the students through both daily verbal encouragement and a written report at the end of the program that showed their changes from the beginning to end of the HSSP.
2. **Vicarious Experiences:** The HSSP aimed to ensure that students were aware of the improvements that their peers made as a result of their efforts. When giving feedback, specific effort was made to connect the action (exercise and a healthy lifestyle) to the benefits (improved fitness, feeling better, etc.), such that both the recipient of the positive feedback and his or her peers understood exactly what led to the positive outcome.
3. **Social Persuasion:** The HSSP aimed to encourage regular positive reinforcement between students. Participants who were excelling in the program, as well as student volunteers who were of similar age to the participants, were continually encouraged to give positive feedback to other HSSP participants.
4. **Somatic and Emotional Change:** The HSSP aimed to provide tools for dealing with setbacks. After the program's completion, it was expected that participants would encounter barriers and setbacks that could potentially discourage their attempts to maintain the healthy habits learned at the HSSP. The program sought not only to provide quality education, but to also help participants learn how to determine which sources of information are reliable. Additionally, the HSSP

sought to help students understand that every person experiences setbacks and that these were not a reflection of their ability to maintain a healthy lifestyle.

## **Measures**

### Physical Fitness

*Cardiovascular Fitness:* Cardiovascular endurance was measured via the Progressive Aerobic Cardiovascular Endurance Run (PACER) (Beets & Pitetti, 2006), which requires participants to run between two cones, 20m apart, at a prescribed pace that progressively increases in speed. The final score is recorded as the number of laps a participant successfully completes.

*Lower Body Muscular Endurance:* Lower body muscular endurance was measured via a wall-sit test (WALL), in which students placed their entire back against a wall, with their thighs parallel and their lower legs perpendicular to the floor. WALL performance was recorded as the number of seconds until volitional fatigue or until the student lost the ability to maintain proper form. The WALL has previously been used as a measure of lower body endurance (Arimoto, Kijima, & Muramatsu, 2005; Phillips, Petersen, Abbiss, Netto & Payne, 2011).

*Upper Body Muscular Endurance:* Upper body muscular endurance was measured via a push-up test (PUSH), with females performing modified push-ups (*ACSM's Guidelines for Exercise Testing and Prescription*, 2006). A repetition was recorded if the student was able to descend to the point where the upper arms were parallel to the floor and then return to full extension without a significant pause.

### Psychosocial

*Enjoyment of Physical Activity:* To measure enjoyment of physical activity, two scales were utilized. The Physical Activity Enjoyment Scale (Kendzierski & DeCarlo, 1991) has been shown to have high reliability (Cronbach's  $\alpha=0.96$ ) in a college-aged population. This study also utilized an 8-item Attitude questionnaire that has shown to have good model fit for factor invariance across time in black and white adolescent females [ $\chi^2 = 208.45$ ,  $df = 95$ , RMSEA = 0.034 (90% CI 0.028-0.041)] (Motl et al., 2000).

*Self-Efficacy in Exercise:* As a means of measuring self-efficacy, the modified version of the Athletic Competency subscale (Wichstrøm, 1995) from the Harter Self-Perception Profile for Adolescents (Harter, 1988) was utilized, as the revised version showed better reliability (Cronbach's  $\alpha=0.79$  vs 0.66) and acceptable discriminant validity when compared to actual participation in physical activity ( $r=0.55$ ). This study also utilized a 9-item Self-Efficacy questionnaire and a 4-item Perceived Behavioral Control questionnaire (Motl et al., 2000), which both showed good model fit, respectively, for factor invariance across time in a population of white and black adolescent females [Self-Efficacy:  $\chi^2 = 225.61$ ,  $df = 95$ , RMSEA = 0.037 (90% CI 0.031-0.043); Perceived Behavioral Control:  $\chi^2 = 49.57$ ,  $df = 15$ , RMSEA = 0.048 (90% CI 0.033-0.063)].

*Perception of Other's Beliefs about Exercise:* Finally, as a measure of each student's perceptions of others' beliefs as to whether or not they should be regularly active, an 8-item Perceived Behavioral Norm questionnaire was used (Motl et al., 2000). This scale was shown to have good model fit for factor invariance across time in a

population of black and white female adolescents [ $\chi^2 = 257.57$ ,  $df = 87$ , RMSEA = 0.044 (90% CI 0.038-0.050)].

### Demographic and Anthropometric

At PRE, race/ethnicity, gender, and age were recorded. At all time points height, weight, and waist circumference (WC) were measured and recorded. Body mass index (BMI) was calculated for each time point.

### **Statistical Analysis**

Independent sample *t*-tests were used to identify baseline differences between the PART and the CON group and between those students who completed all three evaluations and those who did not. For all subsequent analyses, only those students who completed all three evaluations were included. Change scores were calculated for each variable for the following time points: PRE to POST ( $\text{Change}_{\text{Pre-Post}}$ ), POST to FOLLOW ( $\text{Change}_{\text{Post-Follow}}$ ), and PRE to FOLLOW ( $\text{Change}_{\text{Pre-Follow}}$ ). Mixed design Analyses of Variance (2 Group x 3 Time) were used to evaluate effects for group and time, as well as interactions between group and time.

Bivariate correlations and multiple regression analyses were used to identify associations between variables and change scores. Stepwise regression was utilized to identify which variables or change scores were associated with the  $\text{Change}_{\text{Post-Follow}}$  in PACER scores. Regression analyses included only PART scores, as the investigators were primarily interested in the maintenance of physical fitness and psychosocial variables after the completion of a health and wellness based intervention. Likewise, investigators selected variables and change scores that occurred during the HSSP for inclusion in the regression analyses as investigators felt the main goal of this analysis was

to identify variables that could be measured and targeted during the program that were associated with maintenance of physical fitness after the program. An alpha level of .05 was used for all analyses.

## Chapter 3

### Results

Original enrollment included 82 PART and 38 CON subjects, with 39 PART and 12 CON participants completing all three evaluations (Table 1). There were no significant differences between those participants who dropped out of the study and those who completed all three evaluations. Between the final groups, there were significant differences at baseline for age (Table 1), WC (Figure 1), and PUSH (Figure 2). Mixed design ANOVAs indicated a significant Time x Group interaction for WC ( $p < .001$ ) (Figure 1) and PUSH ( $p = .001$ ) (Figure 3). In addition, there were significant main effects of Time for WC ( $p < .001$ ), PUSH ( $p = .013$ ), WALL ( $p = .028$ ) (Figure 3), and PACER ( $p < .001$ ) (Figure 4). There was a significant between-subjects effect for PACER, with PART being higher than CON across timepoints ( $p = .049$ ). Further analysis of PACER scores via independent- and paired- samples *t*-tests revealed differing patterns of change (Figure 5). Correlation analyses revealed that PACER<sub>Pre</sub> was not significantly related to PACER-Change for any range of time.

Bivariate correlations among all PRE variables revealed that anthropometric and physical fitness variables were largely interrelated (Table 2) and that psychosocial variables were consistently moderately correlated with each other (Table 3). However, there were almost no significant correlations between physical fitness and psychosocial variables, with only PUSH and Athletic Competency being weakly correlated ( $r = .285$ ,  $p = .042$ ). Bivariate correlations among Change<sub>Pre-Post</sub>, Change<sub>Post-Follow</sub>, and Change<sub>Pre-Follow</sub> scores for psychosocial variables showed similar trends (Tables 4, 5, & 6). For Change<sub>Pre-Post</sub>, Change<sub>Post-Follow</sub>, and Change<sub>Pre-Follow</sub>, BMI was directly related to weight

( $p < .048$ ) and indirectly related to height ( $p < .001$ ), while also being related to WC ( $p < .038$ ) for both  $\text{Change}_{\text{Pre-Post}}$  and  $\text{Change}_{\text{Post-Follow}}$ . Additionally, for  $\text{Change}_{\text{Pre-Post}}$ , WC was directly related to weight ( $p = .048$ ). Finally for  $\text{Change}_{\text{Pre-Follow}}$ , height was directly related to weight ( $p = .034$ ). For  $\text{Change}_{\text{Pre-Post}}$ ,  $\text{Change}_{\text{Post-Follow}}$ , and  $\text{Change}_{\text{Pre-Follow}}$ , WALL, PUSH, and PACER were not significantly correlated with any other Physical variables.

Stepwise regression examining the prediction of  $\text{PACER-Change}_{\text{Post-Follow}}$  revealed two significant predictors.  $\text{PACER-Change}_{\text{Pre-Post}}$  ( $\beta = -0.51$ ,  $p = .001$ ) and  $\text{WALL-Change}_{\text{Pre-Post}}$  ( $\beta = -0.30$ ,  $p = .036$ ) combined to account for 32.5% of the variance in  $\text{PACER-Change}_{\text{Post-Follow}}$ ,  $F(2,36) = 8.67$ ,  $p = .001$ .

## **Chapter 4**

### **Discussion**

Participation in the HSSP resulted in improvements of approximately 70% and 48% in PACER and PUSH, respectively, while control subjects showed no significant changes during the summer. Furthermore, at FOLLOW, PART PACER and PUSH scores remained elevated by 45% and 27%, respectively, over baseline values. Previous programs in children and adolescents have seen cardiovascular fitness variables return to baseline after three months of no intervention (Carrel et al., 2007; Gutin et al., 2008). Thus the HSSP's combination of education and physical activity into one cohesive curriculum appears to be an improvement from previous interventions.

Carrel et al (2005) worked with overweight middle adolescents in a specially designed 9-month physical education course focusing on lifestyle physical activities with a small nutrition component. Although students in the intervention group improved in body fat percentage,  $VO_{2max}$ , and fasting insulin as a result of the program, these values returned to baseline levels by three months post-intervention (Carrel, 2007). Gutin et al (2008) developed an after-school physical activity program for elementary school children, without any nutrition or health education component. While children showed improvements in body fat and aerobic fitness after the end of each academic year, these values returned to levels similar to those of control subjects by the end of each respective summer.

The HSSP differed substantially from the programs by Carrel et al (2005) and Gutin et al (2008) in that a strong education component was integrated into the program. Students were not only participating in increased levels of physical activity, but received

translational health education about physiology, nutrition, and chronic diseases related to physical activity and a healthy lifestyle. There were several other key differences between the HSSP and the previous programs, as well. The HSSP participants were older than those in previous programs. Additionally, the HSSP was an intensive seven-week experience, with 8-contact hours per day. Participants in the study by Carrel et al. were in class for 45 min per day, while the after-school program by Gutin et al. lasted two hours per day, forty minutes of which were spent in snack and homework time. The comprehensive nature of the HSSP itself may have accounted for the differences between our findings and previous studies. Finally, the four-month period between the POST and FOLLOW measures in the present study consisted largely of times when the participants were in school, unlike the previous studies, in which participants were followed up after three summer months. Therefore the timing of the intervention may be a significant factor. Since our intervention was followed by a return to school, it is possible that the school setting provides an environment more conducive to maintaining physical activity participation. However, a review of the literature demonstrated that adolescents are more active during the summer and spring than during the school year (Carson & Spence, 2010), which would suggest that retention of physical fitness may be better during the summer.

It is plausible that the ability to maintain increases in physical fitness are related to baseline values. Although lower values may be associated with a greater potential for improvement, these improvements may also be followed by a greater decline. However, our results showed that neither the improvements in PACER nor the maintenance of PACER were related to baseline physical fitness values. In fact, the only two significant

predictors were the magnitude of improvement in PACER and WALL that occurred during the program; the more a participant improved during the program, the more they tended to decline after the program. It appears that PART were unable to maintain a large improvement in their initial cardiovascular fitness levels, regardless of their initial fitness level. Perhaps the most notable portion of the prediction equation were those factors not found to be significant, including all psychosocial measures.

It would seem logical that the maintenance of gains in physical fitness could have been related to improvements in psychosocial affect that were associated with participation in the HSSP. Our findings, however, showed that this was not the case. There were no significant correlations between physical fitness variables and psychosocial constructs at any time point. Previous studies provide support for an association between psychological measures and physical fitness (DiLorenzo et al., 1999). However these findings arose from a study that examined an adult Caucasian population, while our study population consisted of almost exclusively Hispanic, African-American, and Haitian adolescents. Previous literature does support a relationship between physical activity and self-efficacy and perceived behavioral control in an adolescent population (R. K. Dishman et al., 2002; R. W. Motl et al., 2005), therefore the lack of relationship between physical fitness and psychosocial variables was unexpected. However, the present study provided no support for a significant correlation between physical fitness and psychosocial affect, either at a single time point or as changing concomitantly over time. These findings raise the question as to whether or not the same relationships between physical fitness and psychosocial affect exist in this minority

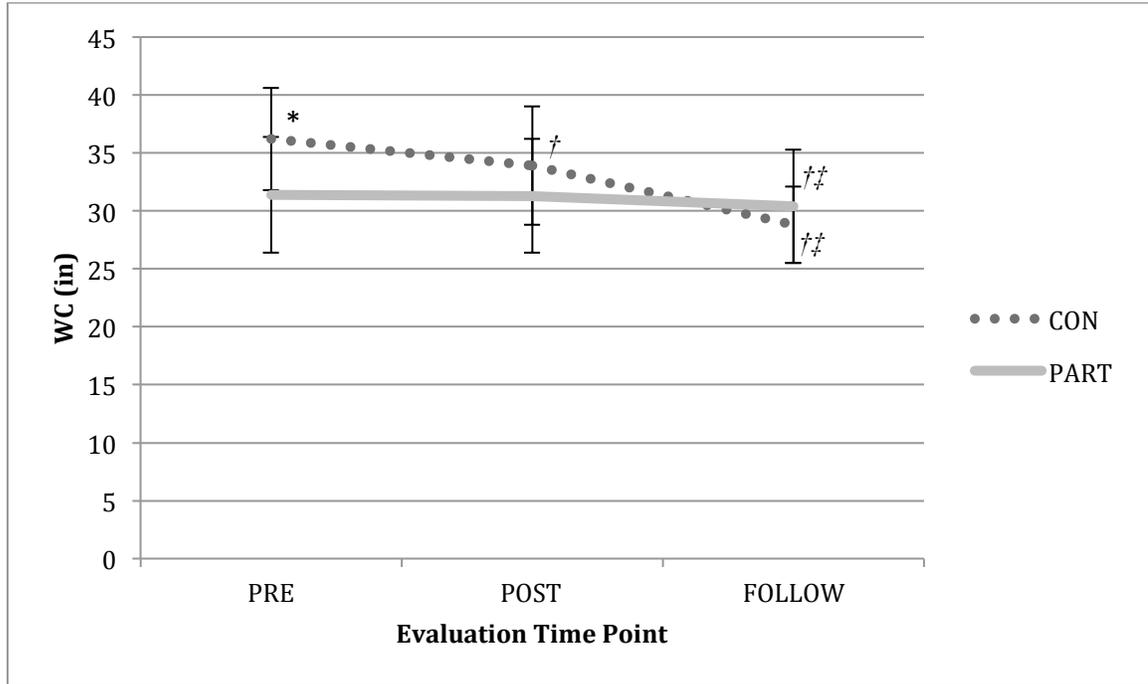
population. This reinforces the need to identify mediating factors for retention of physical fitness in a racially and ethnically diverse adolescent population.

This study has several key limitations. First is the limited sample size and poor follow-up retention rate in the present study. Repeated-measures statistical methods, which this study utilized, are the best way to increase power in small sample sizes. However, future studies should include larger samples sizes. Second, stepwise regression capitalizes on the differences in a particular data set; therefore findings may have limited generalizability. The investigators felt, however, that this was an appropriate method, given that this study is intended as a pilot study. Third, the psychosocial questionnaires have not been validated in the racial/ethnic groups that the HSSP serves. Measurement invariance across race/ethnicity and gender groups is supported by previous research (R. K. Dishman et al., 2002; Paxton et al., 2008), however neither of these studies included either Hispanic and Haitian participants. There is also an inherent problem with self-report measures and questionnaires, particularly in a younger population, in that their validity relies strongly upon the premise that questionnaires will be answered honestly and thoughtfully, as opposed to simply rushing through them to get done. Finally, there may be a self-selection bias because students elected to participate in the HSSP. Therefore, this sample may not be representative of the larger minority adolescent population.

In conclusion, this study provides support for the methods utilized by the HSSP for interventions seeking to increase physical fitness, as both PACER and PUSH remained elevated above baseline at FOLLOW. Although the mechanism behind sustained improvements are unclear, a seven-week comprehensive summer program may

be beneficial for physical fitness. Since our findings indicated that improvements and maintenance of physical fitness were not related to psychosocial variables or initial physical fitness levels, future research should focus on developing a better understanding of the mediating factors related to maintenance of physical fitness in a racially and ethnically diverse student population. Finally, given the promising results in PACER and PUSH scores, which showed better retention than previous interventions (Carrel et al., 2007; Gutin et al., 2008), future interventions should continue to develop the educational model utilized by the HSSP.

Figure 1. Changes in Waist Circumference across Time for Participant and Control Subjects



\*Significantly different from PART at same time point ( $p < 0.05$ )

† Significantly different PRE within the same group ( $p < 0.05$ )

‡ Significantly different from POST within the same group ( $p < 0.05$ )

WC: Waist Circumference

CON: Control Subjects

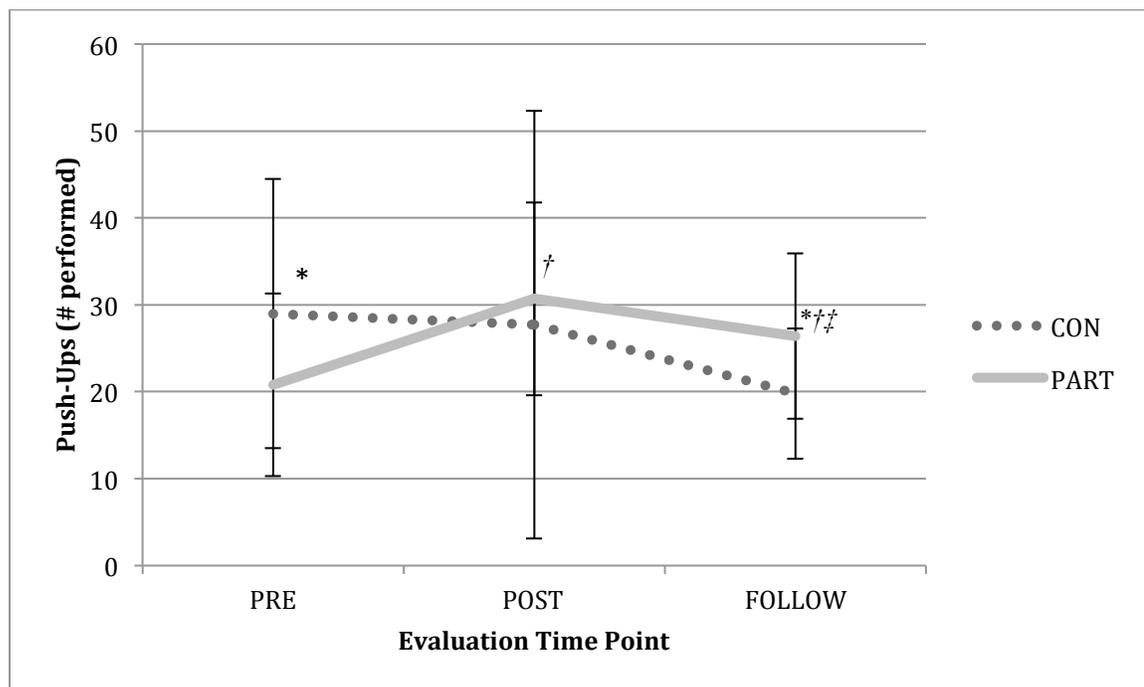
PART: Participant Subjects

PRE: Baseline evaluation

POST: Immediately post-program evaluation

FOLLOW: Follow-up evaluation four months post-program

Figure 2. Changes in Push-ups Performed across Time for Participant and Control Subjects



\*Significantly different from PART at same time point ( $p < 0.05$ )

† Significantly different PRE within the same group ( $p < 0.05$ )

‡ Significantly different from POST within the same group ( $p < 0.05$ )

CON: Control subjects

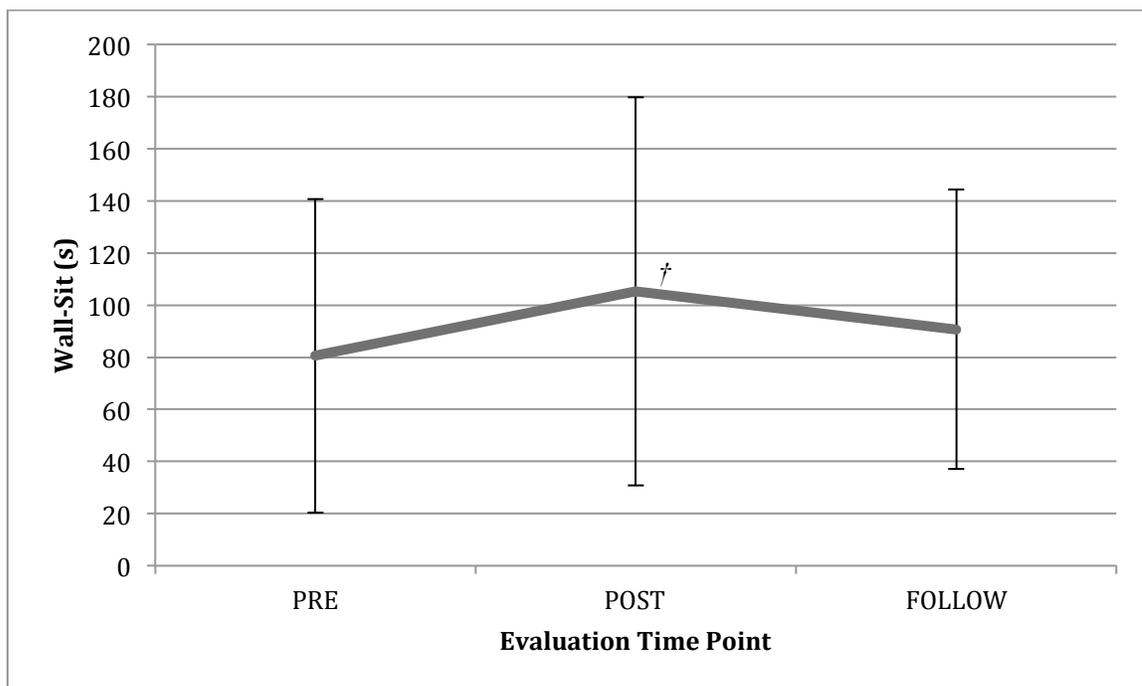
PART: Participant subjects

PRE: Baseline evaluation

POST: Immediately post-program evaluation

FOLLOW: Follow-up evaluation four months post-program

Figure 3. Changes in Wall-Sit Performance across Time Collapsed across Groups



† Significantly different PRE ( $p < 0.05$ )

CON: Control subjects

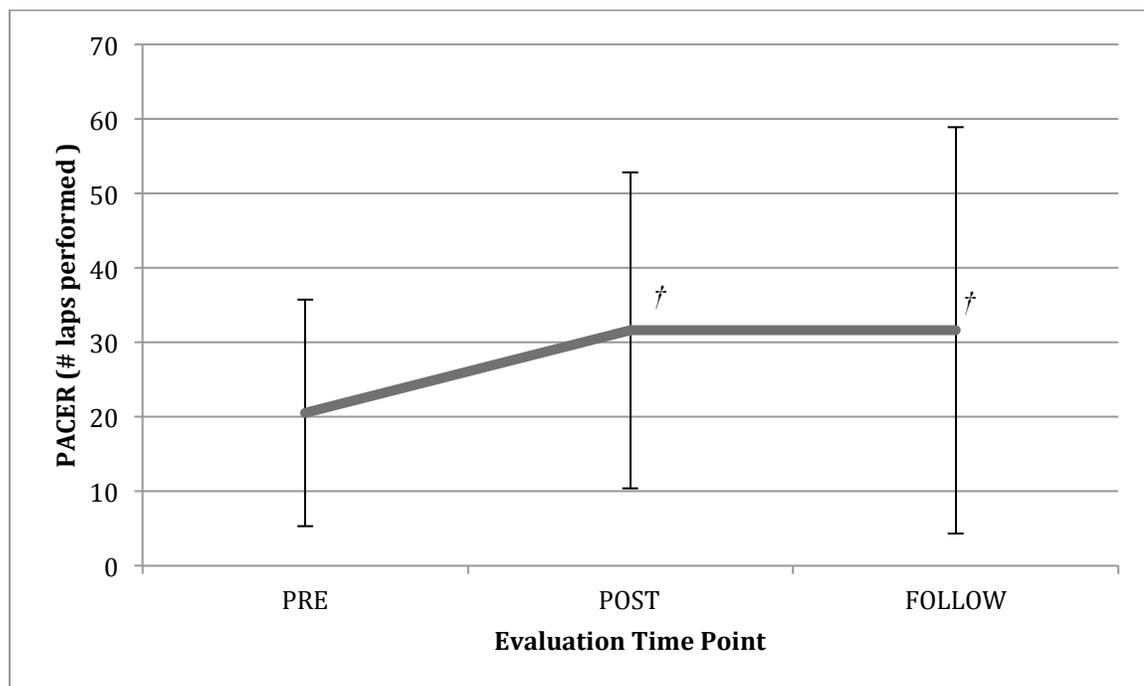
PART: Participant subjects

PRE: Baseline evaluation

POST: Immediately post-program evaluation

FOLLOW: Follow-up evaluation four months post-program

Figure 4. Changes in PACER Laps Performed across Time Collapsed across Groups



† Significantly different PRE ( $p < 0.05$ )

PACER: Progressive Aerobic Cardiovascular Endurance Run (# laps performed)

CON: Control subjects

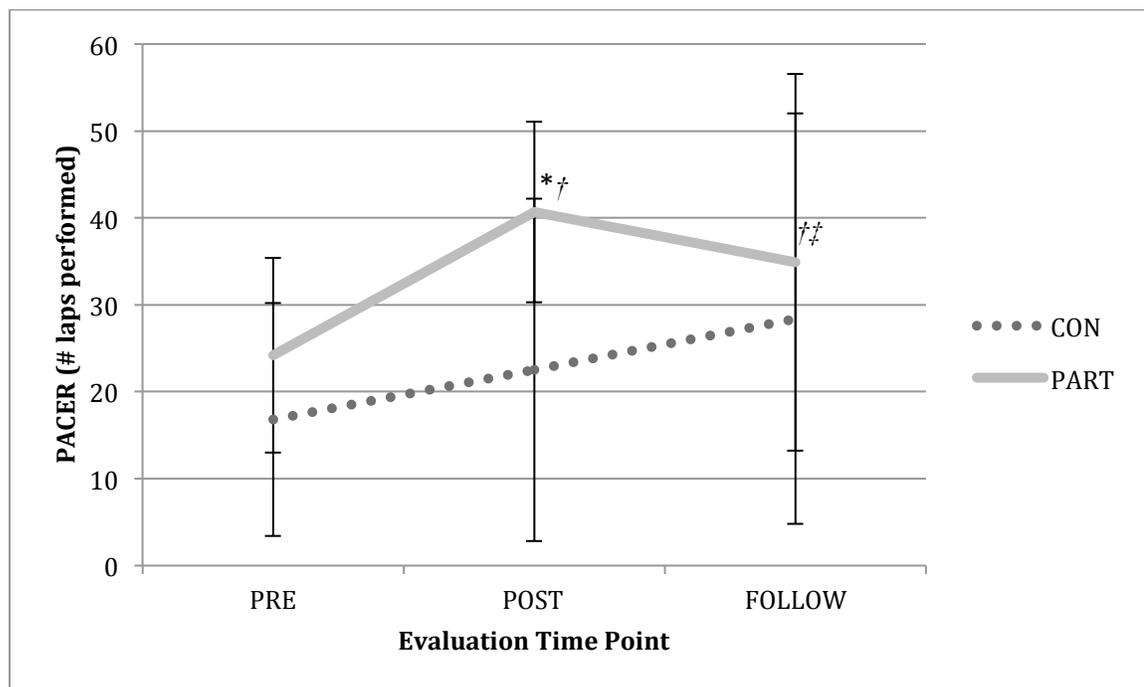
PART: Participant subjects

PRE: Baseline evaluation

POST: Immediately post-program evaluation

FOLLOW: Follow-up evaluation four months post-program

Figure 5. Changes in PACER Laps Performed across Time for Participant and Control Subjects



\*Significantly different from PART at same time point ( $p < 0.05$ )

† Significantly different PRE within the same group ( $p < 0.05$ )

‡ Significantly different from POST within the same group ( $p < 0.05$ )

PACER: Progressive Aerobic Cardiovascular Endurance Run (# laps performed)

CON: Control subjects

PART: Participant subjects

PRE: Baseline evaluation

POST: Immediately post-program evaluation

FOLLOW: Follow-up evaluation four months post-program

Table 1. Demographic Information for Initial Subjects and for Subjects who Completed All Evaluations.

Characteristics	Initial HSSP Participants	Initial Control Participants	Final HSSP Participants	Final Control Participants
N	82	38	39	12
Age	15.3±.9*	14.1±2.4	15.4 ± 0.7*	14.1 ± 0.3
Male	32 (39.0%)	16 (42.1%)	18 (46.2%)	7 (58.3%)
Female	50 (61.0%)	22 (57.9%)	21 (53.8%)	5 (41.7%)
Non-Hispanic White	3 (3.7%)	2 (5.3%)	2 (5.1%)	1 (8.3%)
African-American	36 (43.9%)	15 (39.4%)	16 (41.0%)	4 (33.3%)
Hispanic White	36 (43.9)	13 (34.2%)	15 (38.5%)	6 (50.0%)
Haitian-American	7 (8.5%)	8 (21.1%)	6 (15.4%)	1 (8.3%)

*\*Significant difference between control and participant subjects ( $p < .05$ ).*

*HSSP: Healthy Start Summer Program*

Table 2. Baseline Bivariate Correlations for Physical Variables.

	Height	Weight	BMI	WC	PUSH	WALL	PACER
Height	1						
Weight	.660**	1					
BMI	.270	.896**	1				
WC	.435**	.807**	.773**	1			
PUSH	-.030	-.259	-.287*	-.109	1		
WALL	-.028	-.253	-.310*	-.258	.579**	1	
PACER	.085	-.192	-.307*	-.290*	.438**	.659**	1

\* Correlation is significant at the  $p < 0.05$  level.

\*\* Correlation is significant at the  $p < 0.01$  level.

BMI: Body Mass Index

WC: Waist Circumference (in.)

PUSH: Push-ups (# performed)

WALL: Wall-sit (s)

PACER: Progressive Aerobic Cardiovascular Endurance Run (# laps performed)

Table 3. Baseline Bivariate Correlations for Psychosocial Variables.

	Physical Activity Enjoyment Scale	Attitudes Toward Exercise	Perceived Behavioral Norm	Perceived Behavioral Control	Efficacy in Exercise	Athletic Competency
Physical Activity Enjoyment Scale	1					
Attitudes Toward Exercise	.489**	1				
Perceived Behavioral Norm	.376**	.375**	1			
Perceived Behavioral Control	-.001	.167	.272	1		
Efficacy in Exercise	.324*	.285*	.406**	.467**	1	
Athletic Competency	.566**	.352*	.390**	.240	.503**	1

\* Correlation is significant at the  $p < 0.05$  level.

\*\* Correlation is significant at the  $p < 0.01$  level.

Table 4. Bivariate Correlations among Changes in Psychosocial Variables from Baseline to Post-Program Evaluations.

	Physical Activity Enjoyment Scale	Attitudes Toward Exercise	Perceived Behavioral Norm	Perceived Behavioral Control	Efficacy in Exercise	Athletic Competency
Physical Activity Enjoyment Scale	1					
Attitudes Toward Exercise	.401**	1				
Perceived Behavioral Norm	.283*	.064	1			
Perceived Behavioral Control	.297*	.427**	.152	1		
Efficacy in Exercise	-.040	.425**	.105	.469**	1	
Athletic Competency	.240	.204	.124	.317*	.246	1

\* Correlation is significant at the  $p < 0.05$  level.

\*\* Correlation is significant at the  $p < 0.01$  level.

Table 5. Bivariate Correlations among Changes in Psychosocial Variables from the Post-Program to Follow-Up Evaluations.

	Physical Activity Enjoyment Scale	Attitudes Toward Exercise	Perceived Behavioral Norm	Perceived Behavioral Control	Efficacy in Exercise	Athletic Competency
Physical Activity Enjoyment Scale	1					
Attitudes Toward Exercise	.502**	1				
Perceived Behavioral Norm	.547**	.152	1			
Perceived Behavioral Control	.271	.354*	.201	1		
Efficacy in Exercise	.318*	.371**	.332*	.440**	1	
Athletic Competency	.213	.095	.193	.218	.183	1

\* Correlation is significant at the  $p < 0.05$  level.

\*\* Correlation is significant at the  $p < 0.01$  level.

Table 6. Bivariate Correlations among Changes in Psychosocial Variables from the Baseline to Follow-Up Evaluations.

	Physical Activity Enjoyment Scale	Attitudes Toward Exercise	Perceived Behavioral Norm	Perceived Behavioral Control	Efficacy in Exercise	Athletic Competency
Physical Activity Enjoyment Scale	1					
Attitudes Toward Exercise	.456**	1				
Perceived Behavioral Norm	.024	.046	1			
Perceived Behavioral Control	.091	.251	.405**	1		
Efficacy in Exercise	.289*	.230	.424**	.460**	1	
Athletic Competency	.267	.348*	.175	.404**	.373**	1

\* Correlation is significant at the  $p < 0.05$  level.

\*\* Correlation is significant at the  $p < 0.01$  level.

## Bibliography

- ACSM's guidelines for exercise testing and prescription*(2006). In Whaley M. H., Brubaker P. H. and Otto R. M. (Eds.), (7th ed.). Philadelphia, PA: Lippincott Williams & Wilkins.
- Arimoto, M., Kijima, A., & Muramatsu, S. (2005) Cardiorespiratory response to dynamic and static leg press exercise in humans. *J Physiol Anthropol Appl Human Sci*, 24(4), 277-283.
- Altıntaş, A., & Aşçi, F. H. (2008). Physical self-esteem of adolescents with regard to physical activity and pubertal status. *Pediatric Exercise Science*, 20(2), 142-156.
- Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist*, 44(9), 1175-1184.
- Beets, M. W., & Pitetti, K. H. (2006). Criterion-referenced reliability and equivalency between the PACER and 1-mile Run/Walk for high school students. *Journal of Physical Activity & Health*, 3, S21-S33.
- Burton, L. J., & VanHeest, J. L. (2007). The importance of physical activity in closing the achievement gap. *Quest* (00336297), 59(2), 212-218.
- Carrel, A. L., Clark, R. R., Peterson, S., Eickhoff, J., & Allen, D. B. (2007). School-based fitness changes are lost during the summer vacation. *Archives of Pediatrics & Adolescent Medicine*, 161(6), 561-564.
- Carrel, A. L., Clark, R. R., Peterson, S. E., Nemeth, B. A., Sullivan, J., & Allen, D. B. (2005). Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: A randomized, controlled study. *Archives of Pediatrics & Adolescent Medicine*, 159(10), 963-968.
- Carson, V. & Spence, J.C. (2010). Seasonal variation in physical activity among children and adolescents: a review. *Pediatr. Exerc. Sci*, 22(1), 81-92.
- Castelli, D. M., Hillman, C. H., Buck, S. M., & Erwin, H. E. (2007). Physical fitness and academic achievement in third- and fifth-grade students. *Journal of Sport & Exercise Psychology*, 29(2), 239-252.
- Christodoulos, A. D., Flouris, A. D., & Tokmakidis, S. P. (2006). Obesity and physical fitness of pre-adolescent children during the academic year and the summer period: Effects of organized physical activity. *Journal of Child Health Care*, 10(3), 199-212.
- Crosnoe, R., & Muller, C. (2004). Body mass index, academic achievement, and school context: Examining the educational experiences of adolescents at risk of obesity. *Journal of Health and Social Behavior*, 45(4), 393-407.

- DeBate, R. D., Gabriel, K. P., Huberty, Z., Huberty, J., & Zhang, Y. (2009). Changes in psychosocial factors and physical activity frequency among third- to eighth-grade girls who participated in a developmentally focused youth sport program: A preliminary study. *Journal of School Health, 79*(10), 474-484.
- DiLorenzo, T. M., Bargman, E. P., Stucky-Ropp, R., Brassington, G. S., Frensch, P. A., & LaFontaine, T. (1999). Long-term effects of aerobic exercise on psychological outcomes. *Preventive Medicine, 28*(1), 75-85.
- Dishman, R. K., & Buckworth, J. (1996). Increasing physical activity: A quantitative synthesis. *Medicine and Science in Sports and Exercise, 28*(6), 706-719.
- Dishman, R. K., Motl, R. W., Saunders, R. P., Dowda, M., Felton, G., Ward, D. S., et al. (2002). Factorial invariance and latent mean structure of questionnaires measuring social-cognitive determinants of physical activity among black and white adolescent girls. *Preventive Medicine, 34*(1), 100.
- Dishman, R. K., Motl, R. W., Saunders, R., Felton, G., Ward, D. S., Dowda, M., et al. (2004). Self-efficacy partially mediates the effect of a school-based physical-activity intervention among adolescent girls. *Preventive Medicine, 38*(5), 628.
- Edmundson, E., Parcel, G. S., Feldman, H. A., Elder, J., Perry, C. L., Johnson, C. C., et al. (1996). The effects of the child and adolescent trial for cardiovascular health upon psychosocial determinants of diet and physical activity behavior. *Preventive Medicine, 25*(4), 442-454.
- Gutin, B., Yin, Z., Johnson, M., & Barbeau, P. (2008). Preliminary findings of the effect of a 3-year after-school physical activity intervention on fitness and body fat: The medical college of georgia fitkid project. *International Journal of Pediatric Obesity, 3*, 3-9.
- Hallal, K., Kuramoto, L., Schulzer, M., & Retallack, J. (2006). Adolescent physical activity and health: A systematic review. *Sports Medicine, 36*(12), 1019-1030.
- Harter, S. (1988). *Manual for the self-perception profile for adolescents*. Denver, CO: University of Denver.
- Kendzierski, D., & DeCarlo, K. J. (1991). Physical activity enjoyment scale: Two validation studies. *Journal of Sport & Exercise Psychology, 13*(1), 50-64.
- Lewis, B. A., Marcus, B. H., Pate, R. R., & Dunn, A. L. (2002). Psychosocial mediators of physical activity behavior among adults and children. *American Journal of Preventive Medicine, 23*(2 Suppl), 26-35.
- Motl, R. W., Dishman, R. K., Trost, S. G., Saunders, R. P., Dowda, M., Felton, G., et al. (2000). Factorial validity and invariance of questionnaires measuring social-cognitive determinants of physical activity among adolescent girls. *Preventive Medicine, 31*(5), 584-594.

- Motl, R. W., Birnbaum, A. S., Kubik, M. Y., & Dishman, R. K. (2004). Naturally occurring changes in physical activity are inversely related to depressive symptoms during early adolescence. *Psychosomatic Medicine*, *66*(3), 336-342.
- Motl, R. W., Dishman, R. K., Ward, D. S., Saunders, R. P., Dowda, M., Felton, G., et al. (2005). Perceived physical environment and physical activity across one year among adolescent girls: Self-efficacy as a possible mediator? *The Journal of Adolescent Health : Official Publication of the Society for Adolescent Medicine*, *37*(5), 403-408.
- Nader, P. R., Stone, E. J., Lytle, L. A., Perry, C. L., Osganian, S. K., Kelder, S., et al. (1999). Three-year maintenance of improved diet and physical activity: The CATCH cohort. Child and Adolescent Trial for Cardiovascular Health. *Archives of Pediatrics & Adolescent Medicine*, *153*(7), 695-704.
- Ogden, C. L., Carroll, M. D., Curtin, L. R., Lamb, M. M., & Flegal, K. M. (2010). Prevalence of high body mass index in US children and adolescents, 2007-2008. *JAMA: Journal of the American Medical Association*, *303*(3), 242-249.
- Ortega, F. B., Ruiz, J. R., Castillo, M. J., & Sjostrom, M. (2008). Physical fitness in childhood and adolescence: A powerful marker of health. *International Journal of Obesity (2005)*, *32*(1), 1-11.
- Parcel, G. S., Simons-Morton, B., O'Hara, N. M., Baranowski, T., & Wilson, B. (1989). School promotion of healthful diet and physical activity: Impact on learning outcomes and self-reported behavior. *Health Education Quarterly*, *16*(2), 181-199.
- Parcel, G. S., Simons-Morton, B. G., O'Hara, N. M., Baranowski, T., Kolbe, L. J., & Bee, D. E. (1987). School promotion of healthful diet and exercise behavior: An integration of organizational change and social learning theory interventions. *The Journal of School Health*, *57*(4), 150-156.
- Paxton, R. J., Nigg, C. R., Motl, R. W., McGee, K., McCurdy, D., Matthai, C. H., et al. (2008). Are constructs of the transtheoretical model for physical activity measured equivalently between sexes, age groups, and ethnicities? *Annals of Behavioral Medicine : A Publication of the Society of Behavioral Medicine*, *35*(3), 308-318.
- Phillips, M., Petersen, A., Abbiss, C.R., Netto, K., Payne, W., Nichols, D., & Aisbett, B. (2011). Pack Hike Test finished time for Australian firefighters: Pass rates and correlates of performance. *Appl Ergon*, *42*(3), 411-418.
- Roberts, C. K., Freed, B., & McCarthy, W. J. (2010). Low aerobic fitness and obesity are associated with lower standardized test scores in children. *The Journal of Pediatrics*, *156*(5), 711.
- Sallis, J. F., Prochaska, J. J., & Taylor, W. C. (2000). A review of correlates of physical activity of children and adolescents. *Medicine & Science in Sports & Exercise*, *32*(5), 963-975.

- Sarria, A., Moreno, L. A., Garcia-Llop, L. A., Fleta, J., Morellon, M. P., & Bueno, M. (2001). Body mass index, triceps skinfold and waist circumference in screening for adiposity in male children and adolescents. *Acta Paediatrica (Oslo, Norway : 1992)*, 90(4), 387-392.
- Schwimmer, J. B., Burwinkle, T. M., & Varni, J. W. (2003). Health-related quality of life of severely obese children and adolescents. *JAMA: Journal of the American Medical Association*, 289(14), 1813.
- Sharma, S. V., Hoelscher, D. M., Kelder, S. H., Diamond, P. M., Day, R. S., & Hergenroeder, A. C. (2009). A path analysis to identify the psychosocial factors influencing physical activity and bone health in middle-school girls. *Journal of Physical Activity & Health*, 6(5), 606-616.
- Sibley, B. A., & Etnier, J. L. (2003). The relationship between physical activity and cognition in children: A meta-analysis. *Pediatric Exercise Science*, 15(3), 243-256.
- Singh, G. K., Kogan, M. D., & Yu, S. M. (2009). Disparities in obesity and overweight prevalence among US immigrant children and adolescents by generational status. *Journal of Community Health*, 34(4), 271-281.
- Sothorn, M. S., Loftin, M., Suskind, R. M., Udall, J. N., & Blecker, U. (1999a). The health benefits of physical activity in children and adolescents: Implications for chronic disease prevention. *European Journal of Pediatrics*, 158(4), 271-274.
- Sothorn, M. S., Loftin, M., Suskind, R. M., Udall, J. N., & Blecker, U. (1999b). The health benefits of physical activity in children and adolescents: Implications for chronic disease prevention. *European Journal of Pediatrics*, 158(4), 271-274.
- Swallen, K. C., Reither, E. N., Haas, S. A., & Meier, A. M. (2005). Overweight, obesity, and health-related quality of life among adolescents: The national longitudinal study of adolescent health. *Pediatrics*, 115(2), 340-340.
- Taras, H. (2005). Physical activity and student performance at school. *Journal of School Health*, 75(6), 214-218.
- United States Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Division of Adolescent and School Health. (2008). *Healthy youth! YRBSS youth online: Comprehensive results*. Retrieved April 12th, 2010, from <http://apps.nccd.cdc.gov/yrbss/CategoryQuestions.asp?Cat=6&desc=Physical%20Activity>
- Wallander, J. L., Taylor, W. C., Grunbaum, J. A., Franklin, F. A., Harrison, G. G., Kelder, S. H., et al. (2009). Weight status, quality of life, and self-concept in african american, hispanic, and white fifth-grade children. *Obesity*, 17(7), 1363-1368.

- Warburton, D. E. R., Nicol, C. W., & Bredin, S. S. D. (2006). Health benefits of physical activity: The evidence. *CMAJ: Canadian Medical Association Journal*, 174(6), 801-809.
- Wichstrøm, L. (1995). Harter's self-perception profile for adolescents: Reliability, validity, and evaluation of the question format. *Journal of Personality Assessment*, 65(1), 100.