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A SCALE TO ASSESS PERCEIVED BARRIERS TO PHYSICAL ACTIVITY
AMONG LOW-INCOME HIGH SCHOOL STUDENTS IN NEW JERSEY

By

CHRISTY L. HULLINGS

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Debra M. Palmer

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ABSTRACT OF THE THESIS

A Scale to Assess Perceived Barriers to Physical Activity Among Low-Income High

School Students in New Jersey

by CHRISTY L. HULLINGS

Thesis Director:

Debra M. Palmer

Obesity rates among teenagers have increased as their physical activity levels have simultaneously declined. Obesity and related disorders disproportionately affect teenagers from minority backgrounds and low-income households. To counteract the steady incline in adolescent obesity, public health educators should work to increase the physical activity of high school students, given the well-known health benefits of regular physical activity. By taking perceived barriers to physical activity into consideration, interventions that aim to improve teenagers' physical activity may be more effective because barriers have a strong effect on health behavior changes. The aim of this research project was to create a comprehensive tool to assess high school students' perceived barriers to physical activity. An initial list of 110 potential barriers was compiled from previous research with adults and an extensive literature review. A total of 1,201 high school students in low-income areas of New Jersey completed the survey,

which also measured physical activity level. Exploratory factor analyses revealed a final scale that contained 45 perceived barriers to physical activity, including three internal barriers sub-scales (n = 28 items) and two external barriers sub-scales (n = 17 items). The final scale exhibited acceptable levels of internal consistency, reliability over time and criterion validity. Female high school students were found to perceive significantly more barriers to physical activity than males and reported a significantly lower physical activity level than males, which is consistent with previous studies. Perceived barriers were primarily related to motivation and weather, a lack of exercise equipment, and lacking an exercise partner. Physical activity interventions should provide more activities of interest, more indoor activity opportunities (e.g., exercise DVDs), and address other pertinent barriers in order to improve high school students' physical activity levels. Further research is necessary to confirm the factor structure of the scale developed in this study, and the reliability and validity of this survey among other teenage audiences. The Perceived Barriers to Physical Activity Scale may help to inform the development of interventions by identifying specific barriers that should be addressed in order to help the target audience become more active.

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CHAPTER 1: INTRODUCTION

Adolescent obesity rates have increased from 4.6% to 20.5% over the last four decades.¹ Overweight teenagers are at an increased risk of developing type 2 diabetes, metabolic syndrome, sleep apnea and hypertension.² To aid in the prevention and improvement of obesity and related disorders, nutrition educators may take a variety of approaches. One approach is to promote physical activity. Adequate physical activity is known to effectively aid in weight loss, maintenance of a healthy weight and improvement of metabolic conditions associated with obesity.³ Increasing regular physical activity is one health behavior change that supports a healthy bodyweight.

Socioeconomic and demographic factors are associated with the health behaviors and likelihood of becoming obese of American adolescents. According to the YRBSS 2011, obesity is the most prevalent among minority groups.⁴ Approximately 18.2% of Black and 14.1% of Hispanic high school students are obese compared to 11.5% of white high school students.⁴ Further, as household income and education level of household head decreases, the obesity rate of teenagers increases.⁵

The Supplemental Nutrition Assistance Program-Education, or SNAP-Ed, is responsible for promoting a healthy, active lifestyle to low-income participants receiving SNAP benefits or other federal assistance.⁶ The Healthy Hunger Free Kids Act (HHFKA) gave SNAP-Ed the responsibility to provide nutrition education and implement obesity prevention programs.⁶ In response to these needs and directives, plans have been put into

place to develop interventions to promote physical activity among high school students participating in NJ SNAP-Ed.

Between 2009 and 2010, the NJ SNAP-Ed research team, led by Dr. Palmer-Keenan, assessed adult SNAP participants' barriers to physical activity. Adults often limited their activity due to "feeling tired," "being lazy," "low self-esteem," and/or a lack of "motivation" and "time."⁷ Based on these findings, an indoor walking DVD was developed and tested. After pilot-testing the use of an indoor walking DVD in adult SNAP-Ed classes, the barriers to physical activity were significantly reduced among adult participants.⁷

After completion of this work, the research team turned its attention to teenagers. Based on previous research of physical activity barriers among adults and a literature review of additional barriers, the current study assessed the perceived barriers to physical activity among low-income high school students. This work was done with the purpose that this information could be used to support the development of interventions that promote physical activity among teenagers, and their educational materials.

Taking into account that perceived barriers have a strong impact on health behavior change,⁸ this study provided the formative research necessary to develop interventions that will target specific barriers in order to increase physical activity levels among low-income teenagers. A secondary data analysis of previously-collected data of high school students' barriers to physical activity was performed to determine if there are other

considerations that need to be included in future interventions. Also, a comprehensive tool to assess teenagers' perceived barriers to physical activity was developed, and its reliability and validity was determined.

This introduction intended to present the current issue of adolescent obesity and a unique approach to inform the development of physical activity interventions for teens. The following sections include a comprehensive literature review, which encompasses all aspects of the issue. A manuscript prepared for publication and a conclusion follow. The manuscript was prepared according to the guidelines of the *International Journal of Behavioral Nutrition and Physical Activity* and thus, was referenced separately from the other chapters.

CHAPTER 2: LITERATURE REVIEW

Obesity is a major health concern across all age groups, especially adolescents. Over 17% of youth in the United States were obese in 2009-2010, which included 19.6% of adolescent boys and 17.1% of adolescent girls, ages 12 to 19.⁹ Notably, obesity rates are higher among adolescents from low-income households than teens from higher-income households, regardless of ethnicity.⁵ While no recent projection has been made for adolescent obesity in the U.S., it is thought that approximately 51% of adults in the U.S. will be obese by 2030; a 33% increase since 2008.¹⁰ If adolescent obesity in the U.S. follows a similar trajectory, an increase in obesity prevalence among youth is imminent.

Regular physical activity is one behavior recommended to reverse obesity.³ In an effort to inform interventions that promote physical activity among low-income teenagers, this project aimed to create a comprehensive tool to assess perceived barriers to physical activity among this audience. This section reviews the relevant literature, regarding teenagers (when appropriate), on calorie balance, physical activity, existing self-reported physical activity and intermediary assessments, correlates of physical activity level, and interventions that aim to increase teenagers' physical activity levels.

Calorie Balance and Obesity

Calorie balance, which results in a stable bodyweight, occurs when the amount of calories consumed by an individual equals the amount of calories expended.¹¹ Positive energy balance refers to an excess in caloric intake and reduced energy expenditure.¹¹⁻¹²

This suggests that a small, prolonged occurrence of a positive calorie balance promotes weight gain.¹³⁻¹⁵ Hill et al. estimated that the current obesity rate in the United States is the result of only an excess 100 kilocalories or less per day.¹³ Thus, the ever-increasing rate of obesity indicates that Americans of all ages are in a chronic state of calorie imbalance.¹²⁻¹³

The standard definition of adult obesity is having a body mass index (BMI) of 30.0 kg/m² or greater.^{12,16} Body mass index, or BMI, is the ratio of weight in kilograms versus height in meters-squared.^{12,16} Because BMI does not take lean body mass into consideration, other methods, like measuring central adiposity, are more direct indicators of obesity, yet BMI is easy to measure and continues to be the standard method to diagnose obesity.¹² The definition of adult obesity is not accurate for children and adolescents (ages 2 to 18) since they are still growing.¹⁶ Using growth charts developed from national surveys, child and adolescent obesity is defined as having a BMI-for-age equal to or over the 95th percentile.¹⁶⁻¹⁷ BMI-for-age growth charts accommodate height and sex differences for children and adolescents since these stages of life have characteristic patterns of growth.¹⁷

Researchers have hypothesized that environmental factors contribute significantly more to obesity than genetic factors.^{12,13} This is a plausible explanation because our environment has evolved rapidly over the past thirty years while obesity rates have doubled.¹²⁻¹³ Our modern environment is said to be “obesogenic,” as it alters both sides of the calorie balance equation in favor of positive energy balance.^{12,16} Inexpensive,

calorie-dense foods and larger portion sizes are examples of environmental factors that have increased the amount of calories consumed.^{12-13,16} Increased intake of fast food during adolescence has been found to be associated with weight gain in adulthood.¹⁸ It is also likely that more time spent in sedentary activities has reduced total energy expenditure.^{12-13,16} Youth spend 75% of the day in sedentary activities, such as doing homework and playing video games, and are only active for 1.4% of the day.¹⁹ There is an inverse relationship between the amount of time children and adolescents (ages 10 to 16) spend in sedentary activities and moderate physical activity.¹⁹

As time spent in sedentary activity has increased, physical activity levels of adolescents have declined, especially among girls.²⁰⁻²¹ Overall, the proportion of high school students who attended physical education class on a daily basis decreased from 41.6% to 25.4% between 1991 and 1995 and has remained at similar low levels until 2011.²² This trend has also been shown as teenagers mature. For example, as students progressed from 9th to 12th grade, it was found that physical education participation decreased.⁴ The Project-EAT II study found that as students aged, moderate-to-vigorous physical activity (MVPA) levels significantly decreased and television watching increased, especially among girls.²¹ More importantly, this decline in physical activity has been found to continue into adulthood and may contribute to increasing obesity rates.²⁰

The combination of reducing calories consumed and increasing calories expended may be the most effective approach to create and maintain weight loss.¹¹ However, altering only one side of the energy balance equation may also help to overcome obesity.¹¹ Ultimately,

the goal is to create a negative energy balance to induce weight loss.¹¹ For example, the USDA Dietary Guidelines 2010 recommended reducing caloric intake by decreasing sugar-sweetened beverage consumption, or increasing energy expenditure by increasing physical activity and reducing sedentary activities as appropriate methods for many individuals to achieve energy balance and even weight loss.¹⁶ This research project focused on the energy expenditure side of the calorie balance equation. For this reason, the remainder of this literature review will focus on activity only.

Physical Activity

Physical activity is defined as any movement of muscle which utilizes energy.^{3,23}

Baseline physical activity refers to movements to carry out everyday tasks such as walking or lifting small objects, whereas health-enhancing physical activity is extra activity which improves health, such as lifting weights and jogging.²³ The terms

“exercise” and “physical activity” are often used synonymously, but “exercise” is any planned physical activity for the purpose of improving physical fitness and falls into the health-enhancing category of physical activity.²³ There are three types of health-enhancing physical activity: aerobic, muscle-strengthening and bone-strengthening.³

Aerobic activity refers to rhythmic movement that increases heart rate, whereas muscle- and bone-strengthening activity require the body’s muscle and bone, respectively, to work while applying a force, such as a weight or repetitive movement.³ The intensity of activity refers to “how hard a person works” and ranges from levels low to moderate, and vigorous.³

While the type and amount of physical activity dictates its impact on health, any type or amount of physical activity is more beneficial than none at all.³ The Physical Activity Guidelines for Americans 2008 reported that regular physical activity among children and adolescents improves cardiovascular and metabolic risk factors, bone health, overall fitness and leads to a healthier bodyweight.³ A recent systematic review of 86 studies explored the impact of physical activity interventions on the health of children and adolescents and concluded that as physical activity of any kind increased, its positive impact on health increased as well.²⁴ Moderate to vigorous physical activity levels and aerobic physical activity were found to offer the most health benefits.²⁴ Regular weight training was found to increase bone mineral density in children and adolescents.²⁵ The Avon Longitudinal Study concluded that, for 12-year-old adolescents, the risk of obesity reduces as physical activity increases and that the amount of high-intensity physical activity may have a greater impact on obesity risk than the total physical activity amount.²⁶ If adolescents maintain regular physical activity into young adulthood, cardiovascular risk factors and overall health status are better than those who do not maintain physical activity.²⁷

The health benefits linked to regular physical activity have been firmly established. Nevertheless, the literature suggests that there is a decline in teenagers' engagement in physical activity. According to the Youth Risk Behavior Survey (YRBS) 2011, 28.7% of American high school students performed any type of physical activity 7 days a week.⁴ Approximately 58.4% of students played at least one sport for at least one year.⁴ Interestingly, 41.3% of 9th grade students regularly attended physical education classes,

while 24.2% of 12th students attended, suggesting that as students age, their physical education attendance decreases.⁴ From ages 9 to 15, it is estimated that moderate-to-vigorous physical activity levels significantly decrease by a rate of 38-41 minutes each year.²⁸ Physical activity declines more for adolescent girls, especially black girls, than boys.²⁹ Being an overweight or obese adolescent is associated with reduced levels of physical activity and reduced physical fitness.³⁰ This trend of declining physical activity in adolescence has been shown to continue into adulthood as well.²⁰

For children and adolescents, the *2008 Physical Activity Guidelines for Americans* and the WHO's *Global Recommendations on Physical Activity for Health* both recommend a minimum of 60 minutes of physical activity per day.^{3,31} Sixty minutes of activity may be performed in shorter bouts of 10 minutes throughout the day.³ A majority of the sixty minutes should consist of moderate-to-vigorous aerobic activity and should include vigorous activity, muscle-strengthening and bone-strengthening activities at least 3 days per week.^{3,31} Healthy People 2020 set national goals to increase the number of adolescents who meet aerobic physical activity recommendations from 18.4% to 20.2% and to increase the number of high schools which require daily student participation in physical education class from 2.1% to 2.3%.³²

Self-Reported Physical Activity Measures

When selecting an appropriate tool to assess physical activity, the advantages and disadvantages of each method, and the variables of interest should be considered.³³

Researchers have suggested that direct observation of children and adolescents' physical

activity is the most appropriate method to assess activity, yet it is time and labor-intensive.³⁴ Self-reported questionnaires are a cost effective and easy-to-administer method of assessing physical activity.³³ While accelerometers and heart-rate monitors may produce more accurate measures of activity, these objective assessment methods do not provide information about the type and location of physical activity.³³ Physical activity questionnaires are capable of gathering an estimation of physical activity engagement, as well as the type and location of activity.³³ To determine if a self-reported physical activity questionnaire is appropriate for a specific audience, the criterion validity (involving comparison with objective measures like accelerometers) and the reliability of a survey should be evaluated.³³⁻³⁴ This section will provide a brief description of the most commonly accepted physical activity questionnaires for teenagers (12 -18 years old),^{33,35} and discuss their reliability and validity. These are:

- Physical Activity Questionnaire for Adolescents (PAQ-A)
- Previous Day Physical Activity Recall (PDPAR)
- 3-Day Physical Activity Recall (3DPAR)
- Youth Risk Behavior Survey (YRBS)
- Teen Health Survey.

The PAQ-A (see Appendix I) is a modified version of the Physical Activity Questionnaire for Older Children (PAQ-C) that is used to assess high school students' physical activity levels during the school year.³⁶ Participants are asked to answer a list of Likert scale questions that determine how often they: engaged in a list of sports; were active during gym class, lunch, after school, the evenings, and the past weekend; and,

were asked to describe how active they normally are, to estimate their activity level each day of the week, and if being sick prevented their activity in the past week.³⁶ In a study conducted to determine the convergent validity of this survey, the PAQ-A was compared to one objective (i.e., Caltrac accelerometer) and three subjective measures (i.e., 7-day Physical Activity Recall [PAR], an activity rating and Leisure Time Exercise Questionnaire) of physical activity among eighty-five 8th through 12th grade students.³⁶ Moderate levels of convergent validity, as determined by Pearson correlations (r), have been observed between the PAQ-A and an accelerometer ($r = 0.33$), the PAR ($r = 0.59$), an activity rating ($r = 0.73$) and the Leisure Time Exercise Questionnaire ($r = 0.57$).³⁶ Another study determined that the PAQ-A exhibits good levels of internal consistency (Cronbach's alpha = 0.77 – 0.88) and further supported that it has acceptable validity compared with an accelerometer ($r = 0.41 – 0.62$).³⁷ Although the PAQ-A is only designed for school year use and requires more time to complete than other surveys, it has been highly recommended due to its moderate validity and reasonable reliability levels.³⁵

The PDPAR (see Appendix II) is another useful survey that utilizes a chart of 30-minute blocks of time for participants to report the activity they were engaged in at each time and rank each activity from very light to hard in physical intensity.³⁸ These blocks of time are then converted into metabolic equivalent (METs) units to quantify activity.³⁸ When used with 7th through 12th graders, the PDPAR has shown high test-retest reliability over one hour (Pearson correlation: $r = 0.98$), consistent inter-rater reliability ($r = 0.99$) for converting the PDPAR into METs, and moderately high convergent validity when

compared to a pedometer ($r = 0.88$) and a Caltrac activity counter ($r = 0.77$).³⁹ One weakness of the PDPAR is that it only assesses physical activity over one day and thus, it is recommended that this survey is conducted more than once to acquire adequate information about adolescents' regular physical activity levels.³⁹ Overall, the PDPAR serves as a highly reliable and valid questionnaire to assess physical activity among high school students.

The 3DPAR (see Appendix III) utilizes the same format of the PDPAR to assess high school students' physical activity over three days instead of only one.³⁸ This questionnaire has shown significant levels of convergent validity ($r = 0.35 - 0.51$; $p < 0.01$) when compared to accelerometer data for seven days among 8th and 9th grade girls.⁴⁰ Another study has reported similar results of moderate validity ($r = 0.32 - 0.40$; $p < 0.001$) when compared to pedometer data among 13 to 16-year-olds.⁴¹ Strong levels of test-retest reliability was also reported in two studies (Pearson correlation⁴²: $r = 0.68 - 0.83$; ICC⁴¹ = 0.88). These studies suggest that the 3DPAR is another self-reported physical activity questionnaire with strong validity and reliability among adolescents.

The physical activity portion of the YRBS (see Appendix IV) consists of five items that ask about activity and sedentary behaviors over the past week and the past year.³⁵ The YRBS has been tested among youth, ages 10 to 21, and has shown acceptable levels of validity and reliability in multiple studies.^{33,35} Advantages of this survey are its brevity and the fact that it does not require reporting minutes or hours of activity, which help decrease variability in answers.³⁵ The YRBS was highly recommended by a group of

physical activity experts for these reasons, especially for population surveillance purposes.³⁵ The Teen Health Survey (see Appendix V) utilizes two items that were modified from the YRBS to assess high school students' physical activity.⁴³ It only requires participants to report their how often they were active for at least 60 minutes over the last seven days and in a typical week.⁴³ Test-retest reliability (over nine weeks) was found to be acceptable (ICC = 0.77), and convergent validity when compared to accelerometer data was significant ($r = 0.40$; $p < 0.001$). The brevity and the reasonable reliability and validity of the Teen Health Survey lead experts to endorse the use of this questionnaire.³⁵

Self-reported questionnaires of physical offer a moderately valid and reliable method of acquiring information about the amount and type of activity.³³ The five questionnaires discussed in this section are only a few of the self-report measures available to assess activity, yet these surveys exhibit reasonable validity and reliability among adolescents and should be used when appropriate.

Assessment of Intermediary Variables to Physical Activity

The use of intermediary variables, such as psychosocial constructs that may lead to improvements in physical activity among teens, has been minimally addressed. Measures developed thus far have addressed: intention to change/stage of change, social support, self-efficacy and perceived activity barriers. This section will discuss tools developed to assess each measure among high school students, and their validity and reliability.

Stages of change (or intention to change) is a construct of the Transtheoretical Model (TTM) and refers to the process that an individual goes through to adopt a behavior change.⁴⁴ The six stages consist of: (1) pre-contemplation, (2) contemplation, (3) preparation, (4) action, (5) maintenance, and (6) termination.⁴⁴ Hagler and colleagues developed a two-item questionnaire (see Appendix VI) to assess the stages of change of adolescents (ages 10 to 16) towards meeting the physical activity recommendation of 60 minutes per day.⁴⁵ The convergent validity of the physical activity (PA) staging measure was mixed since results were significantly related to Progressive Aerobic Cardiovascular Endurance Run (PACER), but not to accelerometer measurements of activity.⁴⁵ The divergent validity of the PA staging measure was strong because it was not significantly related to the sedentary behavior measure (i.e., hours spent watching television).⁴⁵ This is one of the few self-reported questionnaire that has been designed to assess stages of change among adolescents.

Social support, including family and peer support, with regard to physical activity refers to support such as encouragement, transportation, and activity companionship that may affect a teenagers' physical activity level.⁴⁶ Sallis et al. had created a 5-item assessment of family support and a 4-item assessment of peer support on 6-point Likert-type scales as part of the Amherst Health and Activity Study (see Appendix VII).⁴⁶⁻⁴⁷ The family support items have exhibited acceptable internal consistency (Cronbach's alpha = 0.78) and test-retest reliability (ICC = 0.70) among grades 1 through 12.⁴⁶ Peer support items have also exhibited acceptable internal consistency (Cronbach's alpha = 0.74) and test-retest reliability (ICC = 0.70) among younger adolescents (ages 6 to 15).⁴⁶ Among 10th

through 12th graders, both family and peer support items had a significant positive correlation with parent-reported vigorous physical activity.⁴⁶ Thus, the family and peer support of physical activity items are valid and reliable measures, but may need further study among older adolescents.

Self-efficacy in relation to physical activity has been assessed in two distinct categories: task and regulatory components.⁴⁸ Task efficacy, or physical activity efficacy, refers to one's beliefs about their ability to be active in specific situations, while regulatory efficacy assesses one's ability to overcome barriers to being physically active.⁴⁹ The Self-Efficacy for Daily Physical Activity Questionnaire (SEPAQ) (see Appendix VIII) is a self-report questionnaire that was recently developed to assess physical activity (task) efficacy among adolescents (mean age = 15.6 years old), and consisted of 34 items in seven categories of physical activity domains (i.e., household, school, occupational, leisure time).⁴⁸ This scale was the first to take a "domain specific approach" to assess self-efficacy (specifically task efficacy), and requires further research of its validity and reliability with other adolescent populations.⁴⁸

Saunders et al. developed a scale about self-efficacy to overcome barriers to being active (see Appendix IX) and this scale contained both task and regulatory efficacy items.⁵⁰ Participants were asked to determine if they could be physically active via seventeen items, using a dichotomous response (i.e., yes or no).⁵⁰ The scale has exhibited acceptable levels of internal consistency (Cronbach's alpha = 0.54 – 0.71) and test-retest reliability (correlation coefficient = 0.61 – 0.82).⁵⁰ This scale was only validated among

5th graders,⁵⁰ nonetheless it has been used to assess self-efficacy to overcome activity barriers by studies conducted with teenagers.^{19,51}

Dwyer and colleagues performed extensive research to develop a scale to assess self-efficacy to overcome physical activity barriers,⁵² which may be considered a regulatory component approach to assessing self-efficacy.⁴⁸ The Self-Efficacy to Overcome Barriers to Physical Activity (SOBPAS) (see Appendix X) is the one of the only validated questionnaires to assess barriers to physical activity among high school students.⁵² The final version of the SOBPAS contained 24 items in five categories (one internal barriers scale and four external barriers scales).⁵² A five-point Likert scale (i.e., 1 = not at all confident and 5 = very confident) was used to assess the extent that an individual believed they could overcome each barrier.⁵² Acceptable internal consistency (Cronbach's alpha = 0.79 – 0.86) was demonstrated, and regressions between physical activity level and self-efficacy to overcome barriers was statistically significant, indicating acceptable predictive validity.⁵²

Assessing self-efficacy to overcome perceived barriers is similar to assessing perceived barriers to physical activity. It has even been suggested that self-efficacy is part of the perceived barriers construct since barriers are known to have a profound effect on behavior change.⁸ Dwyer and colleagues sought to develop a perceived barriers to physical activity scale (see Appendix XI) in another study.⁵³ Participants reported the extent that 16 items “[prevented them] from participating in vigorous physical activity.”⁵³ The perceived barriers scale consisted of one internal (n = 10 items) and one external (n =

6) barriers sub-scale. Internal barriers were negatively correlated to physical activity level, indicating acceptable criterion validity, while external barriers were positively associated with vigorous physical activity level.⁵³ Dwyer's perceived barriers scale may not assess all pertinent activity barriers and did not study barriers in relation to moderate-to-vigorous physical activity level. Other assessments of perceived barriers have only been developed for adults, or do not offer a comprehensive assessment of teenagers' barriers. Many studies use short barriers scales (i.e., nine to twelve items) that do not assess all potential perceived barriers items, and these scales often have questionable reliability and validity.⁵⁴⁻⁵⁵ A standard assessment tool for barriers to physical activity is currently not available.

There is a need to develop self-report tools that assess intermediary variables among adolescents such as those discussed in this section. These variables can offer valuable insight into the factors that public health programs should address over short periods of time. As will be discussed next, some psychosocial factors are correlated with adolescents' physical activity level and may be used as constructs to show change after a short intervention. However, validated and comprehensive scales are necessary to accurately assess these factors.

Correlates and Determinants of Adolescents' Physical Activity

Correlates are “factors associated with activity” and determinants are factors “with a causal relationship” to physical activity.⁵⁶ Bauman et al. analyzed six systematic reviews to identify correlates and determinants of adolescents' physical activity.⁵⁶ The factors

were divided into four categories: demographic, psychosocial, behavioral and social/cultural.⁵⁶ Sallis et al. reviewed 54 studies to identify correlates of adolescent's activity and used similar categories, adding a "factors of physical environment" category.⁵⁷ Based on these review articles, this section will focus on how these factors correlate to or determine adolescents' physical activity.

The first category of factors examined in connection with physical activity is demographic factors, which includes age, gender, ethnicity and socioeconomic status.⁵⁶⁻⁵⁷ Among adolescents, being male has been positively correlated with physical activity, but male gender has not been found to be a determinant, meaning that being a male adolescent may not truly determine if an individual is highly active.⁵⁶⁻⁵⁹ Age and physical activity are negatively associated, especially among adolescent girls.^{57-58,60} In terms of ethnicity, being white has been identified as a positive determinant of physical activity,⁵⁷ while black ethnicity has been shown to be a negative determinant.⁶⁰⁻⁶¹ Socioeconomic status (SES) has been associated with adolescents' physical activity level, indicating that low SES teenagers tend to be less active and high SES teenagers tend to be more active.^{59-60,62} In summary, the literature consistently showed a positive correlation between being male and being active. Ethnicity has also been found to be a positive demographic determinant, with white adolescents being the most likely to be active.

Notably, several systematic reviews have suggested that the association between BMI and the physical activity level of adolescents is either inconclusive^{61,63} or that it does not exist.^{56-57,59} Many studies of nationally-representative samples of adolescents have found

an inverse association between adolescents' BMI and their physical activity levels.^{58,64-65} Most studies have used self-reported physical activity data⁶⁴⁻⁶⁵ and BMI as a measure of adiposity, which may not be an ideal measurement for youth.¹⁶ Thus, no conclusion can be made about the relationship between BMI and physical activity level of adolescents until further research is conducted.

Another important category, psychosocial factors, has been studied in relation to adolescents' physical activity and includes the following factors:

- self-efficacy, or the conviction that one has to be physically active
- attitudes toward physical activity
- barriers to physical activity, or anything that might stop an individual from being active
- intentions, or if an individual intends to be physically active
- goal/achievement orientation, and
- depression.^{56-57,59,63}

Self-efficacy is the only psychological factor that has been found to be both a positive correlate^{56,59-60,66-67} and a positive determinant of adolescents' physical activity.^{56,63,68}

Attitude,^{56,59,69} intentions,^{57,59} and goal/achievement orientation^{57,59} have been found to be positive correlates of physical activity level among teenagers, while depression^{57,59,70} has been found to be a negative correlate of adolescents' physical activity level. A relationship between barriers to physical activity and adolescents' physical activity remains inconclusive.^{56,63,71} Additional research is needed to assess the impact of barriers on adolescent activity.

The third category, behavioral factors, consists of health-related activities that have been studied in relation to adolescents' physical activity. These behaviors include sedentary time, smoking, drinking, dietary habits, previous physical activity levels and involvement in physical education class and/or school sports.^{24,59} Previous physical activity levels^{57,61,71} and involvement in physical education and/or school sports^{57,59-60,71} have been positively associated with adolescents' current physical activity levels. Smoking^{59-60,72-74} and alcohol use^{68,72} have been found to be negatively associated with adolescents' physical activity level. Sedentary time and adolescents' physical activity levels have been found to have an inconclusive association, as some teens are inactive for a large portion of the day, but compensate by regularly engaging in moderate-to-vigorous physical activity for recommended time periods.^{57,60,63,71} The association between the dietary habits of teenagers and their physical activity level remains inconclusive as well.^{63,71} Overall, teens who smoke are less likely to be active, and those with a history of being physically active remain active.

Teenagers' physical activity levels have also been studied in connection to the following sociocultural factors^{57,59,63,71}:

- parental physical activity level
- parental/family support
- peer/social support
- social group/social norms, or the expectations about how one's behavior will be judged by their peers.⁴⁴

A positive correlation has been found between adolescents' physical activity and parental/family support.^{56-57,59-60,71,75} Parental support includes the “encouragement, transport, involvement, and modeling” of parents to help their teenagers become active.⁷⁵ However, while maternal physical activity alone may be a positive correlate of adolescent activity,^{68,75} overall, parental physical activity is not.^{57,59,75-76} Further, the relationship between peer social support^{57,71,76} and social norms,^{57,63,71,76} and teens' activity is inconclusive. Thus, among these sociocultural variables, only parental/family support has been found to be a positive correlate of physical activity among teenagers.

The most common aspects of the physical environment that have been studied in relation to teenagers' physical activity include equipment/facilities available and perceived neighborhood safety.^{57,63} A correlation has been found between adolescents' activity level and neighborhood safety, with lower activity levels observed in unsafe neighborhoods.⁷⁷⁻⁷⁹ The availability of equipment/facilities has been positively correlated with teenagers' activity levels.^{59,77,80} Of the physical environment factors studied, the literature has shown that neighborhood safety is a strong correlate of adolescents' activity levels.

In summary, ethnicity (being white) and self-efficacy have consistently been found to be positive “determinants” of teenagers' activity level, while self-efficacy, previous physical activity, parental/family support and perceived neighborhood safety have also been found to be strong “correlates.” Negative correlates of adolescents' physical activity have been shown to be depression and smoking.

Review of Interventions Aimed Towards Increasing Adolescents' Physical Activity

Public health educators implement interventions that promote physical activity in an effort to combat adolescent obesity. Oftentimes, the interventions focus on manipulating the determinants and correlates of adolescents' physical activity discussed in the previous section, such as self-efficacy to be active, barriers to activity, and social support. The impact of such interventions will be discussed in this section.

After an extensive literature review (using the search terms identified in Appendix XII) was conducted. Those studies were examined met the following criteria. They were conducted in the United States between 2003 and 2013, written in English, and included only adolescents (i.e., grades 9-12 and/or 12 to 18 years old). Nine interventions that aimed at improving physical activity among adolescents were identified. Seven intervention studies were based in high schools, three of which focused on female adolescents' activity levels. School-based interventions included a variety of instruction types, ranging from tailored physical education classes to health education lessons using multi-media tools. Of the remaining two studies, one intervention had been conducted on a community environment level and the other intervention had involved a faith-based exercise class.

The impact of each intervention on measures of physical activity, physical fitness and related measures (i.e., psychosocial factors) is shown in Table 2.1. Studies were listed in chronological order and grouped together based on intervention type (school and community or faith-based). The table includes sample size, participants' age range,

intervention intensity and duration, physical activity type of intervention (if applicable), measurements assessed and any changes observed pre- and post-intervention.

Table 2.1: School-based Intervention Impact on Adolescents' Physical Activity Levels and Related Measures

Study	Study Population (N) (Gender: F= Females, M= Males, B= Both)	Age Range (R, years) Mean (M, years) Grade Level (G)	Intervention Intensity and Duration	Type of Physical Activity	Physical Activity Assessment Measures Used	Intervention Group Change: Pre- to Post- Intervention
Project FAB ⁸⁵	N = 47 (F)	R = NR M = 14.94 ± 0.79 G = 10th - 11th	Five 40-min. sessions/week 4 months	Aerobic activity	Cardiovascular Fitness (VO ₂ peak L/min)	0
					Physical Activity (METS)	Light +*
						Moderate - **
						Total +*
					Lifestyle Activities	+ **
					Self-Efficacy	0
					Perceived Barriers to Physical Activity	0
					Social Support	0
Planning to be Active ⁸¹	N = 240 (B)	R = NR M = 15.13 ± 0.74 G = 9th - 12th	1 session/week 8 weeks	NR	Leisure time physical exercise (days per week)	Moderate + **
						Vigorous + **
LEAP ⁸⁶	N = 1047 (F)	R = NR M = 17.7 ± 0.6 G = 12 th	NR 3-4 years	NR	Vigorous Physical Activity (METS)	+ *

Table 2.1: School-based Intervention Impact on Adolescents' Physical Activity Levels and Related Measures

Study	Study Population (N) (Gender: F= Females, M= Males, B= Both)	Age Range (R, years) Mean (M, years) Grade Level (G)	Intervention Intensity and Duration	Type of Physical Activity	Physical Activity Assessment Measures Used		Intervention Group Change: Pre- to Post- Intervention
Schneider et al. ⁸⁷	N = 120 (F)	R = NR	Five 40-min sessions/week	Aerobic activity	Vigorous Physical Activity (METS)		+ ***
		M = 15.02 ± 0.08	9 months		Cardiovascular Fitness (VO ₂ peak L/min)		+ *
		G = 10th - 11th			Global Physical Self-concept		0
Health in Motion ⁸⁴	N = 1800 (B)	R = NR	One 30-min session/month	NR	Physical Activity (days spent doing 60 minutes or more)		+ ***
		M = 15.78 ± NR	2 months		Stage of Change		+ ***
PHAT ⁸³	N = 1654 (B)	R = 12 – 18	One 8-hour session/week	NR	Physical Activity Behaviors (days)	Moderate PA	0
		M = NR	2 weeks			Vigorous PA	0
		G = 7th - 12th				Strength/Tone Muscles	0
COPE ⁸²	N = 779 (B)	R = 14 – 16	One 20-min session/week	Aerobic activity	Physical Activity (Steps per day)		+ **
		M = 14.74 ± 0.73	15 weeks				
		G = NR					

NR = Not reported; PA = Physical Activity; METs = Metabolic expenditure units; + Increased; - Decreased; 0 No change; Statistical Significance: *p< 0.05; **p<0.01, ***p<0.001

Table 2.2: Community and Faith-based Intervention Impact on Adolescents’ Physical Activity Levels and Related Measures							
Study	Study Population (N) (Gender: F = Females, M = Males, B = Both)	Age Range (R, years) Mean (M, years) Grade Level (G)	Intervention Intensity and Duration	Type of Physical Activity	Physical Activity Assessment Measures Used		Intervention Group Change: Pre- to Post- Intervention
Active Living by Design ⁸⁸	N = 1125 (B)	R = NR M = NR G = 9th - 12th	NR 1 year	NR	Physical Activity-Related Behaviors (days)	Meets moderate and/or vigorous guidelines	+
		Walks to school				0	
Fitness-U-N-joy (F.U.N.) ⁹⁰	N=41 (F)	R = 12–18 M = 14.2 ± 1.6 G = 6th - 12th	Two 30-min sessions/week 12 weeks	Aerobic activity	Cardiovascular Fitness (VO2 max estimation)		0
					Physical Activity (METS)		0
					Social Support		0
					Family Support		0
					Self-efficacy		0
					Physical Activity Enjoyment		0
					Attitude		0
					Intention		0

NR = Not reported; PA = Physical Activity; METs = Metabolic expenditure units; + Increased; - Decreased; 0 No change; Statistical Significance: *p<0.05;

p<.01, *p<0.001

School-based Intervention Studies to Increase Adolescents' Physical Activity

Two school-based interventions were “cognitive-behavioral skill-building” curricula based on Social Cognitive Theory.⁸¹⁻⁸² The *COPE* (Creating Opportunities for Personal Empowerment) program consisted of weekly lessons on healthy behavior skills with a short exercise component over 15 weeks.⁸² The *Planning to be Active* program included weekly lessons on “self-regulation skills” to increase physical activity and a “sport skills physical education” component for eight weeks.⁸¹ Both programs significantly increased physical activity measures of high school students in the intervention groups.⁸¹⁻⁸² *COPE* measured physical activity in steps per day and required students to record daily pedometer readings throughout the study.⁸² *Planning to be Active* measured leisure-time physical activity levels in days per week and had participants record their activity using the Previous Day Physical Activity Recall (PDPAR) questionnaire.^{81,38-39} These results suggest that interventions focused on physical activity that lasting at least eight sessions can have a significant impact on adolescents' physical activity levels.

Mixed results were found with regard to two shorter (two or three sessions) interventions that included physical activity, but also focused on other health behaviors. This included the *PHAT* (Promoting Health Among Teens) curriculum⁸³ and the *Health in Motion* program.⁸⁴ *PHAT*, which targeted urban, African American adolescents, included two 8-hour sessions on diet, physical activity and substance abuse.⁸³ *PHAT* used the Behavioral Risk Factor Surveillance Survey Physical Activity Module questions and self-reported measures to assess engagement in moderate and vigorous physical activity, and strength/muscle toning activities.⁸³ No significant changes in participants' physical

activity behaviors resulted from *PHAT*.⁸³ The *Health in Motion* program used a multi-media approach to promote physical activity, consumption of fruits and vegetables and reducing television viewing among diverse (approximately 70% White, 20% Black, and 10% Other) high school students from four states.⁸⁴ The *Health in Motion* program found a significant increase ($p < 0.001$) in the number of days students reported being active for at least 60 minutes.⁸⁴ The difference in the results may be due to the intervention content, duration, and/or the varied assessments used. Based on this review, the success of short-term interventions with teens that do not focus solely on physical activity is inconclusive.

Three school-based interventions were tailored to increase the physical activity of high school girls.⁸⁵⁻⁸⁷ Two studies were designed by the same investigator and had similar components, yet focused on modifying different psychosocial variables related to physical activity.^{85, 87} During each week of the *Project FAB* (Fitness and Bone) and the Schneider et al.'s studies, teens engaged in 40-minute exercise sessions four days per week, and one 60-minute lecture on physical activity strategies and benefits on the fifth day.^{85, 87} The duration of *Project FAB* was four months, while the Schneider et al. study lasted nine months.^{85,87} Measures used in both studies were identical since the same investigator carried them out. Cardiovascular fitness was measured as VO_2 maxpeak (L/min) using the metabolic cart, and physical activity levels (METs) were measured using either the 2-Day or 3-Day Physical Activity Recall (2-/3-DPAR) questionnaire.^{85,87} *Project FAB* resulted in significant increases in light ($p < 0.05$), total ($p < 0.01$) and lifestyle physical activity ($p < 0.05$), a significant decrease in moderate activity ($p < 0.01$), and no

change in cardiovascular fitness.⁸⁵ Schneider et al. yielded a significant increase in vigorous physical activity level ($p < 0.001$) and cardiovascular fitness ($p < 0.01$).⁸⁷ Overall, both interventions increased physical activity behaviors, but the longer duration of the intervention (i.e., nine months) in the Schneider et al. study also resulted in a significant improvement in cardiovascular fitness.^{85,87}

LEAP was the third intervention tailored for high school girls.⁸⁶ The school-wide intervention was designed to “enhance physical activity self-efficacy and enjoyment” by teaching “physical and behavioral skills needed to adopt and maintain an active lifestyle.”⁸⁶ It also required participation in moderate-to-vigorous physical activity (MVPA) during physical education class.⁸⁶ This intervention measured physical activity using a 3-Day Physical Activity Recall (3DPAR),⁸⁶ just as the Schneider et al. study⁸⁷ and *Project FAB*.⁸⁵ Significantly more female students participated in MVPA on a daily basis in schools that highly implemented and maintained the *LEAP* intervention over four years when compared to schools that did not or minimally implemented the program.⁸⁶ All three interventions increased female adolescents’ physical activity levels by focusing on psychosocial factors related to physical activity during lessons.⁸⁵⁻⁸⁷

Community and Faith-Based Intervention Studies to Increase Adolescents’ Physical Activity

Only one community-based physical activity intervention and one faith-based physical activity intervention targeting teens were found. The *Active Living by Design* project used a Community Action Model to promote physical activity in Somerville, MA over

one year (i.e., 2007-2008).⁸⁸ Some project components were: new sidewalk and bike path creations, park renovations, school-based activities, physical education classes, and community garden development.⁸⁸⁻⁸⁹ The intervention's impact on high school students was assessed, as was its impact on the middle school students and adults of the Somerville community. Data from the annual Youth Risk Behavior Survey (2004 and 2008) was used to measure changes in high school students' physical activity-related behaviors including the frequency of walking to school and meeting the moderate and/or vigorous physical activity guidelines.⁸⁸ There was a significant increase in the number of high school students in Somerville who met the moderate and/or vigorous physical activity guidelines post-intervention.⁸⁸ No significant change in the number of high school students who walked to school was found.⁸⁸ Based on this one study, it appears that community-wide interventions to improve physical activity may have an impact on adolescents' activity levels.

The *Fitness-U-N-joy (FUN)* study was a church-based intervention designed specifically to increase the physical activity levels of Black adolescent girls in an urban area of North Carolina.⁹⁰ Participants attended one 60-minute class per week for 12 weeks.⁹⁰ Classes included 30 minutes of discussion aimed to improve psychosocial factors related to physical activity and 30 minutes of dance aerobics.⁹⁰ The Adolescent Physical Activity Recall Questionnaire (APARQ) was used to measure physical activity levels (METS) and a heart rate monitor estimated cardiovascular fitness (VO₂ max level).⁹⁰ While no statistically significant changes were found in either cardiovascular fitness or physical activity levels, a trend towards being more active was found.⁹⁰ Authors posited that the

intervention length and duration may not have been long enough to observe significant changes in physical activity and fitness.⁹⁰

Summary of Intervention Studies

School-based interventions comprised the majority of those identified, and the primary variables evaluated were self-efficacy and changes in adolescents' activity levels. This review suggests that intervention impacts on adolescents' physical activity levels may be dependent on the intervention's focus and duration. Of the interventions that targeted all adolescents, school-based interventions that focused on "cognitive-behavioral skill-building"⁸¹⁻⁸² or physical activity and other health behaviors⁸⁴ resulted in increased physical activity levels of adolescent participants if the intervention lasted for at least eight weeks. This result was noted in intervention studies with a total number of sessions ranging from two to forty.^{81-82,84} School-based interventions that targeted female adolescents and focused on altering psychosocial factors related to physical activity resulted in increased physical activity levels as well.⁸⁵⁻⁸⁷ *Active Living by Design*, the only community-level program identified, took place over a full year and included environmental support; this intervention also increased physical activity.⁸⁸ In summary, longer intervention durations and an increased number of intervention sessions per week result in significant increases in adolescents' physical activity.

Literature Review Conclusion

This literature review revealed that the trend in declining physical activity among teenagers may be addressed by interventions that aim to modify factors related to physical activity. Psychosocial factors such as self-efficacy, intention to change/stages of

change and social support (i.e., friends and family support) have been shown to be positively related to adolescents' physical activity levels and thus, may act as intermediary variables to affect change on physical activity. However, there are limited tools used to assess these variables, especially perceived barriers to physical activity. The aim of this project was to develop a comprehensive scale to assess teenagers' perceived barriers to physical activity, so that information about barriers may inform and measure change in public health programs that aim to increase teenagers' physical activity levels.

CHAPTER 3: A Scale to Assess Perceived Barriers to Physical Activity among Low-Income High School Students in New Jersey.

By Christy L. Hullings,^{1,2} Debra M. Palmer-Keenan^{1,2}

ABSTRACT

Background: Despite the well-known health benefits of physical activity, less than one third of high school students meet daily activity recommendations, and physical activity levels, especially among females, have continued to decline at an alarming rate. Understanding teenagers' perceived barriers to activity may help educators design more effective interventions that address pertinent barriers. The aims of this study were to: 1) develop a comprehensive tool to assess teens' barriers to physical activity, and 2) use this tool to assess activity barriers among a sample of New Jersey teenagers.

Methods: A 110-item survey consisted of potential barriers to physical activity identified from previous research with adults and a literature review. Fifteen cognitive interviews were conducted to test the face validity of the survey before it was administered to 1,201 high school students in low-income areas of New Jersey. Physical activity levels were also measured using the Physical Activity Questionnaire for Adolescents (PAQ-A). Exploratory factor analysis with Varimax rotation was used to determine the factor structure of the barriers scale. Bivariate correlations between the sum of barriers scores

¹ Department of Nutritional Sciences, Rutgers University, New Brunswick, NJ, USA

² New Jersey Supplemental Nutrition Assistance Program - Education, Rutgers University, 11 Suydam Street, New Brunswick, NJ, USA

and physical activity levels determined criterion validity. Test-retest reliability (Pearson coefficients) and internal consistency (Cronbach's alpha) of the barriers scale and sub-scales were also assessed.

Results: A 45-item scale, comprised of five sub-scales (Motivation, Self-Concept, Financial and Environmental, Perceived Importance, and Weather barriers) resulted. Test-retest reliability (Pearson coefficients: 0.58–0.78) and internal consistency (Cronbach's alphas: 0.78–0.96) levels were acceptable. A negative correlation was observed between physical activity level and the sum of barriers scores (Pearson coefficients: –0.194 to –0.410). More internal (28 items) than external (17 items) barriers were perceived by all participants. Female teenagers reported significantly higher mean responses for all 45 barrier items compared to males. Top barriers were related to motivation, weather, and environment (e.g., lack of equipment), as well as lack of an exercise partner.

Conclusions: The resulting scale offers a comprehensive assessment of perceived barriers to physical activity among low-income high school students. This tool may be used by educators to determine specific barriers to address and, ultimately, to create effective interventions that improve teenagers' physical activity levels.

Keywords: perceived barriers, scale development, teenagers, physical activity

BACKGROUND

Regular physical activity provides many health benefits, ranging from reduced risk of obesity to improved bone health.¹⁻³ The *2008 Physical Activity Guidelines for Americans* recommend that adolescents engage in at least 60 minutes of physical activity per day.¹ According to the Youth Risk Behavior Surveillance survey (YRBS), only 28.7% of high school students meet the requirement.⁴ Adolescents' physical activity levels have been shown to consistently decrease 38-41 minutes each year as they get older,⁵⁻⁶ and female adolescents have been shown to be less active than males.⁷⁻⁸ Higher levels of physical activity during adolescence have been shown to reduce the risk of obesity³ and positively affect bone and mental health.⁹ Further, active youth tend to remain active throughout adulthood,¹ and their overall health status remains better than those who are not active.¹⁰

Researchers have studied various correlates of adolescents' physical activity. Ethnicity (i.e., being White),^{8,11} gender (male),^{8,11-12} self-efficacy,¹¹⁻¹³ previous physical activity level,^{8,14} family support,^{8,12} and perceived neighborhood safety¹⁵⁻¹⁶ have been positively correlated to physical activity, while a negative correlation has been found with depression⁸ and smoking.¹⁷⁻¹⁸ Notably, the relationship between adolescents' physical activity and perceived barriers to physical activity remains indeterminate.^{8,12,19}

Perceived barriers to physical activity include a variety of internal and external factors that prevent an individual from engaging in regular physical activity. External barriers to physical activity include environmental barriers, such as bad weather or lack of access to exercise equipment or facilities.²⁰ Internal barriers to physical activity refer to psycho-

social factors, such as a lack of energy, preference for technology-related activities, the notion that exercise is not important, and concerns about being active amongst peers.²⁰

Federal nutrition education programs that serve low-income youth were charged by the Healthy Hunger-Free Kids Act (HHFKA) to create and implement obesity prevention programs.²¹ The Health Belief Model (HBM) suggests that to create effective educational interventions, perceived barriers to the desired behavior change must be identified²² because these barriers have a strong influence on health behaviors.²³ The aim of the present study was to create a scale to assess the perceived barriers to physical activity of low-income high school students. This was done to assist in filling the research gap that currently exists in this area and to inform future interventions with this audience.

METHODS

Survey Development

An initial list of 77 barriers to physical activity was obtained from previous research conducted by the research team to assess adults' perceived barriers to physical activity. An extensive literature review regarding adolescents' perceived barriers to physical activity revealed 33 additional barriers. Fifteen cognitive interviews were conducted with high school students to assess the face validity of the survey. Barrier items were revised to ensure participants' comprehension of the survey questions. On the final survey, the order of barrier items was randomized and three versions of the survey were created to ensure a degree of validity through triangulation. Three bogus questions (e.g., "On this

line, put two checks in the “Often” column”) were randomly placed in barrier items list to confirm if participants were attentive while completing the survey. If a student did not follow the bogus questions’ instructions, the survey was removed from final analyses. (See Appendix XIII for one version of the survey.)

Participants and Procedure

A convenience sample of adolescents was recruited from five high schools in which 50% or more of the students received free or reduced-price lunches, and five community agencies (The Children’s Home, Lawrence Community Center, Greater Newark Conservancy, Girl Scouts, and 4-H) in low-income areas of Burlington, Camden, Essex, Mercer, Middlesex, and Passaic counties in New Jersey. Eligible participants were in 9th through 12th grade and were required to understand, read, and speak English. Prior to survey administration, participants gave oral assent after listening to a short statement explaining the purpose of the study and the rights of the participant. The survey took approximately 10-15 minutes to complete. All surveys were anonymous. No compensation was provided for survey completion. Data collection took place between May and October 2012. Study approval was obtained from the Institutional Review Board of Rutgers University.

Measures

Perceived Barriers to Physical Activity

Perceived barriers to physical activity were assessed using a checklist of 110 barrier items. The list was prefaced with the question: “Does this stop me from exercising?” A

5-point Likert scale assessed to what extent an item stopped participants from exercising: “Always” (5), “Often” (4), “Sometimes yes, Sometimes no” (3), “Once in a while” (2), and “Never” (1).

Physical Activity

The Physical Activity Questionnaire for Adolescents (PAQ-A) is a survey that was developed in 1997 to assess the physical activity levels of high school students (ages 14 to 18) during the school year.²⁴ Participants answer questions, using a 5-point Likert scale, regarding how often they engaged in various sports and how many times they were active in gym class, at lunch, right after school, evenings, on the weekends and on each day of the week.²⁴ The PAQ-A was included in cognitive interviews of the current study, and no issues in comprehension were found with the target audience. The PAQ-A survey has shown acceptable levels of validity ($r = 0.56$, $p < 0.05$) and reliability (Cronbach’s alpha: 0.77–0.88).²⁵

Demographic

Three demographic questions were included in the survey. Respondents were asked to identify their gender, race/ethnicity and grade level.

Data Analyses

All statistical analyses were performed using SAS software. Pairwise deletion was used to remove missing data for all analyses. Descriptive statistics of participant demographics were calculated. A floor effect was set such that if less than 15% of

participants rated a barrier item as a perceived barrier (i.e., a Likert scale score > 1.0 , indicating it never stopped them from exercising), the barrier item was removed. Pearson correlation coefficients were used to determine the test-retest reliability of the survey when administered two weeks apart. Barrier items that did not show a significant correlation ($p < 0.05$) between the test and retest values were removed. Exploratory factor analyses (EFA) were conducted with Varimax rotation to determine the factor structure of the barrier items. A scree test plot was used to determine the number of factors to retain. Barrier items that did not load onto a factor (i.e., factor loading < 0.40) were removed. Redundant barrier items that loaded onto the same factor were removed as well. Internal consistency was measured by determining the Cronbach's alpha for the entire barriers scale and for each subscale. A Cronbach's alpha coefficient of 0.7 or higher indicates acceptable internal consistency.²⁶ Test-retest reliability was assessed using Pearson correlation coefficients between the means of barriers subscales, and coefficients were classified as "excellent" if 0.81 or greater, "good" if between 0.61 and 0.80, "acceptable" if between 0.41 and 0.60, and "poor" if 0.40 or less.²⁶ Criterion validity was assessed by determining the correlation between PAQ-A scores (i.e., physical activity level measures) and total perceived barriers to physical activity scores. Student's t-test was used to assess differences between PAQ-A scores and gender.

RESULTS

Sample Demographics

A total of 1,364 adolescents in 9th through 12th grade were surveyed from five high schools and five community agencies (Table 3.1). Data presented are for the final sample

of 1,201 students who responded correctly to the three bogus questions (i.e., who were deemed to have given adequate attention to the survey). Significantly more participants were Hispanic/Latino (62.8%, $p < 0.0001$) than those who were Black (19.8%), White (6.5%), and Other (11.0%). The sample also consisted of significantly more participants were female (57.0%, $p < 0.0001$) than male (43.0%), and significantly more upperclassmen (Grade 11 = 28.5%, Grade 12 = 36.4%, $p < 0.0001$) than lowerclassmen (Grade 9 = 18.4%, Grade 10 = 16.7%).

Table 3.1: Participant Demographics by Site											
Site	N	Grade (%)				Gender (%)		Race/Ethnicity (%)			
		9th	10th	11th	12th	Male	Female	Hispanic/ Latino	Black	White	Other
Entire Sample	1,201	18.4	16.7	28.5*	36.4*	43.0	57.0*	62.8*	19.8	6.5	11.0
Perth Amboy HS	679	12.6	11.8	29.0	46.7	41.3	58.7	83.1	7.2	1.8	7.88
Lindenwold HS	337	30.7	25.9	24.9	18.5	48.8	51.6	33.3	33.0	17.3	16.4
J.F.K. HS	73	19.4	19.4	35.5	25.8	34.7	65.3	45.2	35.6	4.1	15.1
Urban Promise Academy	29	32.0	40.0	28.0	0	57.7	42.3	50.0	38.5	0	11.5
Newark Conservancy	39	0	11.1	47.2	41.7	43.6	56.4	25.6	64.1	2.6	7.7
New Brunswick HS	18	NR	NR	NR	NR	0	100.0	100.0	0	0	0
Children's Home (Burlington)	13	36.4	18.2	27.3	18.2	38.5	61.5	30.8	46.2	7.7	15.4
4-H (Middlesex)	6	NR	NR	NR	NR	50.0	50.0	83.3	16.7	0	0
Girl Scouts (Middlesex)	3	33.3	0	33.3	33.3	0	100	66.7	33.3	0	0
Lawrence Community Center	3	66.7	33.3	0	0	100.0	0	0	33.3	0	66.7

Note: Sample sizes may vary for each demographic category due to missing data. NR – Not reported; HS – High School; *p < 0.0001

Item Removal Process

During the initial analyses performed to develop the barriers scale, nine items that were inconsequential or did not demonstrate reliability over time were removed for the following reasons:

- Five items did not meet the floor effect criteria of 15% (which suggested that these items were not actually perceived as barriers).
- Four items did not demonstrate significant ($p < 0.05$) test-retest reliability when responses from a subsample of 97 participants who completed the survey twice with two weeks between each administration were correlated.

Next, 56 items were removed from the remaining 101 items, for the following reasons:

- Twenty-seven items did not load on any factors at ≥ 0.40 .
- Seven items exhibited a high correlation with one or more conceptually similar items (Pearson correlation coefficient > 0.50).
- Fourteen items had questionable conceptual fit with other items.
- Eight items were deemed conceptually similar, even when the Pearson correlation coefficient was less than or equal to 0.50.

These analyses are described in further detail below.

Factor Structure

Exploratory factor analysis with a Varimax rotation was used to determine the factor structure of the remaining 101 barriers. A six-factor solution was deemed most appropriate. However, after further scrutiny, a five-factor solution was used, as the sixth factor lacked interpretability and had poorer internal consistency (Cronbach's alpha:

0.64) than the other five. The top-rated barrier items with a mean over 2.0 (Table 3.2) were retained in the final scale, unless items were conceptually similar. The resulting factors were labeled:

- Factor 1: Motivation Barriers (internal barriers)
- Factor 2: Self-Concept Barriers (internal barriers)
- Factor 3: Financial and Environmental Barriers (external barriers)
- Factor 4: Perceived Importance Barriers (internal barriers)
- Factor 5: Weather Barriers (external barriers)

Thus, three of the subscales encompassed internal barriers and two external barriers.

Additional changes were made to improve the scale's conceptual fit. First, two barrier items were moved to different subscales. "No one encourages me to exercise" was moved from the Financial and Environmental barriers sub-scale to the Motivation barriers sub-scale; and "It is hot outside" was moved from the Motivation barriers to the Weather barriers sub-scale. In both cases, an acceptable internal consistency was retained in the sub-scales to which the items were moved. Next, although the statement "I do not have anyone to do it with" had been rated highly as a perceived barrier, it did not load on (or fit conceptually with) any of the factors. As such, it was retained in the final scale but was not included in any of the sub-scales.

The final barriers scale consisted of 45 items. The 44 items that were included on five factors accounted for 23.96% of the variance. Table 3.3 shows the final factor structure

with factor loadings, eigenvalues, communalities, and the percentage of variance explained by each factor.

Table 3.2: Means of Perceived Barriers to Physical Activity by Gender						
Barrier Item^a	All		Female		Male	
	Mean	SD	Mean	SD	Mean	SD
I would rather be doing something that is more fun ****	2.43	1.36	2.64	1.39	2.19	1.31
I am lazy ****	2.40	1.39	2.69	1.45	2.09	1.27
I'd rather spend time with my friends or family ***	2.37	1.36	2.53	1.41	2.22	1.29
There is snow outside ****	2.27	1.45	2.43	1.49	2.04	1.35
I would rather talk online, on the phone, or text ****	2.22	1.33	2.50	1.41	1.87	1.17
Lack of energy ****	2.20	1.19	2.41	1.23	1.97	1.11
It is rainy outside ****	2.19	1.41	2.38	1.48	1.91	1.39
Feeling tired ****	2.16	1.24	2.40	1.29	1.91	1.13
There is ice outside ****	2.14	1.39	2.33	1.46	1.91	1.27
I would rather spend time on the computer ****	2.10	1.27	2.29	1.35	1.87	1.15
I am too busy to exercise ****	2.08	1.21	2.28	1.27	1.80	1.09
I would rather watch TV ****	2.06	1.28	2.17	1.34	1.91	1.17
It is hot outside ****	2.04	1.25	2.30	1.36	1.75	1.07
I get tired from doing it ****	2.02	1.18	2.20	1.25	1.76	1.03
I don't have the right equipment ****	2.02	1.30	2.20	1.39	1.77	1.14
It is cold outside ****	2.01	1.26	2.21	1.33	1.71	1.09
I do not have anyone to do it with ****	2.01	1.30	2.25	1.38	1.73	1.14
There's no place for me to exercise at home ****	1.97	1.33	2.15	1.42	1.75	1.19
I do not have any motivation to do it ****	1.95	1.26	2.16	1.35	1.74	1.11
I get tired soon after I start exercising ****	1.94	1.18	2.14	1.24	1.70	1.08
It is dark outside ****	1.86	1.23	1.99	1.34	1.64	1.04
No one encourages me to exercise ****	1.80	1.21	2.01	1.31	1.55	1.03
No one helps me with transportation **	1.80	1.18	1.90	1.25	1.67	1.07
I get enough exercise in gym class ****	1.76	1.12	1.93	1.21	1.50	0.91
I am concerned about how I look when exercising ****	1.75	1.21	1.88	1.30	1.53	1.04

Barrier Item ^a	All		Female		Male	
	Mean	SD	Mean	SD	Mean	SD
I do not think I will get any results****	1.74	1.14	1.90	1.21	1.53	0.98
I have no way to get to where I could exercise****	1.74	1.15	1.90	1.24	1.52	0.97
I am self-conscious about my looks****	1.72	1.16	1.92	1.26	1.42	0.88
My family can't afford a gym****	1.67	1.19	1.77	1.26	1.46	1.00
There are no free or low-cost places to exercise near me***	1.66	1.13	1.75	1.20	1.50	1.03
It is windy outside****	1.64	1.05	1.78	1.16	1.40	0.82
I get embarrassed****	1.64	1.10	1.78	1.18	1.42	0.90
I am not strong enough****	1.63	1.05	1.76	1.15	1.41	0.87
I don't think I can do it****	1.61	1.06	1.73	1.15	1.40	0.85
I cannot afford exercise classes****	1.61	1.15	1.72	1.26	1.42	0.97
I do not know how to do the activities near me****	1.61	0.99	1.71	1.06	1.46	0.87
I am not good at it****	1.59	1.03	1.71	1.11	1.41	0.90
Fear of people making fun of me**	1.57	1.07	1.63	1.13	1.43	0.97
People whispering or pointing at me****	1.55	1.07	1.65	1.15	1.37	0.89
There is nowhere close to exercise**	1.54	0.99	1.61	1.03	1.43	0.93
I do not have a good reason to exercise****	1.49	0.98	1.59	1.09	1.33	0.78
I do not need to exercise****	1.46	0.95	1.54	1.04	1.32	0.80
I don't think exercise will do me any good*	1.46	0.95	1.51	1.00	1.35	0.82
People in my family don't believe it is important*	1.39	0.88	1.43	0.93	1.30	0.75
People my age don't need to exercise*	1.39	0.92	1.40	0.93	1.28	0.78

Note: Ns ranged from 1020 to 1187. SD – Standard Deviation. ^ap-value based on t-test of gender differences between barrier items. *p < 0.05; **p < 0.005; ***p < 0.001; ****p < 0.0001

Table 3.3: Factor Loadings for Exploratory Factor Analysis of Barrier Items						
Perceived Barrier to Physical Activity Items	Factor					Comm.
	1	2	3	4	5	
I would rather spend time on the computer	0.57					0.42
I would rather talk online, on the phone, or text	0.50					0.39
I would rather watch TV	0.58					0.48
I do not have any motivation to do it	0.54					0.51
I am lazy	0.73					0.60
I would rather be doing something that is more fun	0.69					0.57
Lack of energy	0.61					0.51
I get tired soon after I start exercising	0.57					0.54
I'd rather spend time with my friends or family	0.63					0.50
Feeling tired	0.51					0.50
I am too busy to exercise	0.49					0.48
No one encourages me to exercise	0.37		0.47			0.47
I get tired from doing it	0.64					0.59
I get embarrassed		0.69				0.44
Fear of people making fun of me		0.73				0.68
I am self-conscious about my looks		0.66				0.58
People whispering or pointing at me		0.64				0.63
I am concerned about how I look when exercising		0.68				0.60
I don't think I can do it		0.58				0.61
I do not think I will get any results		0.47				0.48
I am not good at it		0.55				0.66
I am not strong enough		0.52				0.58
My family can't afford a gym			0.46			0.33
There are no free or low-cost places to exercise near me			0.62			0.50
I cannot afford exercise classes			0.57			0.43

Perceived Barrier to Physical Activity Items	Factor					Comm.
	1	2	3	4	5	
I do not know how to do the activities near me			0.49			0.44
There's no place for me to exercise at home			0.47			0.45
I don't have the right equipment			0.54			0.53
I have no way to get to where I could exercise			0.48			0.41
There is nowhere close to exercise			0.56			0.51
No one helps me with transportation			0.63			0.51
People my age don't need to exercise				0.62		0.49
I don't think exercise will do me any good				0.50		0.47
I do not need to exercise				0.62		0.47
I do not have a good reason to exercise				0.58		0.52
People in my family don't believe it is important				0.49		0.45
I get enough exercise in gym class				0.44		0.38
It is cold outside					0.68	0.62
It is rainy outside					0.74	0.62
It is windy outside					0.46	0.43
There is ice outside					0.73	0.59
There is snow outside					0.72	0.61
It is dark outside					0.52	0.46
It is hot outside	0.44				0.34	0.42
Eigenvalue	15.61	2.50	2.25	1.82	1.78	
Percentage of variance	6.63	5.32	4.94	3.79	3.28	

Comm. - Communalities

Internal Consistency

Internal consistency was established for each sub-scale. Cronbach's alpha values were: 0.90 for Motivational barriers, 0.90 for Self-Concept barriers, 0.85 for Financial and Environmental barriers, 0.78 for Perceived Importance barriers, and 0.83 for Weather barriers. Internal barriers, including Motivational, Self-Concept, and Perceived Importance barriers, had an alpha of 0.94. External barriers included the Financial and Environmental, the Weather barriers sub-scales, and the independent factor, "I do not have anyone to do it with" and had an alpha of 0.89. The entire barriers scale had a Cronbach's alpha value of 0.96, indicating redundancy among barrier items.²⁷

Two-week test-retest reliabilities for the barriers scale and its sub-scales were acceptable to good. The Pearson correlation coefficient for the entire scales' responses was 0.78 (95% CI: 0.67–0.86). For mean responses of each sub-scale, the Pearson correlations were as follows: Motivation barriers = 0.75 (95% CI: 0.63–0.83); Self-Concept barriers = 0.72 (95% CI: 0.58–0.81); Financial and Environmental barriers = 0.75 (95% CI: 0.62 – 0.83); Perceived Importance barriers = 0.58 (95% CI: 0.41–0.71); and Weather barriers = 0.66 (95% CI: 0.50–0.77).

Criterion Validity

No gold standard for assessing perceived barriers to physical activity currently exists. However, the logical assumption that individuals who are less active will perceive the greatest number of barriers, and vice versa, has been used in previous studies and was employed by this study.^{20, 28-29} To determine the criterion validity of the barrier factors,

the bivariate correlation between mean PAQ-A scores (i.e., mean physical activity level) and the mean sum of each barrier factor was measured (Table 3.4). The mean PAQ-A score for female high school students (2.26 ± 0.79) was significantly lower ($p < 0.0001$) than for male high school students (2.75 ± 0.78). An inverse relationship was observed between physical activity levels, as assessed by the mean PAQ-A scores, and the barriers scale and sub-scale results.

Table 3.4: Correlations of High School Students' Physical Activity Levels (PAQ-A score total) with Barriers Scale Sums		
Barriers Scale*	Pearson Correlation	p value
Motivation	-0.410	< 0.0001
Self-Concept	-0.280	< 0.0001
Financial and Environmental	-0.323	< 0.0001
Perceived Importance	-0.194	< 0.0001
Weather	-0.255	< 0.0001
Internal	-0.369	< 0.0001
External	-0.339	< 0.0001
Entire Scale	-0.389	< 0.0001

*Pairwise deletion was used to remove missing values. Ns ranged from 1191 to 1192.

Perceived Barrier Rankings

Seventeen of the 45 barrier items exhibited mean scores greater than 2.00, suggesting that these were barriers to the participants' activity sometimes, often, or always (Table 3.2).

Ten of these items were Motivation barriers, five were Weather-related, one was a Financial and Environmental barrier item, and one suggested a lack of companionship (i.e., "I do not have anyone to do it with"). The mean of external barrier responses (1.87 ± 0.72) was significantly higher ($p < 0.05$) than the mean of internal barrier responses (1.84 ± 0.69), however the effect size (Cohen's $d = 0.057$) was small

Females' responses for all barrier items were significantly higher than those reported by males (Table 3.2). Regarding female participants, twenty-one items had a mean score ≥ 2.0 , while only four items received a mean score ≥ 2.0 for male participants. The five top-ranked barriers for females and males were similar, yet differed in their rank order. Females ranked theirs as: (1) Laziness, (2) Preference for something that is more fun, (3) Preference for spending time with family or friends, (4) Preference for talking online or texting, and (5) Snow. In contrast, males ranked their top barriers as: (1) Preference for spending time with friends or family, (2) Preference for activities that are more fun, (3) Laziness, (4) Snow, and (5) Lack of energy.

DISCUSSION

This study sought to develop a scale to comprehensively assess perceived barriers to physical activity among low-income high school students. A 45-item scale with five factors resulted. The scale exhibited acceptable levels of test-retest reliability, internal consistency, and criterion validity. Another notable finding was that teens appeared to perceive more internal (three factors; 28 items) than external (two factors; 17 items) barriers to physical activity.

Dwyer and colleagues sought to develop a similar scale for high school students, which was called the Self-Efficacy to Overcome Barriers to Physical Activity Scale (SOBPAS).³⁰ Self-efficacy refers to the extent to which an individual will overcome something that keeps them from engaging in a health behavior, such as being physically active.²² Perceived barriers are often considered to be a component of self-efficacy and

are referred to as “tangible and psychological costs” of a health behavior, requiring high self-efficacy to overcome them.²² After Dwyer and colleagues revised the SOBPAS, factor analyses revealed a five-factor scale with four sub-scales addressing external barriers (18 items) and one subscale of internal barriers (6 items).³⁰ The SOBPAS suggested that high school students perceive more external than internal barriers to moderate to vigorous physical activity, while the current study suggests the opposite. However, there were some discrepancies in what items were considered to be internal and external barriers to physical activity. Dwyer and colleagues had considered “feeling tired,” “not having fun,” and “busy social life” to be external barriers,³⁰ but this study considered these items to be internal barriers.

All barrier items of the SOBPAS were also assessed in the current study’s survey, with the exception of “too much schoolwork.” The SOBPAS lacked barrier items that addressed the following: perceived importance (e.g., believing activity is not important), feeling self-conscious, not having the right equipment, and self-concept (e.g., I don’t think I can do it). Both final scales contained the following similar items: not motivated, other interests, not having fun, feeling tired, feeling embarrassed, being too busy to exercise, being teased by others, cost, not having enough skills, no transportation, weather, and lack of someone to be active with.³⁰

Some of the items included in our work were examined more incrementally, as opposed to being assessed with a single item as in the SOBPAS. For example, the cost barrier was assessed with three items: (1) My family can’t afford a gym; (2) There are no free or low

cost places to exercise near me; (3) I cannot afford exercise classes. Only one SOBPAS item, “Cost of doing physical activity,” assessed this barrier.³⁰ Another example is that the SOBPAS contained a single “weather” barrier item,³⁰ while this study assessed this barrier with a seven-item sub-scale of various weather conditions, including snow, heat, and wind. The advantage associated with single-item (SI) assessments is that they require a lower response burden for completion (which can be advantageous for program assessment), yet SI construct assessments are innately ambiguous.³¹ Multiple-item assessments are more sensitive to change over time³² and are especially useful for empirical studies since they provide details that leave little room for misinterpretation.³¹ Thus, the current study’s scale may elicit more complete and reliable information.

The perceived barriers assessed in this study, both internal and external, exhibited an inverse relationship with physical activity. This suggests that perceiving more barriers to physical activity may account for lower physical activity levels among high school students, and vice versa. This result is consistent with previous research,¹¹ especially among female teenagers,^{7-8,33} and supports the criterion validity of this scale and its sub-scales. While the SOBPAS also found a negative correlation between internal barriers and vigorous physical activity levels, it demonstrated a positive correlation between external barriers and vigorous physical activity levels of teenagers, which does not match previous findings.^{20,34} However, Dwyer and colleagues attributed this discrepancy to the fact that they assessed only vigorous (rather than moderate and vigorous) activity among the participants.^{20,34}

Previous studies have reported that female teens perceived that a lack of time, energy and/or interest most prevented them from engaging in physical activity.³⁵⁻³⁹ The current study found similar barriers (e.g., “I am lazy,” “Lack of energy,” and “I am too busy to exercise”) to be high among females. Some researchers have suggested that during adolescence girls experience an “identity conflict”⁴⁰ between being feminine and being a tomboy (i.e., being active).^{35,40} Additionally, having low sports competence and feeling that teachers discouraged their participation in sports were concerns mentioned by female adolescents in previous studies.^{35,41} Thus, motivational barriers reported by girls (e.g., laziness and no motivation) may be derived from “a fear of humiliation and feelings of inadequacy.”⁴¹ These findings may or may not be true among low-income females and should perhaps be further examined, provided the similarities in the barriers identified by this study as compared to others. Regardless of the cause of these perceived barriers, it seems clear that gender-specific interventions may be needed to adequately increase girls’ physical activity levels. These findings also suggest that interventions may need to address time management to improve their effectiveness.³⁶

The common perceived barriers of low-income teenagers were related to a lack of motivation (e.g., other interest, tiredness, lack of energy), unfavorable weather, not having the right equipment, and not having anyone to exercise with. To help teens overcome motivational barriers, school-based interventions have been designed to increase enjoyment of physical activity and self-efficacy by teaching the skills necessary to adopt a healthy lifestyle in physical education classes, and these interventions have resulted in significant increases in physical activity.⁴²⁻⁴⁴ Belanger and colleagues

reported lower levels of physical activity among teenagers during rainy and snowy conditions,⁴⁵ and earlier studies also revealed that adverse weather conditions were perceived barriers among teens.³⁹ Increasing indoor physical activity opportunities (i.e., exercise DVDs) may help improve teens' physical activity levels by overcoming weather barriers. To address a lack of proper equipment and not having an exercise partner, community centers and after-school programs could provide more resources (e.g., programs, exercise equipment) to teens and encourage them to bring their friends. Another study suggested a "physical activity/active living stamp program" for low-income individuals in which stamps are exchanged for exercise programs or equipment.⁴⁶

Several strengths and limitations of this study should be mentioned. A sufficiently large sample size (N = 1,201) and the use of a validated questionnaire (i.e., PAQ-A) to assess adolescents' physical activity levels serve as its strengths. The comprehensive list of 110 barrier items assessed a majority of potential barriers to physical activity among teenagers. The use of three bogus questions helped to check the attentiveness of participants on the survey, and the removal of those surveys where adequate attention was not given helped maintain a data set that excluded those participants who likely were most greatly affected by response burden. Still, the length of the survey (i.e., six pages) may have deterred participants from giving accurate answers as well. Two weaknesses are that the study was cross-sectional, and the study sample was primarily urban, Hispanic/Latino participants, and therefore, these results cannot be generalized nationally. While this survey seems to be adequately reliable and valid in terms of assessing perceived barriers, it has yet to be used to assess change, and its sensitivity to

change if used for this purpose will need to be established. Further, as is always the case with “self-reported” measures, over-reporting of physical activity levels (i.e., PAQ-A) and under-reporting of perceived barriers may have impacted the accuracy of these measures.

CONCLUSION

Because physical activity is difficult to measure reliably, the assessment of perceived barriers may be a valuable intermediary variable that can be used for program evaluation to demonstrate meaningful change, using self-reported survey measures. The Perceived Barriers to Physical Activity Scale developed by this study may serve as a comprehensive tool to help health educators assess these barriers. However, additional cohort studies will be required to test the survey for its use in assessing changes in barriers that result from interventions. Also, further research is needed to confirm the factor structure of internal and external perceived barriers to physical activity and to determine the validity and reliability of this tool among teens from other population subgroups.

The preliminary findings generated in this investigation may be used to inform the development of interventions that aim to increase adolescents’ physical activity by tailoring the approach to specific barriers of the target audience. For example, taking into account the more rapid decline of adequate activity levels among teenage girls and the fact that female teenagers reported significantly higher “perceived barrier” means than males for all barriers items in this study and by Dwyer and colleagues, educators should work to modify these perceptions. Interventions that provide more activities of interest to

teenage girls in gym class or at community centers^{37,47} and address their perceived barriers to activity may more effectively improve their activity levels. Helping teens engage in fun activities in small, indoor spaces using exercise DVDs can overcome their perceptions that exercise is not fun, they have no place to do it, and/or that weather is a problem. Interventions that teach time management skills may be effective in increasing females' physical activity levels as well, since the evidence that time constraints are a top barrier among females.³⁶ These approaches should be tested and implemented.

Abbreviations:

PAQ-A: Physical Activity Questionnaire for Adolescents; SOBPAS: Self-Efficacy to Overcome Barriers to Physical Activity Scale; HHFKA: Healthy Hunger Free Kids Act; HBM: Health Belief Model.

Competing interests:

The authors declare that they have no competing interests.

Authors' contributions:

Study was funded by the New Jersey Supplemental Nutrition Assistance Program – Education (NJ SNAP-Ed). CH reviewed the literature, analyzed the data, wrote the manuscript, and created the tables. DP designed the study, secured funding, contributed to data analysis and interpretation, and critically reviewed the manuscript.

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References

1. United States Department of Health and Human Services, Physical Activity Guidelines Advisory Committee: *2008 Physical Activity Guidelines for Americans*. Washington, DC; 2008.
2. Hind K, Burrows M: **Weight-bearing exercise and bone mineral accrual in children and adolescents: a review of controlled trials**. *Bone* 2007, **40**:14-27.
3. Ness A, Leary S, Mattocks C, Blair S, Reilly J, Wells J, Ingle S, Tilling K, Smith GD, Riddoch C: **Objectively measured physical activity and fat mass in a large cohort of children**. *PLoS Medicine* 2007, **4**:e97.
4. Eaton DK, Kann L, Kinchen S, Shanklin S, Flint KH, Hawkins J, Harris WA, Lowry R, McManus T, Chyen D, Whittle L, Lim C, Wechsler H; Centers for Disease Control and Prevention: **Youth risk behavior surveillance – United States, 2011**. *MMWR* 2012, **61**:1-162.
5. Nelson MC, Neumark-Stzainer D, Hannan PJ, Sirard JR, Story M: **Longitudinal and secular trends in physical activity and sedentary behavior during adolescence**. *Pediatrics* 2006, **118**:e1627-e1634.
6. Nader PR, Bradley RH, Houts RM, McRitchie SL, O'Brien M: **Moderate-to-vigorous physical activity from ages 9 to 15 years**. *JAMA* 2008, **300**:295-305.
7. Centers for Disease Control and Prevention (CDC): **Physical activity levels of high school students – United States, 2010**. *MMWR* 2011, **60**:773-777.
8. Sallis JF, Prochaska JJ, Taylor WC: **A review of correlates of physical activity of children and adolescents**. *Med Sci Sports Exerc* 2000, **32**:963-975.
9. Hallal P, Victora C, Azvedo M, Wells J: **Adolescent physical activity and health: a systematic review**. *Sports Med* 2006, **36**:1019-1030.
10. Rangul V, Bauman A, Holmen TL, Midthjell K: **Is physical activity maintenance from adolescence to young adulthood associated with reduced CVD risk factors, improved mental health and satisfaction with life: the HUNT study, Norway**. *Int J Behav Nutr Phys Act* 2012; **9**:144.
11. Sterdt E, Liersch S, Walter U: **Correlates of physical activity of children and adolescents: a systematic review of reviews**. *Health Educ J* 2014, **73**:72-89.
12. Van Der Horst K, Paw MJ, Twisk JW, van Mechelen W: **A brief review of correlates of physical activity and sedentariness in youth**. *Med Sci Sport Exer* 2007, **39**:1241-1250.

13. Lubans DR, Foster C, Biddle SJ: **A review of mediators of behavior in interventions to promote physical activity among children and adolescents.** *Am J Prev Med* 2008, **47**:463-470.
14. de Bruijn GJ, Kremers SPJ, Lensvelt-Mulders G, de Vries H, van Mechelen W, Brug J: **Modeling individual and physical environmental factors with adolescent physical activity.** *Am J Prev Med* 2006; **30**:507-512.
15. Babey SH, Hastert TA, Yu H, Brown R: **Physical activity among adolescents. When do parks matter?** *Am J Prev Med* 2008, **34**:345-348.
16. Molnar BE, Gortmaker SL, Bull FC, Buka SL: **Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents.** *Am J Health Promot* 2004, **18**:378-386.
17. Larson NI, Story M, Perry CL, Neumark-Sztainer D, Hannan PJ: **Are diet and physical activity patterns related to cigarette smoking in adolescents? Findings from Project EAT.** *Prev Chronic Dis* 2007, **4**:1-12.
18. Wilson DB, Smith BN, Speizer IS, Bean MK, Mitchell KS, Uguy S, Fries EA: **Differences in food intake and exercise by smoking status in adolescents.** *Am J Prev Med* 2005, **40**:872-879.
19. Craggs C, Corder K, Van Sluijs EM, Griffin SJ: **Determinants of change in physical activity in children and adolescents: a systematic review.** *Am J Prev Med* 2011, **40**:645-658.
20. Allison KR, Dwyer JJM, Makin S: **Perceived barriers to physical activity among high school students.** *Prev Med* 1999, **28**:608-615.
21. United States Department of Agriculture: *Supplemental Nutrition Assistance Program Education Guidance, Nutrition Education and Obesity Prevention Grant Program.* Washington, DC; 2014.
22. Glanz K, Rimer BK, Viswanath K (Eds): *Health Behavior and Health Education.* 4th edition. San Francisco, CA: John Wiley & Sons; 2008.
23. Janz NK, Becker MH: **The Health Belief Model: a decade later.** *Health Educ Q* 1984, **11**:1-47.
24. Kowalski KC, Crocker PRE, Kowalski NP: **Convergent validity of the physical activity questionnaire for adolescents.** *Pediatr Exerc Sci* 1997, **9**:342-352.
25. Janz KF, Lutuchy EM, Wenthe P, Levy SM: **Measuring activity in children and adolescents using self-report: PAQ-C and PAQ-A.** *Med Sci Sports Exerc* 2008, **40**:767-772.

26. Nunnally JC, Bernstein IH: *Psychometric Theory*. 3rd edition. New York: McGraw-Hill; 1994.
27. Streiner DL: **Starting at the beginning: an introduction to coefficient alpha and internal consistency.** *J Pers Assess* 2003, **80**:99-103.
28. Dunton GF, Schneider M: **Perceived barriers to walking for physical activity.** *Prev Chronic Dis* 2006, **3**:1-11.
29. Dwyer JJ, Allison KR, Makin S: **Internal structure of a measure of self-efficacy in physical activity among high school students.** *Soc Sci Med* 1998, **46**:1175-1182.
30. Dwyer JJ, Chulak T, Maitland S, Allison KR, Lysy DC, Faulkner GEJ, Sheeshka J: **Adolescents' self-efficacy to overcome barriers to physical activity Scale.** *Res Q Exerc Sport* 2012, **83**:513-521.
31. Diamantopoulos A, Sarstedt M, Fuchs C, Wilczynski P, Kaiser S: **Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective.** *J Acad Mark Sci* 2012, **40**:434-449.
32. Bowling A: **Just one question: If one question works, why ask several?** *J Epidemiol Community Health* 2005, **59**:342-345.
33. Graham DJ, Wall MM, Larson N, Neumark-Sztainer D: **Multicontextual correlates of adolescent leisure-time physical activity.** *Am J Prev Med* 2014, **46**:605-616.
34. Allison KR, Dwyer JJ, Makin S: **Self-efficacy and participation in vigorous physical activity by high school students.** *Health Educ Behav* 1999, **26**:12-24.
35. Dwyer JJ, Allison KR, Goldenberg ER, Fein AJ, Yoshida KK, Boutilier MA: **Adolescent girls' perceived barriers to participation in physical activity.** *Adolescence* 2006, **41**:75-89.
36. Kimm SY, Glynn NW, McMahon RP, Voorhees CC, Striegel-Moore RH, Daniels SR: **Self-perceived barriers to activity participation among sedentary adolescent girls.** *Med Sci Sports Exerc* 2006, **38**:534-540.
37. Tergerson JL, King KA: **Do perceived cues, benefits, and barriers to physical activity differ between male and female adolescents?** *J Sch Health* 2002, **72**:374-380.
38. Eime RM, Casey MM, Harvey JT, Sawyer NA, Symons CM, Payne WR:

Socioecological factors potentially associated with participation in physical activity and sport: a longitudinal study of adolescent girls. *J Sci Med Sport* 2014, in press.

39. Tappe MK, Duda JL, Ehrnwald PM: **Perceived barriers to exercise among adolescents.** *J Sch Health* 1989, **59**:153-155.
40. Pate RR, Saunders RP, O'Neill JR, Dowda M: **Overcoming barriers to physical activity: helping youth be more active.** *ACSMS Health Fit J* 2010, **15**:7-12.
41. Tucker Center for Research on Girls & Women in Sport: *The 2007 Tucker Center Research Report, Developing physically active girls: An evidence-based multidisciplinary approach.* University of Minnesota, Minneapolis, MN; 2007.
42. Jamner MS, Spruijt-Metz D, Bassin S, Cooper DM: **A controlled evaluation of a school-based intervention to promote physical activity among sedentary adolescent females: project FAB.** *J Adolesc Health* 2004, **34**:279-289.
43. Pate RR, Saunders R, Dishman Rk, Addy C, Dowda M, Ward DS: **Long-term effects of physical activity intervention in high school girls.** *Am J Prev Med* 2007, **33**:276-280.
44. Melnyk BM, Jacobson D, Kelly S, Belyea M, Shaibi G, Small L, O'Haver J, Marsiglia FF: **Promoting healthy lifestyles in high school adolescents: a randomized controlled trial.** *Am J Prev Med* 2013, **45**:407-415.
45. Belanger M, Gray-Donald K, O'Loughlin J, Paradis G, Hanley J: **Influence of weather conditions and season on physical activity in adolescents.** *Ann Epidemiol* 2009, **19**:180-186.
46. Pratt MP, Macera CA, Sallis JF, O'Donnell M, Frank LD: **Economic Interventions to Promote Physical Activity: Applications of the SLOTH Model.** *Am J Prev Med* 2004; **27**(3S): 136-145.
47. Allender S, Cowburn G, Foster C: **Understanding participation in sport and physical activity among children and adults: a review of qualitative studies.** *Health Educ Research* 2006; **21**(6): 826-835.

CHAPTER 5: CONCLUSION

With the alarming decline in physical activity among teenagers, particularly girls, there is a need for research that will improve the efficacy of interventions that aim to increase physical activity. Perceived barriers have a strong influence on health behaviors,⁸ and should be taken into consideration when designing physical activity interventions for this audience. Barriers to physical activity may negatively correlate with activity and thereby serve as one intermediary variable assessment for positive change that may increase physical activity. Perceived barriers may be intermediary to physical activity behavior change, among those who are inactive. They may also be a pertinent construct that can be reduced during public health programs' typically brief duration. An instrument sensitive to change may be useful for programs to measure this change.

Previously, Dwyer and colleagues had developed a similar scale to assess teenagers' self-efficacy to overcome barriers to physical activity (i.e., the SOBPAS).⁵² However, as discussed in Chapter 4, the SOBPAS did not contain some of the barrier items such as perceived importance of physical activity and a lack of exercise equipment. The SOBPAS also relied on single-item (SI) assessments of barrier items, which often do not provide enough detail.⁹¹

This study aimed to fill the current research gap regarding the development of a comprehensive scale to assess perceived barriers to physical activity among high school students (See Appendix XIV). The multiple-item assessments contained in this scale are

particularly advantageous for preliminary studies because they provide more details, and thereby, decrease the likelihood of misinterpretation.⁹¹ In addition, this investigation revealed important barriers to physical activity among teenagers, which include motivation issues (e.g., preference for other interests, laziness, and being too busy), adverse weather, lack of exercise equipment and lack of an exercise partner. Thus, interventions that utilize indoor activities (e.g., exercise DVDs), provide other activities of interest and address time management skills may improve high school students' physical activity levels. These types of interventions should be tested.

In conclusion, the comprehensive perceived barriers to physical activity scale developed by this study may help to tailor public health interventions that aim to improve teenagers' physical activity. Further research is needed to confirm the sub-scale structure of perceived barriers to activity revealed by this study, and to determine the validity and reliability of this scale among teenage audiences in other population subgroups. Most importantly, if the scale is to be used for intervention purposes, it must be tested for its sensitivity to change. With a detailed understanding of high school students' barriers to activity, public health educators may more appropriately modify their approaches to help teens overcome specific barriers, and have a profound effect on their engagement in physical activity.

Appendix I: Physical Activity Questionnaire for Adolescents (PAQ-A)

Physical Activity Questionnaire (High School)

Name: _____

Age: _____

Sex: M _____ F _____

Grade: _____

Teacher: _____

We are trying to find out about your level of physical activity from ***the last 7 days*** (in the last week). This includes sports or dance that make you sweat or make your legs feel tired, or games that make you breathe hard, like tag, skipping, running, climbing, and others.

Remember:

3. There are no right and wrong answers — this is not a test.
4. Please answer all the questions as honestly and accurately as you can — this is very important.

1. Physical activity in your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one circle per row.)

	No	1-2	3-4	5-6	7 times or more
Skipping	☐	☐	☐	☐	☐
Rowing/canoeing	☐	☐	☐	☐	☐
In-line skating	☐	☐	☐	☐	☐
Tag	☐	☐	☐	☐	☐
Walking for exercise	☐	☐	☐	☐	☐
Bicycling	☐	☐	☐	☐	☐
Jogging or running	☐	☐	☐	☐	☐
Aerobics	☐	☐	☐	☐	☐
Swimming	☐	☐	☐	☐	☐
Baseball, softball	☐	☐	☐	☐	☐
Dance	☐	☐	☐	☐	☐
Football	☐	☐	☐	☐	☐
Badminton	☐	☐	☐	☐	☐
Skateboarding	☐	☐	☐	☐	☐
Soccer	☐	☐	☐	☐	☐
Street hockey	☐	☐	☐	☐	☐
Volleyball	☐	☐	☐	☐	☐
Floor hockey	☐	☐	☐	☐	☐
Basketball	☐	☐	☐	☐	☐
Ice skating	☐	☐	☐	☐	☐
Cross-country skiing	☐	☐	☐	☐	☐
Ice hockey/ringette	☐	☐	☐	☐	☐
Other:					
.....	☐	☐	☐	☐	☐
.....	☐	☐	☐	☐	☐

2. In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? (Check one only.)

- I don't do PE ☐
 Hardly ever ☐
 Sometimes ☐
 Quite often ☐
 Always ☐

3. In the last 7 days, what did you normally do *at lunch* (besides eating lunch)? (Check one only.)

- Sat down (talking, reading, doing schoolwork)..... ☐
 Stood around or walked around ☐
 Ran or played a little bit ☐
 Ran around and played quite a bit ☐
 Ran and played hard most of the time ☐

4. In the last 7 days, on how many days *right after school*, did you do sports, dance, or play games in which you were very active? (Check one only.)

- None ☐
 1 time last week ☐
 2 or 3 times last week ☐
 4 times last week ☐
 5 times last week ☐

5. In the last 7 days, on how many *evenings* did you do sports, dance, or play games in which you were very active? (Check one only.)

- None ☐
 1 time last week ☐
 2 or 3 times last week ☐
 4 or 5 last week ☐
 6 or 7 times last week ☐

6. *On the last weekend*, how many times did you do sports, dance, or play games in which you were very active? (Check one only.)

- None ☐
 1 time ☐
 2 — 3 times ☐
 4 — 5 times ☐
 6 or more times ☐

7. Which *one* of the following describes you best for the last 7 days? Read *all five* statements before deciding on the *one* answer that describes you.

- F. All or most of my free time was spent doing things that involve little physical effort○
- G. I sometimes (1 — 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics)○
- H. I often (3 — 4 times last week) did physical things in my free time○
- I. I quite often (5 — 6 times last week) did physical things in my free time○
- J. I very often (7 or more times last week) did physical things in my free time○

8. Mark how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week.

	None	Little bit	Medium	Often	Very often
Monday	○	○	○	○	○
Tuesday	○	○	○	○	○
Wednesday	○	○	○	○	○
Thursday	○	○	○	○	○
Friday	○	○	○	○	○
Saturday	○	○	○	○	○
Sunday	○	○	○	○	○

9. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Check one.)

- Yes○
- No○

If Yes, what prevented you? _____

Appendix II: Previous Day Physical Activity Recall (PDPAR)

Activities Scale

On the next page is a scale which records the **main** activities you did yesterday. Please be certain to write on the scale the **day of the week** that "yesterday" was.

1. For each time period write in the **number(s)** of the main activities you actually did in the boxes on the time scale.
2. Then rate how physically **hard** these activities were. Place an "X" on the rating scale to indicate if the activities for each time period were:

- **Very Light** = Slow breathing, little or no movement.



- **Light** = Normal breathing, regular movement.



- **Medium** = Increased breathing, moving quickly for short periods of time.



- **Hard** = Hard breathing, moving quickly for 20 minutes or more.



Please be as accurate as possible but fill out the scale quickly.

Activity Numbers**Eating**

1. Meal
2. Snack
3. Cooking

Sleep/Bathing

4. Sleeping
5. Resting
6. Shower/bath

Transportation

7. Ride in car, bus
8. Travel by walking
9. Travel by bike

Work/School

10. Job (list): _____
11. Housework/paperwork
12. House chores (list): _____

Spare Time

13. Watch TV
14. Go to movies/concert
15. Listen to music
16. Talk on the phone
17. Hang around
18. Shopping
19. Play video games
20. Other (list): _____

Physical Activities

21. Walk
22. Jog/run
23. Dance (for fun)
24. Aerobic dance
25. Swim (for fun)
26. Swim laps
27. Ride bicycle
28. Lift weights
29. Use skateboard
30. Play organized sport
31. Did individual exercise
32. Did active game outside
33. Other (list): _____

1. Put Activity Numbers in this column

2. Put an "X" to rate how hard these activities were

	<u>Time</u>	<u>Activity Numbers</u>	<u>Very Light</u> 	<u>Light</u> 	<u>Medium</u> 	<u>Hard</u> 
Afternoon	3:00					
	3:30					
	4:00					
	4:30					
Supper	5:00					
	5:30					
	6:00					
	6:30					
Evening	7:00					
	7:30					
	8:00					
	8:30					
Night	9:00					
	9:30					
	10:00					
	10:30					
	11:00					

Circle the day of the week that you did these activities:

M T W Th F Sa Su

Appendix III: 3-Day Physical Activity Recall (3DPAR)

Activities Scale

This purpose of this questionnaire is to estimate the amount of physical activity that you perform. The name of each day (Tuesday, Monday, and Sunday) that you will describe is located in the top right hand corner of each time sheet.

1. For **each** time period, write in the activity number that corresponds to the **main** activity you actually performed during that particular time period.
2. Then rate how physically **hard** each activity was. Place a "✓" in the timetable to indicate one of the following intensity levels for each activity.

• **Light** - Slow breathing, little or no movement.



• **Moderate** - Normal breathing and some movement.



• **Hard** - Increased breathing and moderate movement.



• **Very Hard** - Hard breathing and quick movement.



Activity Numbers

Eating

- 1.) Eating a meal
- 2.) Snacking

Work

- 3.) Working (e.g., part-time job, child care)
(list) _____
- 4.) Doing house chores (e.g., vacuuming,
dusting, washing dishes, animal care, etc.)
- 5.) Yard Work (e.g., mowing, raking)

After School/Spare Time/ Hobbies

- 6.) Church
- 7.) Hanging around
- 8.) Homework
- 9.) Listening to music
- 10.) Marching band/flag line/drill team
- 11.) Music lesson/playing instrument
- 12.) Playing video games/surfing Internet
- 13.) Reading
- 14.) Shopping
- 15.) Talking on phone
- 16.) Watching TV or movie

Transportation

- 17.) Riding in a car/bus
- 18.) Travel by walking
- 19.) Travel by bicycling

Sleep/Bathing

- 20.) Getting dressed
- 21.) Getting ready (hair, make-up, etc.)
- 22.) Showering/bathing
- 23.) Sleeping

School

- 24.) Club, student activity
- 25.) Lunch/free time/study hall
- 26.) P. E. Class
- 27.) ROTC
- 28.) Sitting in class

Physical Activities and Sports

- 29.) Aerobics/aerobic dancing
- 30.) Basketball
- 31.) Bicycling
- 32.) Bowling
- 33.) Calisthenics(i.e., jumping jacks, sit-ups)
- 34.) Cheerleading
- 35.) Dancing (social, recreational)
- 36.) Dancing (ballet, jazz, modern, tap)
- 37.) Field hockey
- 38.) Frisbee
- 39.) Golf
- 40.) Horseback riding
- 41.) Ice/roller skating
- 42.) Jogging/running
- 43.) Karate/judo/martial arts/ self-defense
- 44.) Rollerblading
- 45.) Skateboarding
- 46.) Soccer
- 47.) Softball/baseball
- 48.) Stationary exercise machines (e.g., cycle,
ski machine, stair climber, treadmill)
- 49.) Street hockey
- 50.) Swimming, water exercise
- 51.) Tennis
- 52.) Volleyball
- 53.) Walking (briskly)
- 54.) Weight/circuit training
- 55.) Gymnastics/tumbling
- 56.) Kickboxing/Tae Bo
- 57.) Track and field
- 58.) Trampoline
- 59.) Other _____

Sample activity time sheet:

The table below shows the correct way to fill out the activity time sheets.
Note that only **one** intensity level is checked for each activity.

	Activity Number	Light	Moderate	Hard	Very Hard
7:00-7:30	22	✓			
7:30-8:00	21	✓			
8:00-8:30	18		✓		
8:30-9:00	28	✓			
9:00-9:30	28	✓			
9:30-10:00	26			✓	
10:00-10:30	26			✓	

TUESDAY

Put a "✓" to rate the intensity of each activity.

Write activity numbers in this column.

	Activity Number	Light	Moderate	Hard	Very Hard
before school	7:00-7:30				
	7:30-8:00				
during school	8:00-8:30				
	8:30-9:00				
	9:00-9:30				
	9:30-10:00				
	10:00-10:30				
	10:30-11:00				
lunch time	11:00-11:30				
	11:30-12:00				
	12:00-12:30				
	12:30-1:00				
	1:00-1:30				
	1:30-2:00				
after school	2:00-2:30				
	2:30-3:00				
	3:00-3:30				
	3:30-4:00				
	4:00-4:30				
	4:30-5:00				
supper time	5:00-5:30				
	5:30-6:00				
	6:00-6:30				
	6:30-7:00				
	7:00-7:30				
	7:30-8:00				
evening	8:00-8:30				
	8:30-9:00				
	9:00-9:30				
	9:30-10:00				
	10:00-10:30				
	10:30-11:00				
	11:00-11:30				
	11:30-12:00				

(The survey repeats the three pages presented two more times in order to collect three days of physical activity information from participants.)

Appendix IV: Youth Risk Behavioral Surveillance Survey – Physical Activity Items

The next 5 questions ask about physical activity.

1. During the past 7 days, on how many days were you physically active for a total of **at least 60 minutes per day**? (Add up all the time you spent in any kind of physical activity that increased your heart rate and made you breathe hard some of the time.)
 - A. 0 days
 - B. 1 day
 - C. 2 days
 - D. 3 days
 - E. 4 days
 - F. 5 days
 - G. 6 days
 - H. 7 days
2. On an average school day, how many hours do you watch TV?
 - A. I do not watch TV on an average school day
 - B. Less than 1 hour per day
 - C. 1 hour per day
 - D. 2 hours per day
 - E. 3 hours per day
 - F. 4 hours per day
 - G. 5 or more hours per day
3. On an average school day, how many hours do you play video or computer games or use a computer for something that is not school work? (Count time spent on things such as Xbox, PlayStation, an iPod, an iPad or other tablet, a smartphone, YouTube, Facebook or other social networking tools, and the Internet.)
 - A. I do not play video or computer games or use a computer for something that is not school work
 - B. Less than 1 hour per day
 - C. 1 hour per day
 - D. 2 hours per day
 - E. 3 hours per day
 - F. 4 hours per day
 - G. 5 or more hours per day

83. In an average week when you are in school, on how many days do you go to physical education (PE) classes?
- A. 0 days
 - B. 1 day
 - C. 2 days
 - D. 3 days
 - E. 4 days
 - F. 5 days
84. During the past 12 months, on how many sports teams did you play? (Count any teams run by your school or community groups.)
- A. 0 teams
 - B. 1 team
 - C. 2 teams
 - D. 3 or more teams

Appendix V: Teen Health Survey – Physical Activity Items⁴³

PACE+ Adolescent Physical Activity Measure

Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time.

Physical activity can be done in sports, playing with friends, or walking to school.

Some examples of **physical activity** are running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, basketball, football, and surfing.

Add up all the time you spend in physical activity each day (don't include your physical education or gym class).

P1 Over the past 7 d, on how many days were you physically active for a total of at least 60 min per day?

☐ 0 days
 ☐ 1
 ☐ 2
 ☐ 3
 ☐ 4
 ☐ 5
 ☐ 6
 ☐ 7 days

P2 Over a typical or usual week, on how many days are you physically active for a total of at least 60 min per day?

☐ 0 days
 ☐ 1
 ☐ 2
 ☐ 3
 ☐ 4
 ☐ 5
 ☐ 6
 ☐ 7 days

Scoring: $(P1 + P2)/2 < 5$ indicates not meeting physical activity guidelines.

Appendix VI: Physical Activity Staging Measure⁴⁵

Physical Activity Stages																														
Physical activity is any activity that increases your heart rate and makes you get out of breath some of the time. Physical activity can be done in sports, playing with friends, or walking to school. - Some examples of physical activity are running, brisk walking, rollerblading, biking, skateboarding, dancing, swimming, soccer, basketball, football, & surfing.																														
1. In a typical week, how many days do you do physical activity for <u>60 minutes</u> or more? <i>Mark the answer that is true for you.</i>																														
<table border="1"> <thead> <tr> <th>Zero</th> <th>One</th> <th>Two</th> <th>Three</th> <th>Four</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>☐</td> <td>☐</td> <td>☐</td> <td>☐</td> <td>☐</td> </tr> </tbody> </table>					Zero	One	Two	Three	Four	0	1	2	3	4	☐	☐	☐	☐	☐	<table border="1"> <thead> <tr> <th>Five</th> <th>Six or more</th> </tr> </thead> <tbody> <tr> <td>5</td> <td>6+</td> </tr> <tr> <td>☐</td> <td>☐</td> </tr> </tbody> </table>					Five	Six or more	5	6+	☐	☐
Zero	One	Two	Three	Four																										
0	1	2	3	4																										
☐	☐	☐	☐	☐																										
Five	Six or more																													
5	6+																													
☐	☐																													
(If you answered between "0" and "4" to question 1, go to question 3.)					(If you answered "5" or "6 or more" to question 1, go to question 2.)																									
↓ ↓ ↓ ↓ ↓					↓ ↓																									
3. Do you think you will start doing 60 minutes of physical activity <u>5 or more days</u> a week in the next 6 months?					2. How many months have you been doing 60 minutes of physical activity on 5 or more days per week?																									
1 ☐ No, and I do not intend to in the next six months.					1 ☐ Less than 6 months																									
2 ☐ Yes, I intend to in the next six months.					2 ☐ 6 months or more																									
3 ☐ Yes, I intend to in the next 30 days.																														

Appendix VII: Amherst Health and Physical Activity – Social Support Items⁴⁷

During a typical week how often has a member of your household:

(CIRCLE ONE NUMBER FOR EACH TYPE OF PERSON)

	None	Once	Sometimes	Almost daily	Daily	Don't know
Q8. Encouraged you to do physical activities or play sports?						
A. Male adult(s)	0	1	2	3	4	5
B. Female adult(s)	0	1	2	3	4	5
C. Other children	0	1	2	3	4	5
Q9. Done a physical activity or played sports with you?						
A. Male adult(s)	0	1	2	3	4	5
B. Female adult(s)	0	1	2	3	4	5
C. Other children	0	1	2	3	4	5
Q10. Provided transportation to a place where you can do physical activities or play sports?						
A. Male adult(s)	0	1	2	3	4	5
B. Female adult(s)	0	1	2	3	4	5
C. Other children	0	1	2	3	4	5
Q11. Watched you participate in physical activities or sports?						
A. Male adult(s)	0	1	2	3	4	5
B. Female adult(s)	0	1	2	3	4	5
C. Other children	0	1	2	3	4	5
Q12. Told you that physical activity is good for his or her health?						
A. Male adult(s)	0	1	2	3	4	5
B. Female adult(s)	0	1	2	3	4	5
C. Other children	0	1	2	3	4	5

During a typical week how often: (CIRCLE ONE NUMBER)

	None	Once	Sometimes	Almost daily	Daily	Don't know
Q16. Do you encourage your friends to do physical activities or organize games or sports?	0	1	2	3	4	5
Q17. Do your friends encourage you to do sports or physical activities?	0		2	3	4	5
Q18. Do your friends do physical activities or play sports with you?	0		2	3	4	5
Q19. Do your friends or classmates tease you about not being good at physical activities or sports?	0		2	3	4	5

Appendix VIII: Self-Efficacy for Daily Physical Activity Questionnaire (SEPAQ)

The Self-Efficacy for Daily Physical Activity Questionnaire

In answering the following questions you will be asked to think about **HOW CONFIDENT** you are that you can participate in a variety of physical activities at increasing intensity levels (light, moderate, and/or vigorous) and increasing periods of time (in minutes). The word "confident" refers to your belief that you can do something well. Please see the definitions below to help familiarize you with what is considered a light, moderate, and vigorous physical activity.

Light activity: You are moving around, but your heart rate and breathing do not increase very much. You probably will not be sweating doing these activities unless the weather is really hot. You would be able to talk easily through the activity.



Moderate activity: Your breathing and heart rate increase. You may start to sweat, your legs might feel a little bit tired and you may feel out of breath. You may also find it hard to talk during the activity.



Vigorous activity: your heart beats very fast, your breathing is fast and you start sweating. You may feel exhausted and out of breath. Your legs would probably feel heavy. It would be very hard to talk during the activity.



**Appendix IX: Items to Assess Self-Efficacy to Overcome Barriers to Physical
Activity Developed by Saunders et al.⁵⁰**

1. I think I can ask my parent or other adult to sign me up for a sport, dance, or other physical activity.
2. I think I can ask my parent or other adult to take me to a physical activity or sport practice.
3. I think I can ask my best friend to be physically active with me.
4. I think I can ask my parents or other adult to do physically active things with me.
5. I think I can ask my parent or other adult to get me the equipment I need to be physically active.
6. I think I have the skills I need to be physically active.
7. I think I can be physically active most days after school.
8. I think I can be physically active no matter how busy my day is.
9. I think I can be physically active no matter how tired I may feel.
10. I think I can be physically active even if it is hot or cold outside.
11. I think I can be physically active, even if I have a lot of homework.
12. I think I can be physically active after school even if I could watch TV or play video games instead.
13. I think I can be physically active even if I have to stay at home.
14. I think I can be physically active even when I'd rather be doing something else
15. I think I can be physically active even if my friends don't want me to.
16. I think I can be physically active after school even if my friends want me to do something else.
17. I think I can be physically active at least three times a week for the next 2 weeks.

Appendix X: Items Included in the Self-Efficacy to Overcome Barriers to Physical Activity Scale (SOBPAS) Developed by Dwyer et al.⁵²

The following items were ranked on a 5-point Likert scale (i.e., 1 = not at all confident, 5 = very confident) in response to the main question: “How confident are you that you can overcome this thing and still do moderate or vigorous physical activities?”⁵²

1. Embarrassed about others watching
2. Not motivated
3. Too much competition
4. Concerned about weight
5. Other interests (e.g., internet, TV or videos, and computer games)
6. Not enough skills
7. Teased by friends
8. Bullied or intimidated by others
9. Not having a safe place to do physical activity
10. Community programs are not available
11. School programs are not available
12. Parent is not supportive
13. Cost of doing physical activity
14. Not having transport to facilities
15. Not having someone to do physical activity with
16. Not having fun
17. Friends are not supportive
18. Busy social life

- 19. Weather
- 20. Too much school work
- 21. Feeling tired
- 22. Sick or injured
- 23. Family responsibilities
- 24. Having a job³

³ The actual questions used to assess these items in the survey were not available. The items listed above were obtained from the tables provided by the Dwyer et al. study.⁵²

Appendix XI: Items Used to Assess Perceived Barriers to Physical Activity by**Allison et al. study⁵³**

The items below were assessed using a 5-point Likert scale (i.e., 1 = not at all, 5 = a great deal) to determine the extent to which each item prevented the participant from participating in vigorous physical activity.⁵³

1. Time – school work
2. Time – other interests
3. Mood
4. Time – family activities
5. Lack energy
6. Lack self-discipline
7. Discomfort
8. Cost
9. Not fun
10. Self-conscious
11. Stressed
12. Lack family support
13. Lack friends' support
14. Time – part-time work
15. Illness
16. Injury⁴

⁴ The actual questions used to assess these items in the survey were not available. The items listed above were obtained from the tables provided by the Allison et al. study.

APPENDIX XII: Search Terms and Databases Used to Find Interventions Aimed Towards Increasing High School Students' Physical Activity

Databases Searched:

- Agricola
- CINAHL
- Science Direct
- PubMed
- Google Scholar

Search Terms Used:

Physical activity AND intervention AND adolescent OR, high school students, OR,
teenagers

Filter Criteria:

- English language
- Humans
- United States
- Adolescents (13 – 18 years old)
- Peer-Reviewed Journals
- Between 2003 – 2013

Appendix XIII: High School Students' Perceived Barriers to Physical Activity

Survey Used for This Research (Initial Survey)⁵

DO NOT write your NAME on this survey. The answers you give will be kept private. This survey is voluntary.

1. Please read the **list of things that people say stops them from exercising** and check the appropriate box for each. Read each item and check if:

- It **never** stops you from exercising
- It stops you from exercising **once in a while**
- **Sometimes** it does, and sometimes it does not stop you from exercising
- It **often** stops you from exercising
- It **always** stops you from exercising

Does this <u>stop me</u> from exercising? If this doesn't apply to me, check "It Never Stops Me"	It Never Stops Me	Once in a while	Sometimes yes Sometimes no	Often	It Always Stops Me
My whole family is fat no matter what they do					
My friends don't do it					
I don't feel like it					
I would rather spend time on the computer					
There's no place for me to exercise at home					
I don't like doing it					
Lack of energy					
I have no way to get to where I could exercise					
My family can't afford a gym					
I have pain from my injury					
My neighborhood is not safe					
I get embarrassed					
I am too busy to exercise					
I am too young to need to exercise					
I am not good at it					
I do not know what activities there are to do					
I get enough exercise in gym class					
I am in a good mood					
I am not strong enough					

⁵ This is one version (Version A) of the initial barriers survey used by this study.

Does this <u>stop me</u> from exercising? If this doesn't apply to me, check "It Never Stops Me"	It Never Stops Me	Once in a while	Sometimes yes Sometimes no	Often	It Always Stops Me
My current health problem, like heart disease, diabetes, cancer or arthritis stops me					
Other peoples' dogs scare me					
I get tired from doing it					
Doing drugs					
My school doesn't have after-school activities I like					
I am lazy					
It feels like hard work					
It is windy outside					
I get too sweaty					
Depression					
Fear of people making fun of me					
Chores leave me with too little time					
I do not have anyone to do it with					
It makes me feel stressed					
I do not need to exercise					
There is ice outside					
I do not have a good reason to exercise					
On this line, put 2 checks in "Often"					
I do not know how to do the activities near me					
I am in a bad mood					
My school does not have gym class					
There are no free or low cost places to exercise near me					
I would rather be doing something that is more fun					
I get tired soon after I start exercising					
There is nowhere close to exercise					
I cannot afford exercise classes					
An injury I had					
Kids or other people on my street get in the way					
I am self-conscious about my looks					
I do not have the time to exercise					
People whispering or pointing at me					
I don't think I can do it					

Does this <u>stop me</u> from exercising? If this doesn't apply to me, check "It Never Stops Me"	It Never Stops Me	Once in a while	Sometimes yes Sometimes no	Often	It Always Stops Me
No one encourages me to exercise					
It's not fun					
I would rather play video games					
I have a curfew					
I worry I might get injured					
I do not think I will get any results					
It is hot outside					
It did not help me lose weight in the past					
When I am at home, I need to baby-sit					
I'd rather spend time with my friends or family					
I have too many places I have to go					
I feel like goofing off					
My heart beats too fast when I exercise					
There is snow outside					
I stopped exercising; now it's too hard to start again					
I don't like competition					
It is dark outside					
I am stressed					
On this line, put 2 checks in "Often"					
Smoking cigarettes					
I'd rather spend time with my friends					
No one in my family expects me to exercise					
I don't have self-discipline					
I would rather talk online, on the phone, or text					
I don't have the right equipment					
It does not feel good					
I'm not good at sports					
No one helps me with transportation					
I need to save money for other things like food					
A surgery I had					
The parks where I can exercise are not safe					

Does this <u>stop me</u> from exercising? If this doesn't apply to me, check "It Never Stops Me"	It Never Stops Me	Once in a while	Sometimes yes Sometimes no	Often	It Always Stops Me
I am concerned about how I look when I exercise					
My job takes up my time					
People my age don't need to exercise					
Drinking alcohol					
I am depressed					
I don't think exercise will do me any good					
People in my family don't believe it is important					
I would rather watch TV					
There's no place to wash up at school after exercise					
I don't have fun doing exercise					
I am not coordinated					
My family is not active					
Exercising could make my health worse					
I do not have any motivation to do it					
It is cold outside					
On this line, put 2 checks in "Often"					
My chores wear me out					
It takes too much time					
Lack of willpower					
My school doesn't have after-school activities					
I think taking care of all my chores gives me enough exercise					
I have a job					
I have asthma					
It is raining outside					
I get too smelly					
I need to get a doctor's note					
I get out of breath					
Feeling tired					
I do not know how to do activity					
Interruptions at home like the phone or my family					
My doctor told me not to exercise If so, why? _____					

In this section, we are trying to find out about your activities over the past **7 days** (in the last week). This includes sports or dances that make you sweat or make your legs feel tired, exercise, or games that make you breathe hard, like tag, skipping, running, climbing, and others.

- There are no right and wrong answers — **this is not a test.**
- Please answer **all the questions** as honestly and accurately as you can — this is very important.

2. In your spare time: Have you done any of the following activities in the past 7 days (last week)? If yes, how many times? (Mark only one circle per row.)

	No	1-2	3-4	5-6	7times or more
Skipping	☐	☐	☐	☐	☐
Rowing/canoeing	☐	☐	☐	☐	☐
In-line skating	☐	☐	☐	☐	☐
Tag	☐	☐	☐	☐	☐
Walking for exercise	☐	☐	☐	☐	☐
Bicycling	☐	☐	☐	☐	☐
Jogging or running	☐	☐	☐	☐	☐
Aerobics	☐	☐	☐	☐	☐
Swimming	☐	☐	☐	☐	☐
Baseball, softball	☐	☐	☐	☐	☐
Dance	☐	☐	☐	☐	☐
Football	☐	☐	☐	☐	☐
Badminton	☐	☐	☐	☐	☐
Skateboarding	☐	☐	☐	☐	☐
Soccer	☐	☐	☐	☐	☐
Street hockey	☐	☐	☐	☐	☐
Volleyball	☐	☐	☐	☐	☐
Floor hockey	☐	☐	☐	☐	☐
Basketball	☐	☐	☐	☐	☐
Ice skating	☐	☐	☐	☐	☐
Cross-country skiing	☐	☐	☐	☐	☐
Ice hockey/ringette	☐	☐	☐	☐	☐
Other:_____	☐	☐	☐	☐	☐

3. In the last 7 days, during your physical education (PE) classes, how often were you very active (playing hard, running, jumping, throwing)? (*Check one only.*)

I don't do PE ☐
 Hardly ever ☐
 Sometimes ☐
 Quite often ☐
 Always ☐

4. In the last 7 days, what did you normally do *at lunch* (besides eating lunch)? (*Check one*)

Sat down (talking, reading, doing schoolwork)..... ☐
 Stood around or walked around ☐
 Ran or played a little bit ☐
 Ran around and played quite a bit ☐
 Ran and played hard most of the time ☐

5. In the last 7 days, on how many days *right after school*, did you do sports, dance, or play games in which you were very active? (*Check one only.*)

None ☐
 1 time last week ☐
 2 or 3 times last week ☐
 4 times last week ☐
 5 times last week ☐

6. In the last 7 days, on how many *evenings* did you do sports, dance, or play games in which you were very active? (*Check one only.*)

None ☐
 1 time last week ☐
 2 or 3 times last week ☐
 4 or 5 last week..... ☐
 6 or 7 times last week..... ☐

7. On the **last weekend**, how many times did you do sports, dance, or play games in which you were very active? (*Check one only.*)

None ☐
 1 time ☐
 2 or 3 times ☐
 4 or 5 times ☐
 6 or more times ☐

8. Which *one* of the following describes you best for the last 7 days? Read *all five* statements before deciding on the **one** answer that describes you.

- A. All or most of my free time was spent doing things that involve little physical effort..... ☐
- B. I sometimes (1 or 2 times last week) did physical things in my free time (e.g. played sports, went running, swimming, bike riding, did aerobics) ☐
- C. I often (3 or 4 times last week) did physical things in my free time..... ☐
- D. I quite often (5 or 6 times last week) did physical things in my free time ☐
- E. I very often (7 or more times last week) did physical things in my free time.... ☐

9. Were you sick last week, or did anything prevent you from doing your normal physical activities? (Check one only.)

- Yes ☐
- No ☐

If Yes, what prevented you? _____

10. Mark how often you did physical activity (like playing sports, games, doing dance, or any other physical activity) for each day last week.

	None	Little bit	Medium	Often	Very Often
Monday	☐	☐	☐	☐	☐
Tuesday	☐	☐	☐	☐	☐
Wednesday	☐	☐	☐	☐	☐
Thursday	☐	☐	☐	☐	☐
Friday	☐	☐	☐	☐	☐
Saturday	☐	☐	☐	☐	☐
Sunday	☐	☐	☐	☐	☐

11. ___Female ___Male

12. Which race/ethnicity do you most closely identify with? Mark (X) all that apply:

- ___ African-American/Black ___ Asian ___ Hispanic/Latino
- ___ Native American ___ Caucasian/White
- ___ Other (specify) _____

13. Were you born in this country? ___Yes ___No

If no, what country were you born in? _____, and how many years have you lived in the USA? _____

Thank you for completing this survey!

Appendix XIV: High School Student's Perceived Barriers to Physical Activity

Survey Developed by This Research (Final Survey)

DO NOT write your NAME on this survey. The answers you give will be kept private. This survey is voluntary.

14. Please read the **list of things that people say stops them from exercising** and check the appropriate box for each. Read each item and check if:

- It **never** stops you from exercising
- It stops you from exercising **once in a while**
- **Sometimes** it does, and sometimes it does not stop you from exercising
- It **often** stops you from exercising
- It **always** stops you from exercising

Does this <u>stop me</u> from exercising? If this doesn't apply to me, check "It Never Stops Me"	It Never Stops Me	Once in a while	Sometimes yes Sometimes no	Often	It Always Stops Me
I don't have the right equipment					
I do not have a good reason to exercise					
I am concerned about how I look when exercising					
There is ice outside					
There are no free or low-cost places to exercise near me					
I do not need to exercise					
I am too busy to exercise					
It is dark outside					
I get enough exercise in gym class					
It is hot outside					
I have no way to get to where I could exercise					
Fear of people making fun of me					
I don't think exercise will do me any good					
People whispering or pointing at me					
I cannot afford exercise classes					
I do not know how to do the activities near me					
Lack of energy					

Does this <u>stop me</u> from exercising? If this doesn't apply to me, check "It Never Stops Me"	It Never Stops Me	Once in a while	Sometimes yes Sometimes no	Often	It Always Stops Me
I get embarrassed					
I don't think I can do it					
I would rather be doing something that is more fun					
I get tired from doing it					
It is rainy outside					
I am lazy					
There is snow outside					
Feeling tired					
There's no place for me to exercise at home					
I do not have anyone to do it with					
I do not have any motivation to do it					
I would rather talk online, on the phone, or text					
It is windy outside					
My family can't afford a gym					
I am not strong enough					
People my age don't need to exercise					
I would rather watch TV					
There is nowhere close to exercise					
I am not good at it					
I do not think I will get any results					
No one helps me with transportation					
I get tired soon after I start exercising					
I am self-conscious about my looks					
People in my family don't believe it is important					
No one encourages me to exercise					
I would rather spend time on the computer					
It is cold outside					
I'd rather spend time with my friends or family					

BIBLIOGRAPHY

1. Fryar C, Carroll M, Ogden C. Prevalence of Obesity Among Children and Adolescents: United States, Trends 1963-1965 Through 2011 – 2012. National Center for Health Statistics. September 2014. Available from: http://www.cdc.gov/nchs/data/hestat/obesity_child_11_12/obesity_child_11_12.htm
2. Daniels S, Arnett D, Eckel R, Gidding S, Hayman L, Kumanyika S, Robinson T, Scott B, Jeor S, Williams C. Overweight in Children and Adolescents: Pathophysiology, Consequences, Prevention, and Treatment. *Circulation*. 2005;111:1999-2012.
3. United States Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans*. Washington, DC; 2008.
4. Centers for Disease Control and Prevention. Youth Risk Behavior Surveillance – United States, 2011. *MMWR*. 2012;61:1-162.
5. Ogden C, Lamb M, Carroll M, Flegal K. Obesity and Socioeconomic Status in Children and Adolescents: United States, 2005 – 2008. *NCHS Data Brief*. 2010;51:1-7.
6. United States Department of Agriculture. Rules and Regulations: Supplemental Nutrition Assistance Program: Nutrition Education and Obesity Prevention Grant Program. *Federal Register*. 2013;78(66):20411-20422.
7. Corda K. The preliminary examination of the integration of an indoor-walking DVD in NJ SNAP-Ed and EFNEP nutrition classes. (Doctoral dissertation). 2012. Retrieved from Rutgers Electronic Theses & Dissertations (RUetd).
8. Janz NK, Becker MH. The Health Belief Model: a decade later. *Health Educ Q*. 1984;11:1-47.
9. Ogden C, Carroll M, Kit B, Flegal K. Prevalence of Obesity in the United States, 2009 – 2010. *NCHS Data Brief*. 2012;82:1-7.
10. Finkelstein E, Khavjou O, Thompson H, Trogdon J, Pan L, Sherry B, Dietz W. Obesity and Severe Obesity Forecasts Through 2030. *Am J Prev Med*. 2012;42(6):563-570.
11. Sparling P, Franklin B, Hill J. Energy Balance: The key to a unified message on diet and physical activity. *J Cardiopulm Rehabil Prev*. 2013;33:12-15.

12. Selassie M, Sinha A. The epidemiology and aetiology of obesity: A global challenge. *Best Pract Res Clin Anaesthesiol*. 2011;25:1-9.
13. Hill J, Wyatt H, Reed G, Peters J. Obesity and the Environment: Where Do We Go from Here? *Science*. 2003;299:853-855.
14. Bray G. Lifestyle and Pharmacological Approaches to Weight Loss: Efficacy and Safety. *J Clin Endocrinol Metab*. 2008;93:S81-S88.
15. Pereira H, Bobbio T, Antonio M, Barros Filho A. Childhood and adolescent obesity: how many extra calories are responsible for excess of weight? *Rev Paul Pediatr*. 2013;31(2):252-257.
16. U.S. Department of Agriculture and U.S. Department of Health and Human Services. Dietary Guidelines for Americans 2010. 7th Edition, Washington, DC: 2010.
17. Krebs N, Himes J, Jacobson D, Nicklas T, Guilday P, Styne D. Assessment of Child and Adolescent Overweight and Obesity. *Pediatrics*. 2007;120:S193-S228.
18. Niemeier H, Raynor H, Lloyd-Richardson E, Rogers M, Wing R. Fast Food Consumption and Breakfast Skipping: Predictors of Weight Gain from Adolescence to Adulthood in a Nationally Representative Sample. *J Adol Health*. 2006;39:842-849.
19. Strauss R, Rodzilsky D, Burack G, Colin M. Psychosocial Correlates of Physical Activity in Healthy Children. *Arch Pediatr Adolesc Med*. 2001;155:897-902.
20. Gordon-Larsen P, Nelson M, Popkin B. Longitudinal Physical Activity and Sedentary Behavior Trends: Adolescence to Adulthood. *Am J Prev Med*. 2004;27(4):277-283.
21. Nelson M, Neumark-Stzainer D, Hannan P, Sirard J, Story M. Longitudinal and Secular Trends in Physical Activity and Sedentary Behavior During Adolescence. *Pediatrics*. 2006;118(6):e1627-e1634.
22. U.S. Department of Health and Human Services. Trends in the Prevalence of Physical Activity and Sedentary Behaviors National YRBS: 1991–2011. Accessed August 20, 2013. Available from: http://www.cdc.gov/healthyyouth/yrbs/pdf/us_physical_trend_yrbs.pdf.
23. Physical Activity Guidelines Advisory Committee. *Physical Activity Guidelines Advisory Committee Report, 2008*. Washington, DC: U.S. Department of Health and Human Services, 2008.

24. Janssen I, LeBlanc A. Systematic review of the health benefits of physical activity and fitness in school-aged children and youth. *Int J Behav Phys Act.* 2010;7(40):1-16.
25. Hind K, Burrows M. Weight-bearing exercise and bone mineral accrual in children and adolescents: a review of controlled trials. *Bone.* 2007;40(1):14-27.
26. Ness A, Leary S, Mattocks C, Blair S, Reilly J, Wells J, Ingle S, Tilling K, Smith GD, Riddoch C. Objectively measured physical activity and fat mass in a large cohort of children. *PLoS Med.* 2007;4(3):e97
27. Rangul V, Bauman A, Holmen TL, Midthjell K. Is physical activity maintenance from adolescence to young adulthood associated with reduced CVD risk factors, improved mental health and satisfaction with life: the HUNT Study, Norway. 2012;144(9):1-11.
28. Nader PR, Bradley RH, Houts RM, McRitchie SL, O'Brien M. Moderate-to-vigorous physical activity from ages 9 to 15 years. *JAMA* 2008;300:295-305.
29. Broderson NH, Steptoe A, Boniface D, Wardle J. Trends in physical activity and sedentary behaviour in adolescence: ethnic and socioeconomic differences. *Br J Sports Med.* 2007;41(3):140-144.
30. Rauner A, Mess F, Woll A. The relationship between physical activity, physical fitness and overweight in adolescents: a systematic review of studies published in or after 2000. *BMC Pediatrics.* 2013;13:1-9.
31. World Health Organization. *Global Recommendations on Physical Activity for Health: 5 – 17 years old.* 2011. Available from: http://www.who.int/dietphysicalactivity/factsheet_recommendations/en/ .
32. U.S. Office of Disease Prevention and Health Promotion. *Healthy People 2020 Topics and Objectives: Adolescent Health.* Available from: <https://www.healthypeople.gov/2020/topics-objectives/topic/physical-activity>.
33. Chinapaw M, Mokkink L, Van Poppel M, Van Mechelen W, Terwee C. Physical Activity Questionnaires for Youth: A systematic review of measurement properties. *Sports Med.* 2010;40(7):539-563.
34. Sirard J, Pate R. Physical Activity Assessment in Children and Adolescents. *Sports Med.* 2001;31(6):439-454.
35. Biddle S, Gorely T, Pearson N, Bull F. An assessment of self-reported physical activity instruments in young people for population surveillance: Project ALPHA. *Int J Behav Nutr Phys Act.* 2011;8:1-9.

36. Kowalski K, Crocker P, Kowalski N. Convergent validity of the Physical Activity Questionnaire for Adolescents. *Pediatr Exerc Sci*. 1997;9:342-352.
37. Janz K, Lutuchy E, Wenthe P, Levy S. Measuring physical activity in children and adolescents using self-report: PAQ-C and PAQ-A. *Med Sci Sports Exerc*. 2008;40(4):767-772.
38. Foley L, Maddison R, Ridley K. Self-report use-of-time tools for the assessment of physical activity and sedentary behavior in young people: a systematic review. *Obesity Reviews*. 2012;13:711-722.
39. Weston A, Petosa R, Pate R. Validation of an instrument for measurement of physical activity in youth. *Med Sci Sports Exerc*. 1997;29(1):138-143.
40. Pate R, Ross R, Dowda M, Trost S, Sirard J. Validation of a 3-Day Physical Activity recall Instrument in Female Youth. *Pediatr Exerc Sci*. 2003;15:257-265.
41. Lee KS, Trost KG. Validity and reliability of the 3-day physical activity recall in Singaporean adolescents. *Res Q Exerc Sport*. 2005;76:101-106.
42. McMurray RG, Ring KB, Treuth MS et al. Comparison of two approaches to structured physical activity surveys for adolescents. *Med Sci Sports Exerc*. 2004;36:2135-2143.
43. Prochaska J, Sallis J, Long B. A physical activity screening measure for use with adolescents in primary care. *Arch Pediatr Adolesc Med*. 2001;155:554-559.
44. Glanz K, Rimer B, Viswanath K, Eds. *Health Behavior and Health Education: Theory, Research, and Practice*. 4th edition. John Wiley & Sons: San Francisco, CA; 2008.
45. Hagler A, Calfas K, Norman G, Sallis J, Patrick K. Construct validity of physical activity and sedentary behaviors staging measures for adolescents. *Ann Behav Med*. 2006;31(2):186-193.
46. Sallis J, Taylor W, Dowda W, Freedson P, Pate R. Correlates of vigorous physical activity for children in grades 1 through 12: comparing parent-reported and objectively measured physical activity. *Pediatr Exerc Sci*. 2002;14:30-44.
47. Prochaska J, Rodgers M, Sallis J. Association of parent and peer support with adolescent physical activity. *Res Q Exerc Sport*. 2002;73(2):206-210.

48. Campbell N. The measurement of physical activity and self-efficacy in adolescents: prospects, problems and future directions. (Published doctoral dissertation). University of Western Ontario; Ontario, Canada: 2012.
49. Maddux JE, Lewis J. Self-efficacy and adjustment: basic principles and issues. In J.E. Maddux (Ed.) *Self-efficacy, adaptation, and adjustment: theory, research, and application* pp. 37-68. New York: Plenum Press; 1995.
50. Saunders R, Pate R, Felton G, Dowda M, Weinrich M, Ward D, Parsons M, Baranowski T. Development of Questionnaires to Measure Psychosocial Influences on Children's Physical Activity. *Prev Med.* 1997;26:241-247.
51. Thompson W, Berry D, Hu J. A church-based intervention to change attitudes about physical activity among black adolescent girls: a feasibility study. *Pub Health Nurs.* 2012;30(3):221-230.
52. Dwyer JJM, Chulak T, Maitland S, Allison K, Lysy D, Faulkner G, Sheeshka J. Adolescent's self-efficacy to overcome barriers to physical activity scale. *Res Q Exerc Sport.* 2012;83:513-521.
53. Allison K, Dwyer JJM, Makin S. Perceived barriers to physical activity among high school students. *Prev Med.* 1999;28:608-615.
54. Duda J, Ehrnwald P, Tappe M. Perceived barriers to exercise among adolescents. *J School Health.* 1989;59:153.
55. Tergerson J, King K. Do perceived cues, benefits, and barriers to physical activity differ between male and female adolescents? *J Sch Health.* 2002;72(9):374-380.
56. Bauman A, Reis R, Sallis J, Wells J, Loos R, Martin B. Correlates of physical activity: why are some people physically active and others not? *Lancet.* 2012;380:258-271.
57. Sallis J, Prochaska J, Taylor W. A review of correlates of physical activity of children and adolescents. *Med Sci Sports Exerc.* 2000;32(5):963-975.
58. Belcher B, Berrigan D, Dodd K, Emken B, Choua CP, Spuijt-Metz. Physical Activity in US Youth: Impact of Race/Ethnicity, Age, Gender & Weight Status. *Med Sci Sports Exerc.* 2010;42(12):2211-2221.
59. Van der Horst K, Paw M, Twisk J, Van Mechlen W. A brief review on correlates of physical activity and sedentariness in youth. *Med Sci Sports Exerc.* 2007;39(8):1241-1250.

60. Biddle S, Whitehead S, O'Donovan T, Nevill M. Correlates of participation in physical activity for adolescent girls: A systematic review of recent literature. *J Phys Act Health*. 2005;2:423-434.
61. Uijtdewilligen L, Nauta J, Singh A, Van Mechelen W, Twisk J, Van der Horst K, Chinapaw M. Determinants of physical activity and sedentary behaviour in young people: a review and quality synthesis of prospective studies. *Br J Sports Med*. 2011;45:896-905.
62. Hanson M, Chen E. Socioeconomic status and health behaviors in adolescence: a review of the literature. *J Behav Med*. 2007;30:263-285.
63. Craggs C, Corder K, Van Sluijs E, Griffin S. Determinants of Change in Physical Activity in Children and Adolescents. *Am J Prev Med*. 2011;40(6):645-658.
64. Levin S, Lowry R, Brown D, Dietz W. Physical Activity and Body Mass Index Among U.S. Adolescents: Youth Risk Behavior Survey, 1999. *Arch Pediatr Adolesc Med*. 2003;157:816-820.
65. Menschik D, Ahmed S, Alexander M, Blum R. Adolescent physical activities as predictors of young adult weight. *Arch Pediatr Adolesc Med*. 2008;162(1):29-33.
66. Lubans D, Foster C, Biddle S. A review of mediators of behavior in interventions to promote physical activity among children and adolescents. *Prev Med*. 2008;47:463-470.
67. Neumark-Sztainer D, Story M, Hannan P, Tharp T, Rex J. Factors associated with changes in physical activity: a cohort study of inactive adolescent girls. *Arch Pediatr Adolesc Med*. 2003;157:803-810.
68. Dishman R, Motl R, Saunders R, Felton G, Ward D, Dowda M, Pate R. Self-efficacy partially mediates the effect of a school-based physical-activity intervention among adolescent girls. *Prev Med*. 2004;38:626-636.
69. Kahn J, Huang B, Gillman M, Field A, Austin B, Colditz G, Frazier A. Patterns and Determinants of Physical Activity in U.S. Adolescents. *J Adol Health*. 2008;42:369-377.
70. Dishman R, Hales D, Pfeiffer K, Felton G, Saunders R, Ward D, Dowda M, Pate R. Physical Self-Concept and Self-Esteem Mediate Cross-Sectional Relations of Physical Activity and Sport Participation With Depression Symptoms Among Adolescent Girls. *Health Psych*. 2006;25(3):396-407.
71. Sterdt E, Liersch S, Walter U. Correlates of physical activity of children and adolescents: a systematic review of reviews. *Health Educ J*. 2014;73(1):72-89.

72. Nelson M, Gordon-Larsen P. Physical activity and sedentary behavior patterns are associated with selected adolescent health risk behaviors. *Pediatrics*. 2006;117:1281-1290.
73. Audrain-Govern J, Rodriguez D, Moss H. Smoking progression and physical activity. *Cancer Epidemiol Biomarkers Prev*. 2003;12:1121-1129.
74. Wilson D, Smith B, Speizer I, Bean M, Mitchell K, Uguy L, Fries E. Differences in food intake and exercise by smoking status in adolescents. *Prev Med*. 2005;40:872-879.
75. Edwardson C, Gorely T. Parental influences on different types and intensities of physical activity in youth: a systematic review. *Psych Sport Exerc*. 2010;11:522-535.
76. Ferreria I, Van der Horst K, Wendel-Vos W, Kremers S, Van Lenthe F, Brug J. Environmental correlates of physical activity in youth – a review and update. *Obes Rev*. 2006;8:129-154.
77. Babey S, Hastert T, Yo H, Brown R. Physical activity among adolescents: when do parks matter? *Am J Prev Med*. 2008;34(4):345-348.
78. Gomez J, Johnson B, Selva M, Sallis J. Violent crime and outdoor physical activity among inner-city youth. *Prev Med*. 2004;39:876-881.
79. Molnar BE, Gortmaker SL, Bull FC, Buka SL. Unsafe to play? Neighborhood disorder and lack of safety predict reduced physical activity among urban children and adolescents. *Am J Health Promot*. 2004;18(5):378-386.
80. Mota J, Almeida M, Santos P, Ribeiro J. Perceived neighborhood environments and physical activity in adolescents. *Prev Med*. 2005;41:834-836.
81. Hartz B, Petosa R. Impact of the “Planning to be Active” leisure time physical exercise program for rural high school students. *J Adol Health*. 2006;39:530-535.
82. Melnyk B, Jacobson D, Kelly S, Belyea M, Shaibi G, Small L, O’Haver J, Marsiglia F. Promoting healthy lifestyles in high school adolescents. *Am J Prev Med*. 2013;45(4):407-415.
83. Kerr J, Valois R, Farber N, Venable P, DiClemente R, Salazar L, Brown L, Carey M, Romer D, Stanton B, Jemmott J, Jemmott L, Spencer A, Annang L. Effects of promoting health among teens on dietary, physical activity, and substance use knowledge and behaviors for African American adolescents. *Am J Health Educ*. 2013;44:191-202.

84. Mauriello L, Ciavatta M, Paiva A, Sherman K, Castle P, Johnson J, Prochaska J. Results of a multi-media multiple behavior obesity prevention program for adolescents. *Prev Med.* 2010;51:451-456.
85. Jamner M, Spruijt-Metz D, Bassin S, Cooper D. A controlled evaluation of a school-based intervention to promote physical activity among sedentary adolescent females: Project FAB. *J Adol Health.* 2004;34:279-289.
86. Pate R, Saunders R, Dishman R, Addy C, Dowda M, Ward D. Long-term effects of a physical activity intervention in high school girls. *Am J Prev Med.* 2007;33(4):276-280.
87. Schneider M, Dunton G, Cooper D. Physical activity and physical self-concept among sedentary adolescent females: An intervention study. *Psych Sport Exerc.* 2008;9:1-14.
88. Chomitz V, McDonald J, Aske D, Arsenault L, Rioles N, Brukilacchio L, Hacker K, Cabral H. Evolution results from an Active Living Intervention in Somerville, Massachusetts. *Am J Prev Med.* 2012;43(5S4):S367-S378.
89. Burke NM, Chomitz VR, Rioles NA, Winslow SP, Brukilacchio LB, Baker JC. The path to active living: Physical activity through community design in Somerville, Massachusetts. *Am J Prev Med.* 2009;37(6S2):S386-S394.
90. Thompson W, Berry D, Hu J. A church-based intervention to change attitudes about physical activity among Black adolescent girls: A feasibility study. *Public Health Nurs.* 2012;30(3):221-230.
91. Diamantopoulos A, Sarstedt M, Fuchs C, Wilczynski P, Kaiser S. Guidelines for choosing between multi-item and single-item scales for construct measurement: a predictive validity perspective. *J Acad Mark Sci.* 2012;40:434-449.