The relationship between youth and adult physical activity

Kane M. Miller

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THE RELATIONSHIP BETWEEN YOUTH AND ADULT PHYSICAL ACTIVITY

A Thesis
Presented to the
School of Health, Physical Education and Recreation
and the
Faculty of the Graduate College
University of Nebraska
In Partial Fulfillment
of the Requirements for the Degree
Master of Science
University of Nebraska at Omaha

By
Kane M. Miller
THESIS ACCEPTANCE

Acceptance for the faculty of the Graduate College, University of Nebraska, in partial fulfillment of the requirements for the degree of Master of Science, University of Nebraska at Omaha

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Next I would like to thank the tremendous support of Dr. Joseph Leutzinger, my boss and my mentor in the field of health promotion. I greatly appreciate the flexibility in my work schedule and the support you have provided me to see this thesis through to completion. Also to Dr. Robin Rager, I thank you for your professional insight and advice.
The purpose of this study was to examine correlations between youth and adult physical activity (PA), and to examine the amount of variance in adult PA that can be explained by youth PA variables. Subjects were 232 male (n = 91) and female (n = 141) full- and part-time employees of the University of Nebraska at Omaha, ranging from 23 to 76 years of age. Employees were faculty and staff volunteers from a variety of departments throughout the university campus. A non-experimental recall technique was used for this study. Subjects were sampled regarding their youth and adult PA using two instruments, the Baecke Questionnaire of Habitual Activity and the Childhood and Adolescent Physical Activity Questionnaire. Results of this study indicate there was a statistically significant positive correlation between the total scores of youth PA and adult PA (r = .239, SEE 0.710, p < .001). Backward regression analysis identified seven youth PA variables in the regression model that explained 8.1 percent of the variance in adult PA: pre-teen encouragement for PA, pre-teen athletic ability, pre-teen school sports, teen informal activities, teen encouragement for PA, teen PA classes/lessons, and teen athletic ability. It was the conclusion of this research that although there was a positive correlation between the total scores of youth and adult PA, the relationship was weak. Furthermore, the variables used in the regression model failed to explain a large portion of the variance between the adult and youth PA scores. Therefore, additional research is recommended to identify other variables that may further explain that variance.
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CHAPTER I

Introduction

Predicting adult physical activity

Physical activity (PA) has been linked to many health benefits for individuals of all ages (Blair, Franklin, Jakicic & Kibler, 2003; Brown et al., 2003; Penedo, Schneiderman, Dahn & Gonzalez, 2004; Sothern, Loftin, Suskind, Udall & Blecker, 1999). Unfortunately, Americans are a population lacking in regular PA. The Centers for Disease Control and Prevention (CDC) released information from a new study that cites a 33 percent increase in deaths over the past 10 years as a result of poor diet and physical inactivity, which is second only to tobacco as the leading preventable cause of death (Agency Group 02, 2004). An earlier study by the CDC reported that, including both leisure time and work activities, about only one in five adult Americans participate in a high level of PA (Agency Group 02, 2003).

Researchers have examined the influence of youth sport and leisure-time PA as predictors of adult PA. The implications for making interventions in childhood that may produce more physically active adults rely on past findings. Studies indicate that most individuals’ PA levels are consistent from early childhood into adolescence (Pate, Baranowski, Dowda & Trost, 1996; Pate et al., 1999), but do physically active children become physically active adults? A modest volume of research has focused on answering this question; however, results are conflicting and many limitations exist in the designs of such studies.

The majority of studies which analyzed youth/adolescent and adult PA examined subjects representing a limited age cohort and, in many cases, subjects of the exact same
age (Barnekow-Bergkvist, Hedberg, Janlert & Jansson, 1998; Dennison, Straus, Mellits
& Charney 1988; Glenmark, Hedberg & Jansson 1994; Kissinger, 2000; Robertson-
Wilson, Baker, Derbyshire & Cote, 2003; Scott & Willis, 1998; Tammelin, Nayha,
Laitinen, Rintamaki & Jarvelin, 2003). However, some researchers did attempt to
explored two one-year cohorts. However, the cohorts were still within seven years of age,
judging by the fact that their study was conducted on children entering primary school
between 1970 and 1977. Another study examined four cohorts staggered three years apart
at ages nine, twelve, fifteen, and eighteen. Each cohort completed the follow-up nine and
twelve years later (Telama, Yang, Laakso & Viikari, 1997). Although it covered multiple
cohorts over time, when the study ended, the oldest subjects had only reached age thirty.

The majority of research was limited to subjects in early to mid adulthood, at ages
less than or close to thirty years (Barnekow-Bergkvist, et al., 1998; Dennison, et al.,
1988; Glenmark, et al., 1994; Kissinger, 2000; Robertson-Wilson, et al., 2003;
examined multiple cohorts ranging from the young adult to the older adult; however, their
study sample consisted solely of Jewish males. Another study, which was designed to
examine several cohorts of ages ranging between 18-39, targeted low income and African
American women for their female-only study sample (Alfano, Klesges, Murray, Beech,
subjects of multiple cohorts ranging from 32-60 years of age; however, this study sample
was small (n = 105), and all subjects were male. Sallis, Hovell and Hofstetter (1992) also
sampled a wide range of cohorts from young to older adults. The authors reported,
however, that their study sample overrepresented the well-educated and underrepresented ethnic minorities. Two other studies examined multiple cohorts from several different decades, but examined only Caucasian male subjects and refuted any significant link between adolescent athleticism and adult health and PA (Brill, Burkhalter, Kohl & Blair 1989; Dishman, 1988).

All past studies examining the relationship between youth/adolescent PA and adult PA have been limited in their research designs. Many of these studies have examined only one or a few cohorts of young adults. Additionally, many have had a limited sample of subjects, such as males only. Limitations such as these make it difficult to infer results to a general population of Americans. Therefore, further research is warranted on this topic which examines correlations between youth and adult PA in a sample that includes males and females of multiple age cohorts.
CHAPTER II

The Problem

The purpose of this study was to examine correlations between youth and adult PA. Specifically, this research examined these correlations in the study sample, as well as by gender in multiple age cohorts. Multiple correlation regression analysis will be conducted on the study sample data set to determine the amount of variance in adult PA that can be explained by youth PA variables.

Hypotheses

Four null hypotheses were established for statistical purposes in this study. The dependent variable, adult PA, is represented by the adult total index, as measured by the Baecke Questionnaire of Habitual Activity (Baecke, Burema, & Frijters, 1982). The adult total index is a summation of the adult work index, adult sport index, and adult leisure index.

Null Hypotheses:

Null Hypothesis 1: There will be no statistically significant correlation between the total score of youth PA and the adult work index.

Null Hypothesis 2: There will be no statistically significant correlation between the total score of youth PA and the adult sport index.

Null Hypothesis 3: There will be no statistically significant correlation between the total score of youth PA and the adult leisure index.

Null Hypothesis 4: There will be no statistically significant correlation between the total score of youth PA and the adult total index.
Based on previous literature, four directional hypotheses were established.

**Research Hypotheses:**

Research Hypothesis 1: There is a statistically significant positive correlation between the total score of youth PA and the adult work index.

Research Hypothesis 2: There will be a statistically significant positive correlation between the total score of youth PA and the adult sport index.

Research Hypothesis 3: There will be a statistically significant positive correlation between the total score of youth PA and the adult leisure index.

Research Hypothesis 4: There will be a statistically significant positive correlation between the total score of youth PA and the adult total index.

**Limitations**

The following limitations may have affected the outcome of this study:

1. The memory recall of PA by subjects when estimating the amount of PA performed.

2. The accuracy of the questionnaire in measuring current and past PA.

3. The ability of participants to understand the survey questions and respond appropriately.

4. The length of the survey and potential respondent fatigue.

5. The possibility of order effect related to how the adult PA and youth PA question sets were provided.

6. A convenient random sample was used for the study population.
7. Surveys contained missing data that were accounted for by using mean values to replace those unanswered items.

**Definitions**

The following definitions were used for the purposes of this study:

**Physical Activity (PA)** - Any body movement that results in an increase in the resting energy expenditure (Malina, 1996).

**Preteen** - The period in a person's life when they are 6 through 12 years of age.

**Teen** - The period in a person's life when they are 13 through 19 years of age.

**Youth** - The period in a person's life when they are 19 years of age or younger (i.e., pre-teen and teen, collectively).

**Adult** - Any person that is 20 years of age or older.

**Significance**

Physical activity (PA) has been linked to many health benefits. Unfortunately, Americans are a population lacking in regular PA. It was the intent of this study to provide more sound evidence to justify childhood interventions for promoting adult PA and to identify youth PA variables that may explain the variance in adult PA.
CHAPTER III

Review of Literature

Past research has examined the effects of youth and adolescent sport participation on adult physical activity (PA) levels, PA adoption, or adherence to PA. Childhood physical fitness test scores and youth involvement in daily physical education class have also been examined as predictor variables of adult PA. A modest volume of research studies have included several variables in their definition of youth and adolescent PA. Past studies have yielded mixed results, and have had weaknesses in their research design. They have examined only one or few cohorts of young adults, have had a limited sample of subjects, or have had a combination of these limitations. One study was unobtainable in the English language and therefore was not included in this review (Hirvensalo, Lintunen & Rantanen, 2000).

Previous Research on the Relationship Between Youth PA and Adulthood PA

Dishman (1988) examined the influence of school sport participation on present PA. The study recruited a broad-aged sample of Caucasian males (N = 265; 49.7 ± 8.5 years of age) who were either referred by a physician or reported on their own accord to the Biodynamics Exercise Program administered at the University of Wisconsin-Madison between June 30, 1972 and July 1, 1977. Subjects reported on current PA via a questionnaire, which inquired about mode of activity, as well as frequency, intensity, and duration. Based on responses to these items, estimated weekly calorie expenditure was calculated for each subject. Past interscholastic or intercollegiate sport participation was determined by a question that simply asked, “Did you participate in school sports?”
Attendance records for each subject in the Biodynamics Exercise Program were also obtained. One-way ANOVA was used to analyze the data collected. Current PA, attendance (total days), and attendance (days per week) in the Biodynamics Exercise Program were dependent variables.

The author reported no significant difference between past sport participation and any of the three dependent variables (Dishman, 1988). The obvious limitation to this study is that subjects were not required to report details regarding their past sport participation. Number of years of involvement, level of involvement, and number of sports played are just a few variables that could have been assessed to provide a more accurate analysis.

Similarly, Brill et al. (1989) attempted to determine if there was any difference in exercise adoption rates between former athletes and non-athletes. Like Dishman, Brill utilized a wide range of cohorts in the sample of Caucasian males, who were visiting a preventative medicine clinic for fitness evaluations. Participants were classified as either former athletes (FA, n = 345) or non-athletes (NA, n = 75). Category determination was based on participants’ responses to items on a questionnaire that asked if they had lettered or participated in track, football, basketball, baseball, wrestling, soccer, tennis, or other sports during their high school or college years. Additional items on the questionnaire categorized participants as present exercisers or non-exercisers, but did not account for intensity, frequency, or duration of their present activities. The authors reported no statistically significant difference in current exercise rates for FA and NA participants at baseline.
At the conclusion of each baseline visit, sedentary subjects were provided with a personalized workout plan and a strong recommendation from a physician to begin regular exercise. Adoption rates were obtained at the second clinic visit (mean = 56 months later). The authors reported adoption rates of 82 percent (FA) and 85 percent (NA); however, no statistical significance was found between the two groups concerning exercise adoption.

Sallis, et al. (1992) also observed exercise adoption. However, their study examined several predictor variables in addition to childhood sport participation. In this study, the researchers randomly selected 6,000 residents of San Diego, California for their initial survey by using a commercial directory listing. A response rate of 43.4 percent (n = 2,053) was obtained. Age range of subjects at baseline was very broad (18-90 years of age). The initial survey contained 25 items dealing with physiological, psychological, social, and physical environmental variables of the past and present. Subjects were classified as either sedentary, intermediate, or active at baseline. A follow-up survey was administered (n = 2,011) 24 months later, and again based on subjects’ responses, each was categorized as sedentary, intermediate, or active.

Using one-way ANOVA, the researchers analyzed predictors that lead subjects to either maintain their PA habits or change those habits after baseline, over the 24-month period. PA history was a significant predictor of exercise adoption among initially sedentary men and women, but it was not a significant predictor of exercise adherence in males or females who were intermediate at baseline and then intermediate or active at follow-up. Likewise, PA history was not a significant predictor in males and females who were
active at baseline and still active at follow-up. In summary, findings of this research suggest that PA history is a significant predictor of PA adoption but not PA adherence.

Scott et al. (1998) observed one cohort of older male and female subjects to determine if adolescent participation in social, creative/artistic, intellectual, and sport activities as well as involvement in formal organizations would correlate with participation in those same activities several years later in life. Subjects were 2,806 sophomores of rural Pennsylvania high schools in 1947. During this time, a questionnaire was completed by each participant regarding the activities in which they participated. In 1992, 45 years later, a total of 1,374 subjects from the original sample responded to another survey that collected information on the activities in which they currently participated. For both the baseline and follow up questionnaires, subjects were not required to indicate the total number of hours of participation per week.

Multiple correlation regression analysis was used to determine if statistically significant relationships existed between past and present participation in similar activities. The researchers used gender, health, education, and income as control variables. For each activity category, a statistical significant relationship was found between past and present participation. Adolescent participation in sports activities was significantly correlated with adult leisure participation in sports ($r = .319, p < .001$).

Kraut et al. (2003) collected and utilized data from a broad-aged sample of Jewish males ($N = 3,687$) who were participants in the Cardiovascular Occupational Risk Factors in Israel Study (CORDIS) between 1985 and 1987. Subjects from 21 industrial plants in Israel participated in a free cardiovascular risk screening which included routine blood tests, electrocardiogram, and physical examination. During the screenings, subjects
also completed a questionnaire on a variety of personal and workplace factors. Included in the questionnaire were inquiries designed to extract information on school-aged sport participation (SASP), excluding regular physical education class participation, as well as current leisure time PA (LTPA). For SASP, the men were asked how many years they participated. The subjects were considered to be participants of SASP if they reported participation for at least one year. Participants were also asked how often per week they participated in LTPA and with what duration (<30 min, 30-60, and >60).

In the analysis, researchers controlled for several confounding variables, including age at the time of survey, ancestry, country of origin, level of religious observance, marital status, blue-collar vs. white-collar employment, physical workload, work schedule, several medical history items, and smoking vs. non-smoking status. The authors reported that only 20.8 percent of the study sample participated in LTPA at least once a week for a minimum duration of 30 minutes. Even so, a logistic regression analysis indicated that high SASP was a strong predictor of current participation in LTPA (adjusted OR = 3.55, 95% CI = 2.90-4.13). When the researchers constricted the LTPA requirement to five days a week of LTPA for at least 30 minutes per day, although only 2.5 percent of the sample was represented, high SASP was found to be a strong predictor of high current LTPA (adjusted OR = 4.79, 95% CI = 2.94-7.81). Being single was also a moderately strong predictor of high LTPA (adjusted OR = 1.50, 95% CI = 1.16-1.95).

Barnekow-Bergkvist et al. (1998) explored the relationships between teen and adult LTPA, using a randomly selected cohort of Swedish students (220 males, 205 females) who were in their first year of high school in 1974. Subjects were 16 years of age at the time baseline LTPA measures were conducted, including involvement in
leisure sports activities and memberships in sports clubs. Follow-up measures were conducted 18 years later, when 157 male and 121 female subjects continuing from the original sample were 34 years of age. LTPA measures were again collected, including mode, frequency, intensity, and duration of current sport participation; walking/cycling to work; involvement in leisure sports activities over the past year; marital status; number of children living with them; education level; and socioeconomic status of themselves and their parents. To quantify adult LTPA, an exercise index was calculated based on the estimated energy expenditure of the subjects at age 34. Using multiple linear regression, the researchers found a statistically significant positive correlation \((p < .05)\) between teen LTPA and adult LTPA for both men \((r^2 = .16, \beta = .28)\) and women \((r^2 = .16, \beta = .27)\).

Alfano et al. (2002) examined youth sport participation as a predictor variable for adult PA, obesity, and dietary habits. The cohort used in this study was composed of 486 low-income African-American women (mean age = 27.9, range = 18-39), who completed a six-item questionnaire to assess past sport participation and the Baecke Questionnaire of Habitual Physical Activity to assess current at-work and leisure-time PA (Baecke, Burema & Frijters, 1982). Unlike the other studies previously discussed, years of participation and volume of training for sports were quantified in this research. Body mass index (BMI) was used to quantify the obesity variable, and calories consumed per day for the diet variable.

The authors found that past sport participation was associated with current BMI \((F(6,423) = 56.672, p < .001)\), current total PA level \((F(2,417) = 23.780, p < .001)\), work-related PA \((F(4,440) = 4.642, p < .001)\), and current sport participation \((\kappa(1) = 5.069, p <\)
.001). However, because this study used a cohort of low-income and African American women, generalization of the findings to the general population is limited.

Another recent study was conducted using a single cohort of subjects to examine past PA and present inactivity, while controlling for social environment in adulthood (Tammelin et al., 2003). The researchers sent questionnaires to nearly 12,000 children in Finland who were estimated to be at 14 years of age. A response rate of 97 percent (n = 11,399) was obtained at baseline. When subjects were age 31, researchers again mailed a questionnaire to those for whom an address was available. A response rate of 75 percent was obtained at follow-up (n = 8,767). The baseline questionnaire asked subjects to report their frequency of participation in after-school sports and sports clubs, as well as what grade they earned in their school sports class. At follow-up, subjects reported on frequency, intensity, and duration of leisure time PA. Based on follow-up responses, each subject was classified as inactive, moderately active, active, or very active. To be classified as very active, subjects needed to complete brisk activity for at least 20 minutes for a minimum frequency of four times per week. The active group consisted of subjects who completed the same intensity and duration for two to three times per week. To control for social environmental variables in adulthood, researchers gathered information and made classifications of subjects based on number of children in their family, education level, job status, and location of residence.

The researchers analyzed the study data using logistic regression, and found that subjects who participated in sports at baseline were less likely to be inactive at follow-up. Additionally, when they controlled for variables associated with adult physical inactivity,
participation in sport at baseline reduced the probability that subjects would be inactive at follow-up.

An earlier study by Dennison et al. (1988) examined childhood physical fitness test scores, among other variables, as determinants of adult PA. Analogous with the first two studies discussed above, this research used an all-male sample (n = 453). Subjects physical fitness test completed in the Baltimore County public school system when they were ages 10 to 11 and again at ages 15 to 18 were available. Subjects were currently 23 to 25 years of age. Current PA was assessed using the Seven-Day Activity Recall Method, which obtained, to the nearest half-hour, the amount of time subjects spent on PA in the seven days prior to receiving the survey. Both at-work and leisure-time activities were provided, and each was categorized as moderate, hard, and very hard. Subjects were classified as either active or inactive, based on the American College of Sports Medicine recommendations of two or three sessions of PA per week for at least 20 to 30 minutes at ≥ 60 percent of the individual’s maximum oxygen consumption.

Dennison’s study revealed that the active group of subjects had better standardized fitness test scores as children than the inactive group of subjects. Bivariate analysis revealed that the highest correlates of adult PA were the 548.6-m run (F(13.0), p < .001), parental encouragement (F(9.4), p < .001), level of completed education (F(9.0), p < .001), participation in organized sports after high school (F(9.4), p < .001), and spousal encouragement (F(3.0), p < .01).

Another study worth reporting investigated the influence of a daily school physical education (PE) program on PA level and attitude toward PA in adults (Trudeau et al., 1999). This study, conducted during 1995-1996, drew on subjects from an earlier
study, the Trois-Rivieres longitudinal study in Quebec. The Trois-Rivieres used a sample of 272 subjects who had entered primary school between 1970 and 1977, and compared free leisure activity patterns of students who had received one hour of PE instruction from a professional physical educator every day for their six years of primary schooling, versus those who had received only the standard PE instruction from their home room teacher. For the Trudeau et al. study, questionnaires concerning PA and general lifestyle were sent out to 178 of the Trois-Rivieres subjects that were located. Of this group, 147 questionnaires were returned and able to be used for analysis. A control group \((n = 720)\) composed of matched subjects who had completed the same questionnaire in 1993 was also used.

When responses to the questionnaire were analyzed using a two-sample chi-squared test, no statistically significant differences between the two groups were found for self-reported PA. However, when the results were examined by gender, statistically significant higher PA levels were discovered for the female subjects who had received the professional PE instruction \((X^2 = 11.0, df = 2)\).

Glenmark et al. (1994) examined a small sample of young men \((n = 62)\) and women \((n = 43)\) from one cohort of 27-year-olds to determine if their adult PA levels could be predicted by how physically active the subjects were in adolescence. Physical characteristics and physical performance were also investigated as potential predictors. Subjects were drawn from an earlier study conducted in 1974, which targeted 16-year-old students who were in their first year of high school. At that time, subjects completed a battery of physical fitness tests, as well as a physical activity questionnaire that inquired about frequency and duration of PA while at leisure, sport club memberships, and
attitudes regarding PA. The same subjects completed a similar questionnaire 11 years later, at the age of 27, which included additional items regarding mode of transportation to and from work, number and age of any children they have, smoking preference, and work-related PA. A physical activity index was calculated based on how the subjects rated themselves, at baseline and follow-up, on a scale ranging from very inactive to very active.

The authors reported similar percentages for physically active subjects at baseline and follow-up. At age 16, 72 percent of the women and 85 percent of the men were physically active at leisure versus 65 percent of the women and 76 percent of the men at age 27. Using linear regression analysis, the researchers examined correlations between the adult PA index and youth PA levels, physical characteristics, and performance. Activity index in adulthood was found to be correlated with several predictor variables (p ≤ .05). Most importantly, number of physical activities, number of competitive activities, and adolescent activity index in both women (r = .40, r = .54, and r = .64, respectively) and men (r = .39, r = .30, and r = .48, respectively) were correlated to adult PA index.

In a recent study, a cohort of young female subjects from a university in Canada was used in a survey concerning the number of hours per week each person participated in organized sports, recreational PA, and working out during their senior year of high school (Robertson-Wilson et al., 2003). Subjects ranged in age from 18 to 22 years who were classified as either active or inactive at the time of the study, based on their responses to items on the survey. The active group consisted of subjects who had been involved in a minimum of 25 hours per week of PA during their senior year of high school. Inactive subjects were those who had been involved in less than five hours of PA
per week during that same period of time. Of the 102 women who participated by completing the survey, nine were selected from each group to be interviewed regarding their involvement in organized activities between the ages of 6 and 18, including arts, music, organized clubs, and sports. The interviewer recorded ages that subjects began and ended each activity, as well as the number hours spent on each activity per week, month, and year.

The researchers used a two-way ANOVA with repeated measures to inspect differences in participation in organized activities between the active and inactive groups of interviewed females. Results indicated that active females took part in a statistically significant larger amount of activities than the inactive group ($F(1, 17) = 34.0, p < .001$), with differences also found by age ($F(1, 17) = 3.4, p < .05$) and number hours spent on PA ($F(1, 17) = 17.7, p < .001$).

Taylor et al. (1999) conducted a study that utilized a sample of 105 mostly middle-aged men (mean age = 45.0, age range = 32-60 years old) who completed questionnaires regarding past and present PA activities. The retrospective data were collected for childhood (ages 6-12) and adolescence (ages 13-18) regarding participation in PE class, organized sports, sport lessons, and leisure-time PA. Subjects also rated their past PA level, compared to others their age, on a scale of 1-5 (1= much less active, and 5 = much more active). The present PA questionnaire gathered information regarding the subject’s weekly exercise over the past three-month period, including frequency, intensity, and duration of cardiovascular activities. An activity level was established based on the number kilocalories expended each day. Subjects also reported on enjoyment of PA, self-rated ability, whether they were encouraged or forced to
participate in PA, and whether they participated primarily in team or individual sports during youth and adolescent years.

Pearson correlation was used to examine individual relationships between several independent variables and adult PA, and multiple correlation regression analysis was used to examine combined effects and interactions. Teen skill in PA \( (r = .17, p < .05) \) and being forced to exercise during youth \( (r = -.20, p < .05) \) were the only variables found to be related to adult PA. In addition, frequency of being forced to exercise during youth was strongly related to adult kilocalorie expenditure from exercise \( (\beta = -44.95, p < .05) \).

The findings suggest that it is not past participation but past experiences with participation, and ability, which predict adult PA levels. However, the use of a relatively small all-male study sample limits the generalization of this study to the general population.

Telama et al. (1997) conducted a longitudinal study of cardiovascular risk among young Finns, using several cohort groups. Subjects were staggered in age by three-year intervals. At baseline, in 1980, subjects \( (n = 2,309) \) were age 9 \( (n = 610) \), 12 \( (n = 624) \), 15 \( (n = 572) \), and 18 \( (n = 503) \). Follow-up was conducted in three year intervals as well, in 1983, 1986, 1989, and 1992. However, the researchers only reported on data collected nine years from baseline in 1989, and twelve years from baseline in 1992. In 1980 and 1989 subjects completed a questionnaire regarding frequency and intensity of leisure time PA, participation in sports clubs, participation in sports competition, and how subjects spent their leisure time. In 1989, subjects \( (n = 1,687) \) were age 18 \( (n = 471) \), 21 \( (n = 440) \), 24 \( (n = 417) \), and 27 \( (n = 359) \). In 1992 subjects completed a questionnaire regarding frequency and intensity of PA, number of hours per week spent in intensive PA, and
membership in sports clubs. In 1992, subjects (n = 1,398) were age 21 (n = 380), 24 (n = 386), 27 (n = 333), and 30 (n = 299).

Spearman’s rank order correlation analysis was used to examine correlations between indices at baseline and at nine and twelve years later. Results were sorted by age at baseline, as well as by gender. All correlations were relatively weak, but statistically significant (p ≤ .05), with the exception of the relationship between females age nine at baseline and follow-up twelve years later. When researchers used stepwise multiple regression to individually analyze the influence of the predictor variables on PA both nine and twelve years later, participation in competitive sports and grade earned in physical education class were found to be statistically significant predictors.

Kissinger (2000) studied PA among college students attending a university in Omaha, Nebraska. This study is one of few that have been conducted on a sample of Americans. A sample of 249 students (ages 19-30) were surveyed regarding childhood PA (6-12 years old) and adolescent PA (13-18 years old). Simultaneously with the first survey questionnaire, an additional questionnaire was administered regarding PA completed over the past year. This second questionnaire consisted of indices regarding sports participation, work-time PA, leisure-time PA, and a total of these three types of PA participation.

The data were analyzed using Pearson correlation and stepwise multiple correlation regression analyses. Statistical significance at the .05 level was found between past PA and all four indices of the present PA questionnaire: work index (r = .129), sport index (r = .335), leisure index (r = .195), and total index (r = .284). From stepwise regression analysis, the researchers found that 17.6 percent of the variance in adult PA
was explained by five youth variables: number of varsity athletic letters received \( (r = 0.287, \text{SEE} = 8.88) \), informal activities as a pre-teen \( (r = 0.354, \text{SEE} = 8.69) \), level of athletic ability or coordination in favorite sport as a teen \( (r = 0.383, \text{SEE} = 8.60) \), PE classes as a teen \( (r = 0.401, \text{SEE} = 8.54) \), and activity level compared to peers as a pre-teen \( (r = 0.420, \text{SEE} = 8.48) \).

In summary, a modest volume of research had been conducted which individually examines youth sport participation as a predictor of adult PA. These studies have yielded mixed results (Alfano, et al., 2002; Dishman, 1988; Kraut, et al., 2003; Scott & Willis, 1998; Tammelin, et al., 2003). In two studies that examined the influence of a single predictor variable on adult PA, youth fitness test scores where found to be higher in active individuals when compared to their counterparts (Dennison, et al., 1990) and youth participation in a daily PE class was found to have no influence on adult PA (Trudeau, et al., 1999). Many other studies have defined youth PA using several variables, and examined the relationship it has with adult PA. One study indicated that youth PA was a predictor of PA adoption in adults, but not adherence (Sallis, et al., 1992), while another study refuted any statistically significant difference in exercise adoption rates between those who participated in youth sports versus those who did not (Brill, et al., 1989). A few studies have suggested youth PA is a predictor of adult PA, even though some have reported weak correlations (Bernekow-Bergkvist, et al., 1998; Glenmark, et al., 1994; Kissinger, 2000; Telama, et al., 1997; Robertson-Wilson, et al., 2003). One study suggested that youth PA did not predict adult PA; however, youth experiences and ability in PA were found to be statistically significant predictors of adult PA (Taylor, et al., 1999). Unfortunately, each of these studies either examined only one
or a small number of cohorts of young adults, had a limited sample of subjects, or had a combination of these limitations.

In this extensive review of literature, no study was found that used a representative sample of both male and female Americans using several cohorts of a broad age range. Therefore, further research is warranted to examine the relationship of youth PA and adult PA.

**Measurement of PA**

The measurement of PA can be accomplished through several procedures. Direct observation, wearing a device that estimates calorie expenditure such as a Caltrac monitor, keeping a log or journal, responding to interview inquiries, and completing questionnaires are all possible methods that can be used. Depending on the purpose for obtaining such data, or the design of the study intending to make use of such information, some methods may be more suitable than others.

Research intending to quantify PA for a large sample of individuals would not be served well by using direct observation or performing interviews. Likewise, requiring subjects to wear and report the results from a Caltrac monitor or to fill out an activity log every day over a period of time may reduce participation because of the inconvenience imposed on the subjects. The use of a simple questionnaire, however, can be used to effectively gather information from a large sample without requiring much time of the subjects or additional manpower.

Several physical activity questionnaires have been developed (Jacobs, Ainsworth, Hartman & Leon, 1993). One such questionnaire uses indices regarding work, leisure, and sport PA (Baecke, et. al., 1982). A total PA index is also calculated in this instrument
using a combination of the three indices. The Baecke Questionnaire of Habitual Physical Activity has been used in past research (Cuppett & Latin, 2002; Pereira et al., 1999; Sternfeld, Ainsworth & Quesenberry, 1999). Additionally, several scientific studies have examined the validity of this instrument (Evenson et al., 1999; Jacobs, Ainsworth, Hartmen & Leon, 1993; Lee & Paffenbarger, 2001; Miller, Freedson & Kline, 1994; Philippaerts, Westerterp & Lefevre, 1999; Philippaerts, Westerterp & Lefevre, 2001). Philippaerts et al. (1999) conducted research to validate the Baecke Questionnaire indices against average daily metabolic rate (ADMR) and physical activity level (PAL) of subjects using doubly labeled water, the gold-standard for measuring energy expenditure. The researchers concluded that the total activity index of the questionnaire correlated well with both variables, ADMR \( (r = 0.68, p < .01) \) and PAL \( (r = .69, p < .001) \).

The Baecke Questionnaire of Habitual Physical Activity was designed to obtain PA information about the present time. Having subjects complete a questionnaire regarding activities performed in their youth or adolescence requires memory recall. Although the ability of a subject to accurately recall and report information has been questioned, memory recall has gained the acceptance of researchers, and a number of studies have shown that adults possess the ability to accurately recall information from their youth and adolescence (Coleman & Dwyer, 1994; Blair et al., 1991).

The Childhood and Adolescent Physical Activity Patterns Questionnaire is the instrument that will be used in this study for memory recall of past PA. This instrument inquires about youth PA (preteen years: ages 6-12) and adolescence (teen years: ages 13-18) (Taylor et al., 1999). Psychosocial items based on Bandura’s Cognitive Theory are contained in the instrument. Additionally, all 34 items of the questionnaire have been pre-
tested for clarity and understanding with Cronbach's alpha scores $\geq 0.70$ (Taylor et al., 1999), and the questionnaire has been used in at least one other study (Kissinger, 2000).
CHAPTER IV

Methods

Subjects

The volunteer subjects for this study were male and female faculty and staff of the University of Nebraska Omaha employed full- or part-time in a variety of departments throughout the university campus. The use of these subjects in the study was approved by the university’s Institutional Review Board prior to the collection of research data.

Design

A non-experimental recall technique was used for this study. Subjects were sampled regarding their participation in youth and adult physical activity (PA).

Procedures

To recruit study participants, the investigator sent a letter (Appendix A) to the campus mailboxes of all employees of the University of Nebraska Omaha (N = 1,658) inviting them to participate in the study by completing two questionnaires, one pertaining to past youth PA and one related to current adult PA. Both questionnaires were made available on-line, or participants could request a hard-copy to be mailed to them at their university mailbox. The survey was available for completion for one month (31 days). Six subjects requested and completed hard copy versions of the questionnaires and 255 completed the questionnaires on-line, for a total response of 261 participants (15.7 percent).

Data from participants completing the questionnaires on-line was captured in a data file. Participants who completed hard-copy versions of the questionnaires returned
them by campus mail to the study investigator, who entered the responses into a data file. Upon conclusion of the survey completion period, data from on-line participants and hard-copy participants were merged into one data file for response scoring and statistical analysis.

Of the 261 two-part surveys that were received, 29 were excluded from analysis because of excessive missing data (four or more survey items left blank). The final study sample was 232 (14 percent) university employees (91 males and 141 females) ranging in age from 23 to 76. Ninety-six participants from the sample of 232 (41 percent) had no response for 1-3 of the survey items. For those non-responses, the missing data were replaced by using the mean value for the item based on the responses from the other respondents in the same gender/age group (Male < 50; Male 50+; Female < 50; Female 50+). Table 1 provides a summary of the distribution of non-responses. A detailed listing by item is provided in Appendix D.

<table>
<thead>
<tr>
<th>Gender/Age Group</th>
<th>No. of Subjects with Non-Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For 1 item</td>
</tr>
<tr>
<td>Male &lt; 50 (n = 39)</td>
<td>14</td>
</tr>
<tr>
<td>Male 50+ (n = 52)</td>
<td>16</td>
</tr>
<tr>
<td>Female &lt; 50 (n = 76)</td>
<td>24</td>
</tr>
<tr>
<td>Female 50+ (n = 65)</td>
<td>22</td>
</tr>
<tr>
<td>TOTAL (n = 232)</td>
<td>76</td>
</tr>
</tbody>
</table>

Table 1. Non-Responses for Survey Items

Survey

The Baecke Questionnaire of Habitual Physical Activity (Appendix B) was used to assess the subjects' participation in PA within the last year (Baecke, et al., 1982). The questionnaire contains four different indices: work, sport, leisure, and total. The first
eight questions relate to the work index, questions nine through twelve relate to the sport index, and questions thirteen through sixteen relate to the leisure index. The total score is a combination of the work, sport, and leisure indices. Scoring was conducted using the instrument developers’ scoring procedures (Baecke, et al., 1982). When tested for reliability, a Cronbach’s alpha of .61 was calculated for this instrument, which assesses the independent variable, adult PA, in this study.

The Childhood and Adolescent Physical Activity Patterns Questionnaire (CAPAQ)(Appendix C) was used to assess participants’ past PA when they were between the ages of 6 and 18 (Taylor, et al., 1999). The survey uses cues to aid with memory recall of childhood and adolescent frequency of participation in PE classes, organized youth sports, specific sport lessons, and informal or team activities. Other items in this instrument use a five-point Likert-type scale for subjects to rate their youth PA level in comparison to their childhood/adolescent peers, self-perceived skill, and experiences. This instrument has demonstrated good internal reliability, with a Cronbach’s alpha of .70 (Taylor, et al., 1999). A similar reliability was observed for this study. When items that make up the independent variable, youth PA, were examined a Cronbach’s alpha of .71 was observed.

No standardized scoring was available for this instrument. Therefore, questions were identified from this instrument that quantify youth PA. These questions were used to gather data for correlation and regression analysis. See Appendix E for more detail on item scoring.
Data Analysis

From the usable data set obtained using the process described above, descriptive statistics were calculated for the youth PA variables, including mean (M), standard deviation (SD), and range for the pre-teen PA, teen PA, and total youth PA, and for the adult PA variables, including the work, sport, leisure, and total PA indices. For gender and gender/age cohorts, independent t-tests were conducted to assess differences in mean scores of youth items from the CAPAQ, youth PA score, and the four adult PA indexes. Pearson correlation coefficients were used to examine the relationships between youth PA and adult PA variables. Backward multiple correlation regression analysis was conducted to determine which combination of youth PA variables explained the most variance in adult PA. Past research has relied on stepwise correlation regression to explain variance between youth and adult PA. This statistical procedure examines the contribution of one variable at a time, independent of the others, until all possible variance is explained. In this research, backward multiple correlation regression was chosen to examine all independent variables simultaneously, and determine the best combination of interacting variables to explain the variance between youth and adult PA.

Lastly, Pearson correlation analysis was conducted following the regression analysis to examine covariance among the identified regression variables as well as the co-variance between each variable and the dependent variable.
CHAPTER V

Results

In this chapter, the results of the analyses of the self-report survey data on youth and adult PA, gathered from study participants using the Childhood and Adolescent Physical Activity Questionnaire (CAPAQ) and The Baecke Questionnaire of Habitual Physical Activity, are presented.

Descriptive Statistics

Descriptive statistics were calculated for youth PA and adult PA. The units of measure for these scores are arbitrary units used to quantify PA, with a higher number reflecting a higher participation in PA.

Scores for preteen PA, teen PA, and total youth PA are presented in Table 2. The possible range for the preteen PA score was 0 – 1,082; for teen PA score, 0 – 1,604; and for total youth PA score, 0 – 2,686.

<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Possible Range</th>
<th>Actual Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preteen PA score</td>
<td>232</td>
<td>226.1</td>
<td>152.0</td>
<td>0 – 1,082</td>
<td>0 – 834</td>
</tr>
<tr>
<td>Teen PA score</td>
<td>232</td>
<td>212.4</td>
<td>215.1</td>
<td>0 – 1,604</td>
<td>0 – 1,251</td>
</tr>
<tr>
<td>Total Youth PA Score</td>
<td>232</td>
<td>438.5</td>
<td>334.2</td>
<td>0 – 2,686</td>
<td>0 – 2,085</td>
</tr>
</tbody>
</table>

Table 2. Descriptive Statistics for Preteen and Teen PA Scores

Descriptive statistics for adult PA data are presented in Table 3. The total index represents the total adult PA score and is the sum of the work, sport, and leisure indices. The possible score ranges were as follows: work index, 1.00 to 5.00; sport index, 0.75 to 7.39; leisure index, 1.00 to 5.00; and total index 2.75 to 17.39.
<table>
<thead>
<tr>
<th>Variable</th>
<th>N</th>
<th>M</th>
<th>SD</th>
<th>Possible Range</th>
<th>Actual Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work PA index score</td>
<td>232</td>
<td>2.70</td>
<td>.259</td>
<td>1.00 – 5.00</td>
<td>2.13 – 3.63</td>
</tr>
<tr>
<td>Sport PA index score</td>
<td>232</td>
<td>2.21</td>
<td>.506</td>
<td>0.75 – 7.39</td>
<td>1.00 – 3.79</td>
</tr>
<tr>
<td>Leisure PA index score</td>
<td>232</td>
<td>2.75</td>
<td>.554</td>
<td>1.00 – 5.00</td>
<td>1.25 – 4.25</td>
</tr>
<tr>
<td>Total Adult PA index</td>
<td>232</td>
<td>7.66</td>
<td>.736</td>
<td>2.75 – 17.39</td>
<td>5.75 – 10.14</td>
</tr>
</tbody>
</table>

Table 3. Descriptive Statistics for Adult PA Scores

**Independent t-test Results**

For gender and gender/age cohorts, independent t-tests (with unequal variance assumed) were conducted to assess differences in mean scores for youth PA (pre-teen, teen, and total scores) and adult PA (work, sport, leisure, and total scores). The independent t-test results are presented in Table 4.

Independent t-tests were also conducted on the mean values for additional items from the CAPAQ that were related to youth PA, but did not quantify the PA. The units of measure for these items are arbitrary units used to quantify magnitude or frequency of occurrence of each variable, based on self-report survey data. Higher scores reflect a higher magnitude or more frequent occurrence of the variable. The results of these t-tests are presented in Table 5.

Based on independent t-test results, the mean total youth PA score was higher for males (M = 520.46, SD = 367.33) than females (M = 385.68, SD = 300.67) indicating that males were more physically active in their youth (p = .004). Males also had a higher mean adult total index (M = 7.83, SD = .66) than females (M = 7.54, SD = .76)(p = .003).

For the age/gender sub-samples, mean differences were observed in total youth PA score between males under age 50 (M = 552.26, SD = 405.01) and males age 50 or older (M = 496.62, SD = 338.45). A similar observation was made between the mean
total youth PA score for females under age 50 (M = 399.14, SD = 294.50) and females age 50 and older (M = 369.94, SD = 309.28). These observations indicate that both males and females under age 50 were more physically active than their older gender cohorts in their youth; however, independent $t$-test results did not indicate statistical significance between the age/gender cohort mean values for either males ($p = .489$) or females ($p = .569$).

The mean adult total index was higher for males age 50 and older (M = 7.87, SD = .70) than for their younger cohort of males under age 50 (M = 7.77, SD = .62); however, this difference was not statistically different according to independent $t$-test results ($p = .491$). The younger females had a higher mean adult total index (M = 7.65, SD = .82) than the females age 50 and older (M = 7.42, SD = .67). This difference was also not found to be statistically significant ($p = .071$).

Youth PA

Younger male and female cohorts reported significantly higher PE class participation in their pre-teen years than the older male and female cohorts. Independent $t$-test results indicated the difference between the male <50 group mean pre-teen PE class score (M = 138.46, SD = 19.44) and the male 50+ group mean pre-teen PE class score (M = 91.44, SD = 65.52) was significant ($p = .000$). Likewise, independent $t$-test results indicated the difference between the female <50 group mean pre-teen PE class score (M = 141.16, SD = 14.11) and the female 50+ group mean pre-teen PE class score (M = 111.88, SD = 56.96) was significant ($p = .000$).

The younger male and female cohorts also reported higher mean pre-teen school sport participation scores compared to the older male and female cohorts. The male <50
group had a mean pre-teen school sport score of 85.31 (SD = 86.02), while the male 50+ group mean pre-teen school sport score of 58.12 (SD = 76.02). Independent t-test results did not indicate statistical significance (p = .121). The female <50 group had a mean pre-teen school sport score of 55.47 (SD = 76.78), while the female 50+ group had a mean pre-teen school sport score of 35.00 (SD = 70.30). Like the males, independent t-test results did not indicate statistical significance (p = .101).

The mean scores for school PE and school sports were not so different in teen years between the male and female age cohorts. For teen school PE the male <50 mean score was 129.23 (SD = 41.6), while the male 50+ group had a mean score of 123.23 (SD = 45.84). This mean difference was not statistically significant (p = .514). The female <50 group had a teen school PE mean score of 119.37 (SD = 44.85), and the female 50+ had a mean score of 120.74 (SD = 51.08). This mean difference was also not statistically significant (p = .867). Findings were similar for the teen school sports mean scores. The male <50 group had a mean score of 89.10 (SD = 101.24), and the male 50+ group had a mean score of 92.90 (SD = 98.92). The difference in these mean scores were not statistically significant (p = .858). The female <50 group had a teen school sports mean score of 67.46 (SD = 86.84), and the female 50+ group had a mean score of 62.77 (SD = 84.44). Independent t-test results indicated no statistical significance in the difference between these mean scores (p = .746).
<table>
<thead>
<tr>
<th></th>
<th>Males (n = 91)</th>
<th>Females (n = 141)</th>
<th>Sig.</th>
<th>Males (n = 39)</th>
<th>Females (n = 52)</th>
<th>Sig.</th>
<th>Males (n = 76)</th>
<th>Females (n = 65)</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>M (SD)</td>
<td></td>
<td></td>
<td></td>
<td>M (SD)</td>
<td></td>
<td></td>
<td>M (SD)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE class</td>
<td>111.56 (56.04)</td>
<td>127.66 (42.48)</td>
<td>.021*</td>
<td>138.46 (19.44)</td>
<td>91.44 (65.52)</td>
<td>.000*</td>
<td>141.16 (14.11)</td>
<td>111.88 (56.96)</td>
<td>.000*</td>
</tr>
<tr>
<td>School sports</td>
<td>69.77 (81.13)</td>
<td>46.04 (74.31)</td>
<td>.026*</td>
<td>85.31 (86.02)</td>
<td>58.12 (76.02)</td>
<td>.121</td>
<td>55.47 (76.78)</td>
<td>35.00 (70.30)</td>
<td>.101</td>
</tr>
<tr>
<td>PA classes/lessons</td>
<td>19.29 (53.86)</td>
<td>30.84 (57.12)</td>
<td>.121</td>
<td>26.72 (66.40)</td>
<td>13.71 (41.96)</td>
<td>.288</td>
<td>33.01 (54.03)</td>
<td>28.31 (60.85)</td>
<td>.631</td>
</tr>
<tr>
<td>Informal PA activities</td>
<td>156.57 (74.95)</td>
<td>136.65 (82.54)</td>
<td>.059</td>
<td>160.00 (74.87)</td>
<td>154.00 (75.64)</td>
<td>.707</td>
<td>131.74 (85.48)</td>
<td>142.40 (79.22)</td>
<td>.444</td>
</tr>
<tr>
<td>Pre-Teen score</td>
<td>245.64 (155.16)</td>
<td>213.52 (149.08)</td>
<td>.120</td>
<td>272.05 (169.03)</td>
<td>225.83 (142.34)</td>
<td>.172</td>
<td>220.22 (150.06)</td>
<td>205.68 (148.71)</td>
<td>.656</td>
</tr>
<tr>
<td>PE class</td>
<td>125.80 (43.72)</td>
<td>120.00 (47.66)</td>
<td>.342</td>
<td>129.23 (41.06)</td>
<td>123.23 (45.84)</td>
<td>.514</td>
<td>119.37 (44.85)</td>
<td>120.74 (51.08)</td>
<td>.867</td>
</tr>
<tr>
<td>Non-school sports</td>
<td>44.40 (77.60)</td>
<td>20.02 (50.90)</td>
<td>.009*</td>
<td>41.51 (71.87)</td>
<td>46.56 (82.26)</td>
<td>.756</td>
<td>21.38 (52.56)</td>
<td>18.43 (49.24)</td>
<td>.732</td>
</tr>
<tr>
<td>PA classes/lessons</td>
<td>26.43 (61.50)</td>
<td>23.08 (52.08)</td>
<td>.668</td>
<td>35.18 (72.53)</td>
<td>19.87 (51.71)</td>
<td>.266</td>
<td>24.78 (48.91)</td>
<td>21.09 (55.88)</td>
<td>.680</td>
</tr>
<tr>
<td>School sports</td>
<td>91.27 (99.38)</td>
<td>65.30 (85.47)</td>
<td>.042*</td>
<td>89.10 (101.24)</td>
<td>92.90 (98.92)</td>
<td>.858</td>
<td>67.46 (86.84)</td>
<td>62.77 (84.44)</td>
<td>.746</td>
</tr>
<tr>
<td>Informal activities</td>
<td>112.65 (108.87)</td>
<td>63.61 (90.89)</td>
<td>.000*</td>
<td>114.21 (112.28)</td>
<td>111.48 (107.33)</td>
<td>.907</td>
<td>65.08 (94.17)</td>
<td>61.89 (87.58)</td>
<td>.835</td>
</tr>
<tr>
<td>Teen PA score</td>
<td>274.82 (248.60)</td>
<td>172.07 (180.15)</td>
<td>.001*</td>
<td>280.10 (262.08)</td>
<td>270.87 (240.52)</td>
<td>.864</td>
<td>178.82 (170.79)</td>
<td>164.18 (191.56)</td>
<td>.636</td>
</tr>
<tr>
<td>TOTAL YOUTH PA Score</td>
<td>520.46 (367.33)</td>
<td>385.68 (300.67)</td>
<td>.004*</td>
<td>552.26 (405.01)</td>
<td>496.62 (338.45)</td>
<td>.489</td>
<td>399.14 (294.50)</td>
<td>369.94 (309.28)</td>
<td>.569</td>
</tr>
<tr>
<td>Work Index</td>
<td>2.77 (0.23)</td>
<td>2.65 (0.27)</td>
<td>.001*</td>
<td>2.74 (0.22)</td>
<td>2.78 (0.22)</td>
<td>.365</td>
<td>2.67 (0.29)</td>
<td>2.64 (0.25)</td>
<td>.523</td>
</tr>
<tr>
<td>Sport Index</td>
<td>2.27 (0.54)</td>
<td>2.17 (0.48)</td>
<td>.161</td>
<td>2.20 (0.58)</td>
<td>2.32 (0.51)</td>
<td>.297</td>
<td>2.26 (0.46)</td>
<td>2.06 (0.49)</td>
<td>.012*</td>
</tr>
<tr>
<td>Leisure Index</td>
<td>2.80 (0.46)</td>
<td>2.72 (0.61)</td>
<td>.297</td>
<td>2.84 (0.42)</td>
<td>2.77 (0.49)</td>
<td>.469</td>
<td>2.72 (0.61)</td>
<td>2.72 (0.60)</td>
<td>.964</td>
</tr>
<tr>
<td>TOTAL INDEX</td>
<td>7.83 (0.66)</td>
<td>7.54 (0.76)</td>
<td>.003*</td>
<td>7.77 (0.70)</td>
<td>7.87 (0.82)</td>
<td>.491</td>
<td>7.65 (0.82)</td>
<td>7.42 (0.67)</td>
<td>.071</td>
</tr>
</tbody>
</table>

Table 4. Summary of Independent t-test Results of Youth and Adult PA Scores

*p ≤ .05
Table 5. Summary of Independent t-test Results for Additional Youth PA Variables

* p ≤ .05

**Correlation Analyses**

To test the null hypotheses, Pearson correlation analyses were conducted to examine the correlation between youth PA and the adult PA indices (work, sport, leisure, and total). The results of these analyses (Table 6) indicated a statistically significant positive correlation between youth PA score and the adult work index (r = .168, p ≤ .05), the adult sport index (r = .203, p ≤ .05), and the adult total index (r = .239, p ≤ .001). As a result, Null Hypotheses 1, 2, and 4 were rejected.
Additional correlation analyses were completed to examine the relationship between youth and adult PA among the age/gender cohorts. Results from these correlation analyses are presented in Table 6.

From these analyses, a positive correlation was found between the total youth PA score and the adult work index for the male age 50+ cohort ($r = .234, p \leq .05$). For the female age $<50$ cohort, positive correlations were found between total youth PA score and three of the four adult PA indices. The strongest relationship for this female cohort was observed between total youth PA and the adult work index score ($r = .343, p \leq .05$), with 11.8 percent common variance, followed by the adult total index score ($r = .329, p \leq .05$) and the adult leisure index score ($r = .205, p \leq .05$). In the female 50+ cohort, a positive correlation was found between total youth PA score and the adult sport index score ($r = .308, p \leq .05$).

**Regression Analysis**

Backward correlation regression analysis identified seven youth PA variables that explain 8.1 percent of the variance in adult PA ($r = .332$, adjusted $r^2 = .081$). The seven
variables identified in the regression model were pre-teen encouragement for PA, pre-teen athletic ability, pre-teen school sports, teen informal activities, teen encouragement for PA, teen PA classes/lessons, and teen athletic ability.

**Intercorrelation Analyses**

Intercorrelations were examined between the seven variables identified in the backward regression model to determine magnitude and direction of relationships. Additionally, each of the seven youth PA variables was examined for correlation with adult PA. The results of these analyses are presented in Table 7.

Among the independent variables, pre-teen school sports had the strongest correlation with adult PA total index score ($r = .200, p < .05$), followed by teen encouragement ($r = .197, p < .05$), and teen informal activities ($r = .195, p < .05$). Two of the seven variables identified in the regression model were not significantly correlated to the dependent variable. These variables were pre-teen encouragement for PA ($r = .078$) and pre-teen athletic ability ($r = .090$). In a backward correlation regression analysis, sometimes a variable identified in the regression model will increase the explained variance even though it has no direct significant correlation with the dependent variable. This occurs because the variable will have a high correlation with other predictors. Such a variable is called a suppressor variable. In the regression model identified in this research, pre-teen encouragement for PA and pre-teen athletic ability were suppressor variables. Pre-teen encouragement had a positive correlation with teen encouragement for PA ($r = .666, p \leq .05$). Likewise, pre-teen athletic ability had a positive correlation with teen athletic ability ($r = .847, p \leq .05$).
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Table 7. Pearson r Values for Youth PA Variables Identified in Backwards Regression Model for Entire Sample
* p ≤ .05
CHAPTER VI

Discussion

An interesting finding was that the younger cohorts of males and females would experience higher mean school PE and school sports scores in their pre-teen years but not their teen years when compared with the older male and female cohorts. This finding leads the researcher to believe that school PE and school sports opportunities were not as great when the older cohorts were in their pre-teen years, but these opportunities improved by the time most individuals in the older cohort groups reached their teen years. This is just one possible explanation however, and additional research may provide more insight into this finding.

Correlations

It was postulated that there would not be significant relationship between the adult work index and the total youth PA score among the entire study sample, because it was thought that PA level in youth would have little if any implications for choice of job and the associated physical demand in adulthood. Pearson correlation results lead to the rejection of this hypothesis by indicating a statistically significant relationship ($p = .005$) however, the relationship was weak ($r = .168$) with a low common variance of 2.8 percent.

The opposite was hypothesized for the relationship between the total youth PA score and the adult leisure index among the study sample. It was anticipated that youth PA behaviors would likely carry over into adulthood leisure physical activity. However, the research hypothesis for the relationship between total youth PA and the adult leisure index among the entire study sample was rejected as a result of a non-statistically
significant relationship (p = .207). This finding raises questions regarding the relationship between youth PA and adult leisure activity. Do physically active youth tend to be more involved in sports versus leisure activity in adulthood? Is there no link between youth PA and adult leisure activity? Findings from this research indicate there is not. More research could assist with answering these questions.

Like adult leisure activity, it was also anticipated that there would be a significant positive relationship between the total youth PA score and the adult sport index. The rationale being that physically active youth will become adults who are active in sport activities because these activities may become habit, an addiction, the individual may simply enjoy the activities, or other possible reasons. Pearson correlation indicated a significant positive relationship between the total youth PA score and the adult sport index (p = .001), but the relationship was weak (r = .203) with a low common variance of 4.1 percent.

The Adult total index was expected to have a strong positive relationship with the total youth PA score among the study sample because it was previously hypothesized that both the adult leisure and sport indices would be positively correlated, and the adult total index is composed of these two variables and the adult work index. Pearson correlation results indicated a significant positive relationship (p = .000); however again, the relationship was not strong (r² x 100 = 5.71). This relationship is illustrated in Figure 1.
While no postulations were made regarding the age/gender correlations, it was expected that results would concur with the research hypotheses for the entire study sample. That is, there would be no significant relationship between the independent variable and the adult work index, while there would be significant positive relationships between the independent variable and the adult sport, leisure, and total indexes.

However, the age/gender correlations revealed positive relationships in all sub-samples between the independent variable and the adult total index, however only the female <50 group demonstrated significance in this relationship. The adult sport index also had positive relationships with the independent variable in all sub-samples, however the only group with a significant relationship between these variables was the female 50+ group. The adult leisure variable had a negative relationship in the male 50+ and the
female 50+ groups, although these relationships were not significant. A significant positive relationship was observed in the female <50 group. The adult work index also had negative relationships in two of the groups (male <50 and female 50+), but these relationships were not significant. The two positive relationships observed for this dependent variable and total youth PA were significant and were found in the male 50+ and female <50 groups.

Males had the highest mean total youth PA scores overall and in each of the sub-samples compared to the females. Male sub-samples also had higher mean scores for all of the dependent variables compared to the female sub-samples except in the sport index. However, males in both sub-samples had much higher standard deviations in total youth PA. Additionally, the female <50 group had the largest n size (76) making significance easier to achieve. The negative relationships, although not significant, are puzzling and provide support for more research regarding age and gender-specific relationships between youth and adult PA. It is possible that using mean values to replace missing data in each of the age/gender cohorts may have had a strong bearing on these results.

**Regression Analysis**

The regression model provided seven variables that explained 8.1 percent of the variance between youth and adult PA. There are an enormous amount of other possible variables that may influence adult PA, such as genetics, socioeconomic factors, access to opportunities and facilities, personal interests, and time commitments, just to name a few. Finding 8.1 percent of the variance explained by youth PA variables is an interesting outcome when all of the possible variables are considered.
For practical application, trying to influence all seven of the identified variables for one individual may not be feasible or realistic. For example, some variables are in pre-teen years while the others are in teen years. Students may also not remain in the same school systems where attempting to get children physically active or develop athletic skills are priorities. Additionally, some of the variables may be influenced in the school setting, but others like informal activities may be more closely related to socioeconomic variables, availability of playgrounds and facilities in the neighborhood, or even the availability of other children to participate in informal activities with. For these reasons, a more practical approach may be to attempt to influence a few select variables.

Three variables identified in the regression model (pre-teen school sports, teen encouragement for PA, and teen informal activities) as they had the strongest significant and positive relationships with the dependent variable. Results of this study suggest that focusing on the seven variables identified in the regression model may increase the likelihood of youth becoming adults who are physically active. However, it may be more sensible in some situations to focus on the three variables from the regression analysis having the strongest relationship with adult PA. For example, encouraging a child to be physically active is a simple task, that likely requires takes little time and effort, and can be done by anyone.

Comparison of Results to the Literature

Past research has refuted the relationship between youth and adult PA. Dishman, et al. (1988) examined the influence of school sport participation on present PA. Subjects reported on current PA via a questionnaire. One-way ANOVA was used to analyze the
data collected. Dependent variables were current PA, attendance (total days) in the Biodynamics Exercise Program, and attendance (days per week) in the Biodynamics Exercise Program. The author reported no significant difference between past sport participation and any of the three dependent variables (Dishman, et al., 1988).

Brill, et al. (1989), attempted to determine if there was any difference in adult exercise adoption rates between former youth athletes and non-athletes. The authors reported no significant difference in current exercise rates for former athletes (FA) and non-athletes (NA) at baseline. The authors reported adoption rates of 82 percent FA and 85 percent NA; however no significance was found between the two groups concerning exercise adoption.

Sallis, et al. (1992) also researched exercise adoption by examining several predictor variables, in addition to childhood sport participation. An initial survey contained 25 items dealing with physiological, psychological, social, and physical environmental variables of the past and present. Subjects were classified as either sedentary, intermediate, or active at baseline. A follow-up survey was administered 24 months later, and again based on subjects' responses each was categorized as sedentary, intermediate, or active. Using one-way ANOVA, the researchers analyzed predictors that lead subjects to either maintain their PA habits or change those habits after baseline, over the 24-month period. PA history was a significant predictor of exercise adoption among initially sedentary men and women, but it was not a significant predictor of exercise adherence in males or females who were intermediate at baseline and then intermediate or active at follow-up. Likewise, PA history was not a significant predictor in males and females who were active at baseline and still active at follow-up.
Contrary to the above mentioned previous research, results of this current project indicated a significant positive, but weak, relationship between the total score of youth PA and adult PA. Other previous research has reported similar findings. Scott (1998) observed data from one cohort of older male and female subjects using multiple regression analysis to determine if adolescent participation in socializing, creative and artistic, intellectual, and sport activities as well as formal organizations would correlate with participation in those same activities several years later in life. The researchers used data collected on gender, health, education, and income to create control variables. Adolescent participation in sports activities was significantly correlated with adult leisure participation in sports.

Kraut, et al. (2003) collected and used data from a broad aged sample of Jewish males who were participants in the Cardiovascular Occupational Risk Factors in Israel Study (CORDIS) between 1985 and 1987. Subjects completed a questionnaire on a variety of personal and work place factors, school aged sport participation (excluding regular physical education class participation), and adult leisure time PA. Multiple logistic regression indicated that school aged sport participation was a strong predictor of adult PA.

Barnekow-Bergkvist, et al. (1998) explored the relationships between several adolescent predictor variables and adult PA. Using multiple linear regression, the research examined to what extent the adolescent predictor variables contributed to adult PA. The exercise index of subjects at age 34 was significantly positively correlated with adolescent leisure time PA for both men and women.
Alfano, et al. (2002) considered youth sport participation as a predictor variable of adult PA. The authors concluded that past sport participation was significantly associated with current BMI, current total PA level, work-related PA, and current sport participation.

The significant association of work-related PA and youth sport participation, as well as the observance of the significant association between youth sport participation and adult sport participation in the Alfano study, is similar to findings of this current study. Although, several independent variables were scored to represent youth PA in the current study, including youth sport participation.

Tammelin, et al. (2003) evaluated youth PA at baseline and adult PA at follow up using two questionnaires in a longitudinal study. Logistic regression was used to analyze physical inactivity and potential causal variables for subjects at follow-up. The researchers concluded that subjects who participated in sports at baseline were less likely to be inactive at follow-up. Additionally, when variables associated with adult physical inactivity were controlled for, participation in sport at baseline reduced the probability that subjects would be inactive at follow-up.

Trudeau, et al. (1999) examined daily school physical education (PE) program participation on PA level and attitude toward PA in adults and found no statistically significant relationship with adult PA.

Glenmark, et al. (1994) examined a small sample of young men and women to determine if their adult PA levels could be predicted by how physically active the subjects were in adolescence. Additional predictor variables were physical characteristics and performance. The authors reported similar percentages for physically active subjects
at baseline and follow up. At age 16, 72 percent of the women and 85 percent of the men were physically active at leisure versus 65 percent of the women and 76 percent of the men at age 27. Using single linear regression, the researchers examined correlations between the dependent variable of adult PA index and independent variables under youth PA levels, physical characteristics and performance. Activity in adulthood was significantly correlated with number of physical activities, number of competitive activities, and adolescent activity index in both women and men.

Kissinger (2000) sampled college students from a university campus in Omaha, Nebraska regarding youth and adult PA. Kissinger used the same childhood instrument to assess youth PA, although scored slightly different than it was in this current study. Kissinger also used a modified version of the Baecke instrument that was used for this project. The modified version is designed primarily to account for retired adults by adding three questions focusing more on leisure time activity. Although Kissinger’s study only involved younger college students, the addition of those three questions may have provided more discrimination and therefore variance for assessing the relationship between youth PA and the adult leisure index. Statistical significance at the .05 level was found between youth PA and all four indices of the present PA questionnaire; work index \( (r = .129) \), sport index \( (r = .335) \), leisure index \( (r = .195) \), and total index \( (r = .284) \). Leisure index was the one index of the four that was not significantly correlated with adult PA in the current study. The correlation strength between youth PA and adult PA in Kissinger’s study was weak, similar to the strength of that same relationship in this study.

In Kissinger’s study, stepwise regression analysis explained 17.6 percent of the variance in adult PA by five youth variables: number of varsity athletic letters received,
informal activities as a pre-teen, level of athletic ability or coordination in favorite sport as a teen, PE classes as a teen, and activity level compared to peers as a pre-teen. Regression findings of this study had some similarity to those in Kissinger’s research, although Kissinger used stepwise regression to predict adult PA and the current study used backward regression to explain the variance between youth and adult PA. Kissinger’s study identified informal activities as a pre-teen to be a predictor of adult PA, while the current study identified teen informal activities to be part of the regression model.

Another similarity is that Kissinger identified level of athletic ability or coordination in favorite sport as a teen to be a predictor of adult PA. The current study identified both pre-teen and teen athletic ability to be part of the regression model. Taylor, et al. (1999) found teen skill in PA to have a statistically significant relationship with adult PA.

Two other variables identified in the current study regression model were pre-teen encouragement for PA and teen encouragement for PA. Teen encouragement for PA was statistically significantly correlated to adult PA, and the inter correlation between pre-teen and teen encouragement for PA was statistically significant and strong. Parental encouragement has been found to be strong correlate with adult PA in past research (Dennison, et al., 1988).

Limitations

This study was conducted using a non-experimental recall technique. With this design there are certain limitations such as the ability of participants to accurately recall past PA. Participants may over or understate their actual PA participation levels.
Additionally, the instruments used may present a limitation in the ability they have to accurately and discriminately assess PA. The instruments chosen for this study only assessed PA and other variables related to PA in youth. It is likely that many other variables are needed to explain a large percentage of adult PA. Although it was the intent of this research to identify PA and PA related variables for analysis, a more comprehensive instrument may better serve the purpose of examining the relationship between youth and adult PA. Additionally, the burden of completing the study questionnaire may be a limitation. This instrument was a long document (52 items) estimated to take 15-20 minutes to complete, which may have influenced how participants responded.

The instrument used for this study was composed of two questionnaires that were merged into one document, the Baecke Questionnaire of Habitual Physical Activity and the Childhood and Adolescent Physical Activity Patterns Questionnaire (CAPAQ). The order in which these two instruments were provided to participants was not randomly assigned by participant due to capability restrictions with the web survey. The Baecke question set made up the first part of this study questionnaire, followed by the CAPAQ question set. This methodology may have resulted in the presence of order effect. That is, participant responses may have been influence by the order in which the question sets were provided.

Another limitation of this study was missing data. A number of participants’ data was excluded as a result of excessive missing data. Furthermore, nearly half of the remaining participants skipped at least one question, with the possibility not providing responses for as many as three questions. This missing data was replaced using the mean
value for the missing data from the appropriate age/gender cohort. This procedure resulted in a reduction of variance for items with missing data, and produced a more conservative scoring of youth and adult PA.

The method in which participants were sought for this study is another limitation. This study used a convenience sampling technique. All employees of the University of Nebraska Omaha were offered the chance to participate. A true random sampling technique was not employed. If the intent is to generalize results to the American population, a better research design would involve random sampling from a much larger population, rather than sampling being limited to local employees of one institution in one city of the United States. Therefore practical application of the study is limited.

Lastly, the convenience sampling technique allowed participants to choose whether they were going to participate. It is possible that a portion of participants that chose to respond had a personal interest or bias towards youth and adult PA, therefore making the sample biased.
CHAPTER VII

Conclusions and Recommendations

As a result of this study, the following conclusions were made:

There is a statistically significant positive correlation between the total score of youth PA and the adult work index.

There is a statistically significant positive correlation between the total score of youth PA and the adult sport index.

There is not a statistically significant correlation between the total score of youth PA and the adult leisure index.

There is a statistically significant positive correlation between the total score of youth PA and the adult total index.

When attempting to identify the strength and direction of the relationships between the amount of youth PA participated in and adult PA behavior, the significant positive relationships observed were weak with little common variance explained.

Additionally, the correlations conducted between youth and adult PA among the age/gender cohorts revealed puzzling results that are difficult to draw conclusions from.

Past research has identified significant relationships between youth and adult PA, but most of these studies involved males only and young adults. Only a few studies examined both males and females, and very few have used a study sample with a broad age range of both males and females. Future research should examine the relationship between youth and adult PA in a broad sample of both male and female participants representing a variety of cohorts.
It is also important to note that many variables may influence adult PA. The focus of this research was youth PA and other related independent variables, such as those used in the regression analysis beyond the youth PA quantifying variables. Variance explained between youth PA and other related youth variables and adult PA was 8.1 percent. Future research should attempt to identify other variables in a regression model that may explain a much larger percentage of the variance between youth and adult PA, such as quality of life, social support, socio-economic variables, time demands, and accessibility, just to name a few.
References


APPENDIX A: Cover Letter
Dear UNO employee,

You have been selected to take part in a collaborative research project. Your help is needed in gathering information for the advancement of understanding on the topic of physical activity. The purpose of this research is to assess past and present physical activity patterns. The information gathered will be used to possibly identify predictors of adult physical activity from patterns of physical activity in childhood and adolescence. As a volunteer participant will NOT be identified or asked to provide any information that could reveal your identity. Your input is very valuable, even if you have not participated in past or are not participating in present physical activity. This research is a collaborative effort between researchers with the University of Nebraska at Omaha and several organizations within the Omaha community. It cannot be completed without your help!

We are respectfully asking for a few moments of your time to complete the questionnaire at the following web address: http://coedb.unomaha.edu/survey/wellness.htm
Feel free to share this web address with fellow colleagues who you feel may be interested in participating.

If you do not have internet access you can email kanemiller@mail.unomaha.edu to request a paper copy of the questionnaire.

Your input is tremendously useful and your assistance is greatly appreciated.

Thank you!

Principal Investigator
Kane Miller
University of Nebraska at Omaha
(402) 554-3246
APPENDIX B: Baecke Questionnaire of Habitual Activity
Age _____

Gender: M or F

Race (Circle one):
- American Indian or Alaska Native
- Asian
- Black
- Hispanic
- Native Hawaiian or Other Pacific Islander
- White

Circle highest level of education completed:
- GED
- Undergraduate degree
- High school diploma
- Some college
- Some graduate courses
- Master's degree
- Doctorate degree

Circle Annual income Range:
- $12,999 or less
- $13,000-19,999
- $20,000-29,999
- $30,000-39,999
- $40,000-49,999
- $50,000-59,999
- $60,000-69,999
- $70,000-79,999
- $80,000-89,999
- $90,000-99,999
- $100,000 +

SECTION I

Baecke Questionnaire of Habitual Physical Activity

1. What is your main Occupation? __________________________

2. At work I sit...
a. never                                           
b. seldom                                           
c. sometimes                                        
d. often                                           
e. always                                           

3. At work I stand...
a. never                                           
b. seldom                                           
c. sometimes                                        
d. often                                           
e. always                                           

4. At work I walk...
a. never                                           
b. seldom                                           
c. sometimes                                        
d. often                                           
e. always                                           

5. At work I lift heavy loads...
a. never                                           
b. seldom                                           
c. sometimes                                        
d. often                                           
e. always                                           

6. After work I am tired...
a. never                                           
b. seldom                                           
c. sometimes                                        
c. often                                           
e. always
7. At work I sweat...
   a. never          b. seldom          c. sometimes
   c. often          d. always

8. In comparison with others of my own age I think my work is physically...
   a. much lighter   b. lighter        c. as heavy
   d. heavier        e. much heavier

9. Do you play sport (organized, intramural, competitive, etc)?  yes / no
   If yes:
   - which sport do you play most frequently? ______________
   - how many hours a week? a. <1   b. 1-2   c. 3-4   d. 5-6   e. >6
   - how many months a year? a. <1   b. 1-3   c. 4-6   d. 7-9   e. >9
   If you play a second sport:
   - which sport is it? ______________
   - how many hours a week? a. <1   b. 1-2   c. 3-4   d. 5-6   e. >6
   - how many months a year? a. <1   b. 1-3   c. 4-6   d. 7-9   e. >9

10. In comparison with others my own age I think my physical activity during leisure time is...
    a. much less       b. less           c. the same
    d. more           e. much more

11. During leisure time I sweat...
    a. never          b. seldom         c. sometimes
    c. often          e. always

12. During leisure time I play sport...
    a. never          b. seldom         c. sometimes
    c. often          e. always

13. During leisure time I watch television...
    a. never          b. seldom         c. sometimes
    c. often          e. always

14. During leisure time I walk...
    a. never          b. seldom         c. sometimes
    c. often          e. always

15. During leisure time I cycle...
    a. never          b. seldom         c. sometimes
    c. often          e. always

16. How many minutes per day do you walk and/or cycle to and from work, school and shopping?
    a. <5            b. 5-15          c. 15-30
    d. 30-45         e. >45
SECTION II

Childhood and Adolescence Physical Activity Patterns Questionnaire

This questionnaire requests information about your physical activity habits during childhood and adolescence. The items in this questionnaire are grouped into two time periods: preteen years (ages 6 to 12) and high school and teen years (ages 13 to 18). You are asked to summarize your physical activity during each time period. If your physical activity habits changed during a time period, please report your typical habits during that period or think about what your average activity level was.

Research suggests that accurate recall of past events is best when important cues are provided. As you remember each time period think of such things as where you lived, the neighborhood, your family and friends, the schools you attended and the general environment. By visualizing the setting for that time period, your recall will be more accurate.

Thank you in advance for your cooperation in completing this instrument.

_________________________

PRETEEN YEARS (Ages 6 – 12)

Think about where you were and what you were doing when you were 6-12. What was your neighborhood, school, family, etc., like? **Please check appropriate responses**

1. **PE Classes during Preteen Years.**
   - Were they offered in your school? No_1 Yes_2
   - If yes, did you participate regularly? No_1 Yes, infrequently_2 Yes, regularly_3
   - If yes, did you enjoy them? No_1 Yes_2

2. **School or Organized Sports during Preteen Years.**
   - Were they offered in your community? No_1 Yes_2
   - If yes, did you participate? No_1 Yes, infrequently_2 Yes, regularly_3
   - If yes, how many months out of a year? Months/Year_1 to 12
   - If yes, how many days of the week? Days/Week_1 to 7
   - If yes, did you enjoy them? No_1 Yes_2

3. **Classes and Lessons related to physical activity (gymnastics, dance, ballet, tennis, etc.) during Preteen Years.**
   - Were they available and could your family afford them? No_1 Yes_2
   - If yes, did you participate? No_1 Yes, infrequently_2 Yes, regularly_3
   - If yes, how many months out of a year? Months/Year_1 to 12
   - If yes, how many days of the week? Days/Week_1 to 7
   - If yes, did you enjoy them? No_1 Yes_2

4. **Informal activities (backyard football, pick-up basketball, badminton, etc.) during Preteen Years.**
   - Were they available in your neighborhood? No_1 Yes_2
   - If yes, did you participate? No_1 Yes, infrequently_2 Yes, regularly_3
   - If yes, how many months out of a year? Months/Year_1 to 12
   - If yes, how many days of the week? Days/Week_1 to 7
   - If yes, did you enjoy them? No_1 Yes_2
5. During your Preteen Years, how many different games, physical activities, or sports did you participate in per year outside of PE classes (including organized & informal activities)?
   Zero 0  One 1  Two 2  Three 3  Four 4  Five 5  Six or more 6

6. During your Preteen Years, compared to others your age, you were:
   Much less active 1  Somewhat less active 2  About as active 3
   Somewhat more active 4  Much more active 5  Uncertain 6

7. During your Preteen Years, did you primarily participate in Team Sports (football, basketball, soccer, baseball, hockey) or Individual Sports (swimming, running, tennis, bowling, hiking, skiing, dancing, skating, weightlifting)?
   Primarily team sports 1  Primarily individual sports 2  Participated equally 3
   Both tam & individual 4  Did not participate 5

8. During your Preteen Years, was your favorite sport to participate in Team Sports (football, basketball, soccer, baseball, hockey) or Individual Sports (swimming, running, bowling, skiing)?
   Team sport 1  Individual sport 2  Did not have favorite 3  Did not participate 4

9. During your Preteen Years, your overall athletic ability or level of coordination was:
   1  2  3  4  5  6  7
   Limited  Average  One of the Best

10. During your Preteen Years, your athletic ability or level of coordination in your favorite sport or physical activity to participate in was:
   1  2  3  4  5  6  7  8
   Limited  Average  Best  Did not have a favorite sport

11. During your Preteen Years, how often were you forced to exercise, to be physically active, or play sports?
    Never 1  Rarely 2  Sometimes 3  Often 4  Very Often 5

12. During your Preteen Years, of the choices given, please choose the TWO primary reasons why you participated in sports, physical activities, or exercise. Rank in order of choice.
    To please my family, friends, teachers or coaches 1
    To socialize with family or friends 2
    To gain recognition 3
    To compete with others 4
    To achieve self-satisfaction/increase self-esteem 5
    To be accepted by my peers 6
    To have fun or to exercise 7
    Did not participate in sports 8

13. During your Preteen Years, how often did your family, friends, teachers or coaches encourage you to exercise, to be physically active or play sports?
    Never 1  Rarely 2  Sometimes 3  Often 4  Very Often 5
14. Please rate your attitude in general toward sports/physical activities during this time period.

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<td>Very Favorable</td>
<td>Neither Favorable or Unfavorable</td>
<td>Very Unfavorable</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

HIGH SCHOOL AND TEEN YEARS (Ages 13 – 18)

Think about where you were and what you were doing when you were 13-18. What was your neighborhood, school, family, etc., like? **Please check appropriate responses**

15. PE Classes during Teen Years.
   Were they offered in your school? No__1 Yes_2
   If yes, did you participate regularly? No__1 Yes, infrequently_2 Yes, regularly_3
   If yes, did you enjoy them? No__1 Yes_2

16. Non-School sponsored Organized Sports through recreational clubs or community agencies such as the YMCA or YWCA during your Teen Years.
   Were they offered in your community? No__1 Yes_2
   If yes, did you participate? No__1 Yes, infrequently_2 Yes, regularly_3
   If yes, how many months out of a year? Months/Year__(1 to 12)
   If yes, how many days of the week? Days/Week__(1 to 7)
   If yes, did you enjoy them? No__1 Yes_2

17. Classes and Lessons related to physical activity (gymnastics, dance, ballet, tennis, etc.,) during your Teen Years.
   Were they available and could your family afford them? No__1 Yes_2
   If yes, did you participate? No__1 Yes, infrequently_2 Yes, regularly_3
   If yes, how many months out of a year? Months/Year__(1 to 12)
   If yes, how many days of the week? Days/Week__(1 to 7)
   If yes, did you enjoy them? No__1 Yes_2

18. School sponsored Organized sports such as intramurals, sport clubs or school teams (including cheerleading) during your Teen Years.
   Were they offered? No__1 Yes_2
   If yes, did you participate? No__1 Yes, infrequently_2 Yes, regularly_3
   If yes, how many months out of a year? Months/Year__(1 to 12)
   If yes, how many days of the week? Days/Week__(1 to 7)
   If yes, did you enjoy them? No__1 Yes_2

19. Informal activities, such as backyard football, pick-up basketball games, badminton, etc., during your Teen Years.
   Were they offered? No__1 Yes_2
   If yes, did you participate? No__1 Yes, infrequently_2 Yes, regularly_3
   If yes, how many months out of a year? Months/Year__(1 to 12)
   If yes, how many days of the week? Days/Week__(1 to 7)
   If yes, did you enjoy them? No__1 Yes_2
20. During High School how many varsity athletic letters did you receive?
   0   1   2   3   4   5   6   7 or more

21. During your Teen Years, how many different games, physical activities, or sports did you participate in per year outside PE classes (including organized and informal activities)?
   Zero_0 One_1 Two_2 Three_3 Four_4 Five_5 Six or more_6

22. During your Teen Years, did you primarily participate in Team Sports (football, basketball, soccer, baseball, hockey) or Individual Sports (swimming, running, bowling, skiing)?
   Primarily team sports_1 Primarily individual sports_2 Participated equally_3 Both tam & individual_4 Did not participate_5

23. During your Teen Years, was your favorite sport to participate in a Team Sport (football, basketball, soccer, baseball, volleyball) or an Individual Sport (swimming, running, bowling, skiing)?
   Team sport_1 Individual sport_2 Did not have favorite_3 Did not participate_4

24. During your Teen Years, your overall athletic ability or level of coordination was:
   Limited 2 3 4 5 6 7

25. During your Teen Years, your athletic ability or level of coordination in your favorite sport to participate in was:
   Limited 2 3 4 5 6 7 8

26. During your Teen Years, how often were you forced to exercise, to be physically active, or play sports?
   Never_1 Rarely_2 Sometimes_3 Often_4 Very Often_5

27. During your Teen Years, of the choices given, please choose the TWO primary reasons why you participated in sports, physical activities, or exercise. Rank in order of choice.
   To please my family, friends, teachers or coaches_1 To socialize with family or friends_2
   To gain recognition_3 To compete with others_4
   To achieve self-satisfaction/increase self-esteem_5 To be accepted by my peers_6
   To have fun or to exercise_7 Did not participate in sports_8

28. During your Teen Years, how often did your family, friends, teachers or coaches encourage you to exercise, to be physically active or play sports?
   Never_1 Rarely_2 Sometimes_3 Often_4 Very Often_5

29. During your Teen Years, how often did you participate in your favorite sport during the off-season?
   Never_1 Rarely_2 Sometimes_3 Often_4 Very Often_5 No off-season for my favorite sport_6 I have no favorite sport_7
30. How many students were in your High School graduating class?
20 or less __1 21-50 __2 51-100 __3
101-300 __4 301-500 __5 501 or more __6

31. Please rate your attitude in general toward participation in sports/physical activities during this time period.
1 2 3 4 5 6 7
Very Favorable
Neither Favorable or
Unfavorable Unfavorable
APPENDIX D: Items Left Blank and Frequency
<table>
<thead>
<tr>
<th>Item left blank</th>
<th>Male &lt; 50 (n = 39)</th>
<th>Male 50+ (n = 52)</th>
<th>Female &lt; 50 (n = 76)</th>
<th>Female 50+ (n = 65)</th>
<th>TOTALS (n = 232)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q2 – BAECKE: School or organized sports (participated) [missing frequency] 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q3 – BAECKE: Classes/lessons related to physical activity (participated) [missing frequency] 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4 – BAECKE: Informal activities [missing whether participated and frequency if so] 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q16 – BAECKE: Non-school organized sports [missing whether participated and frequency if so] 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q16 – BAECKE: Non-school organized sports (participated) [missing frequency] 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q17 – BAECKE: Classes/lessons related to physical activity (participated) [missing frequency] 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q18 – BAECKE: School sponsored organized sports (participated) [missing frequency] 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q19 – BAECKE: Informal activities (participated) [missing frequency] 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q1 – BAECKE: What is your main occupation (open ended response)</td>
<td>11</td>
<td>16</td>
<td>21</td>
<td>17</td>
<td>65 (28%)</td>
</tr>
<tr>
<td>Q2 – BAECKE: At work I sit 3</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1 (&lt; 1%)</td>
</tr>
<tr>
<td>Q3 – BAECKE: At work I stand 3</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q4 – BAECKE: At work I walk 3</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>1 (&lt; 1%)</td>
</tr>
<tr>
<td>Q6 – BAECKE: After work I am tired</td>
<td>2</td>
<td>2</td>
<td></td>
<td></td>
<td>4 (2%)</td>
</tr>
<tr>
<td>Q7 – BAECKE: At work I sweat 4</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1 (&lt; 1%)</td>
</tr>
<tr>
<td>Q8 – BAECKE: In comparison with others my own age my work is physically 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q9 – BAECKE: Do you play sport? (Yes) [Missing sport played most (open ended response)]</td>
<td>1</td>
<td>1</td>
<td></td>
<td></td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Q9 – BAECKE: Do you play sport? (Yes – sport provided) [Missing frequency]</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4 (2%)</td>
</tr>
<tr>
<td>Q9 – BAECKE: If you play a second sport? (Yes) [Missing sport played (open ended response)]</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Q9 – BAECKE: If you play a second sport? (Yes – sport provided) [Missing frequency]</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td></td>
<td>5 (2%)</td>
</tr>
<tr>
<td>Q10 – BAECKE: In comparison with others my own age I think my P.A. during leisure time is 6</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td></td>
<td>5 (2%)</td>
</tr>
<tr>
<td>Q12 – BAECKE: During leisure time I play sport 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Q15 – BAECKE: During leisure time I cycle 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 (&lt; 1%)</td>
</tr>
<tr>
<td>Q16 – BAECKE: How many minutes per day do you walk and/or cycle to and from work, school, and shopping? 8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4 (2%)</td>
</tr>
<tr>
<td>TOTALS (number of items missed by gender/age grouping)</td>
<td>23</td>
<td>27</td>
<td>34</td>
<td>36</td>
<td>120</td>
</tr>
</tbody>
</table>

1 If an individual indicated they did participate but did not provide frequency of participation, they received the average item score of others who participated, within the respective gender/age group.
2 If an individual did not indicate whether they participated or not, they received the average item score for ALL participants within the respective gender/age category.
3 Item response options include: never, seldom, sometimes, often, always
4 Item response options include: very often, often, sometimes, seldom, never
5 Item response options include: much heavier, heavier, as heavy, lighter, much lighter
6 Item response options include: much more, more, the same, less, much less
7 Item response options include: never, seldom, sometimes, often, very often
8 Item response options include: 5, 5-15, 15-30, 30-45, >45
APPENDIX E: CAPAQ Items and Scoring
Items that follow were used for correlation and regression analysis:

PRETEEN YEARS (Ages 6 – 12)

1. PE Classes during Preteen Years.
   Were they offered in your school? No__1  Yes__2
   If yes, did you participate regularly? No__1  Yes, infrequently__2
   Yes, regularly__3

   If “No” score = 0
   If “Yes, infrequently” score = 2 days per week X half of school year (36 weeks) [72]
   If “Yes, frequently” score = 4 days per week X full school year (36 weeks) [144]
   \[ \text{Range} = 0-144 \]
   \text{Label: PE class}

2. School or Organized Sports during Preteen Years.
   Were they offered in your community? No__1  Yes__2
   If yes, did you participate? No__1  Yes, infrequently__2
   Yes, regularly__3

   If yes, how many months out of a year? Months/Year__(1 to 12)
   If yes, how many days of the week? Days/Week__(1 to 7)

   If “No” score = 0;
   If “Yes” score = Months X days X 4.34524*
   \[ \text{Range} = 0-365 \]
   \text{Label: School sports}

3. Classes and Lessons related to physical activity (gymnastics, dance, ballet, tennis, etc.)
during Preteen Years.
   Were they available and could your family afford them? No__1  Yes__2
   If yes, did you participate? No__1  Yes, infrequently__2
   Yes, regularly__3
   If yes, how many months out of a year? Months/Year__(1 to 12)
   If yes, how many days of the week? Days/Week__(1 to 7)

   If “No” score = 0;
   If “Yes” score = Months X days X 4.34524*
   \[ \text{Range} = 0-365 \]
   \text{Label: PA classes/lessons}
4. Informal activities (backyard football, pick-up basketball, badminton, etc.) during Preteen Years.
   Were they available in your neighborhood?          No_1  Yes_2
   If yes, did you participate?                      No_1  Yes, infrequently_2  Yes, regularly_3

   If “No” score = 0
   If “Yes, infrequently” score = 2 days per week X half calendar year (52 weeks) [104]
   If “Yes, frequently” score = 4 days per week X calendar year (52 weeks) [208]
   \[ Range = 0-208 \]
   \[ Label: \text{Informal activities} \]

HIGH SCHOOL AND TEEN YEARS (Ages 13 – 18)

15. PE classes during teen years.
   Were they offered in your school?                No_1  Yes_2
   If yes, did you participate regularly?         No_1  Yes, infrequently_2  Yes, regularly_3

   If “No” score = 0
   If “Yes, infrequently” score = 2 days per week X half of school year (36 weeks) [72]
   If “Yes, frequently” score = 4 days per week X full school year (36 weeks) [144]
   \[ Range = 0-144 \]
   \[ Label: \text{PE class} \]

16. Non-school sponsored organized sports through recreational clubs or community agencies such as the YMCA or YWCA during your teen years.
   Were they offered in your community?            No_1  Yes_2
   If yes, did you participate?                    No_1  Yes, infrequently_2  Yes, regularly_3
   If yes, how many months out of a year?         Months/Year__ (1 to 12)
   If yes, how many days of the week?             Days/Week__ (1 to 7)

   If “No” score = 0;
   If “Yes” score = Months X days X 4.34524*
   \[ Range = 0-365 \]
   \[ Label: \text{Non-school sports} \]
17. Classes and lessons related to physical activity (gymnastics, dance, ballet, tennis, etc.) during your teen years.
   Were they available and could your family afford them?   No__1  Yes__2
   If yes, did you participate?   No__1  Yes, infrequently__2  Yes, regularly__3
   If yes, how many months out of a year?  Months/Year__(1 to 12)
   If yes, how many days of the week?  Days/Week__(1 to 7)

   If “No” score = 0;
   If “Yes” score = Months X days X 4.34524*
   Range = 0-365
   Label: PA classes/lessons

18. School sponsored organized sports such as intramurals, sport clubs or school teams (including cheerleading) during your teen years.
   Were they offered?   No__1  Yes__2
   If yes, did you participate?   No__1  Yes, infrequently__2
                                 Yes, regularly__3
   If yes, how many months out of a year?  Months/Year__(1 to 12)
   If yes, how many days of the week?  Days/Week__(1 to 7)

   If “No” score = 0;
   If “Yes” score = Months X days X 4.34524*
   Range = 0-365
   Label: School sports

19. Informal activities, such as backyard football, pick-up basketball games, badminton, etc., during your teen years.
   Were they offered?   No__1  Yes__2
   If yes, did you participate?   No__1  Yes, infrequently__2
                                 Yes, regularly__3
   If yes, how many months out of a year?  Months/Year__(1 to 12)
   If yes, how many days of the week?  Days/Week__(1 to 7)

   If “No” score = 0;
   If “Yes” score = Months X days X 4.34524*
   Range = 0-365
   Label: Informal activities
The following additional questions from the CAPAQ were used for regression analysis only:

**PRETEEN YEARS (Ages 6 – 12)**

5. During your preteen years, how many different games, physical activities, or sports did you participate in per year outside of PE classes (including organized & informal activities)?

   Zero_0 One_1 Two_2 Three_3 Four_4 Five_5 Six or more_6

   *Range = 0-6*
   *Label: Non-PE PA*

6. During your preteen years, compared to others your age, you were:

   Much less active_1 Somewhat less active_2 About as active_3
   Somewhat more active_4 Much more active_5 Uncertain_3

   *Range = 1-5 (for those who indicated “uncertain” (n = 2) a median score of 3 was assigned)*
   *Label: Activity level*

9. During your preteen years, your overall athletic ability or level of coordination was:

   1 2 3 4 5 6 7
   Limited Average One of the Best

   *Range = 1-7*
   *Label: Athletic ability*

11. During your preteen years, how often were you forced to exercise, to be physically active, or play sports?

   Never_1 Rarely_2 Sometimes_3 Often_4 Very Often_5

   *Range = 1-5*
   *Label: Forced exercise*

13. During your preteen years, how often did your family, friends, teachers or coaches encourage you to exercise, to be physically active or play sports?

   Never_1 Rarely_2 Sometimes_3 Often_4 Very Often_5

   *Range = 1-5*
   *Label: Encouragement for PA*
20. During high school how many varsity athletic letters did you receive?

   0_0  1_1  2_2  3_3  4_4  5_5  6_6  7 or more_7

   Range = 0-7
   Label: Varsity letters won

21. During your teen years, how many different games, physical activities, or sports did you participate in per year outside PE classes (including organized and informal activities)?

   Zero__0  One__1  Two__2  Three__3  Four__4  Five__5  Six or more__6

   Range = 0-6
   Label: Non-PE PA

24. During your teen years, your overall athletic ability or level of coordination was:

   1  2  3  4  5  6  7
   Limited  Average  One of the Best

   Range = 1-7
   Label: Athletic ability

26. During your teen years, how often were you forced to exercise, to be physically active, or play sports?

   Never_1  Rarely_2  Sometimes_3  Often_4  Very Often_5

   Range = 1-5
   Label: Forced exercise

28. During your teen years, how often did your family, friends, teachers or coaches encourage you to exercise, to be physically active or play sports?

   Never_1  Rarely_2  Sometimes_3  Often_4  Very Often_5

   Range = 1-5
   Label: Encouragement for PA

30. How many students were in your High School graduating class?

   20 or less__1  21-50_2  51-100_3  101-300_4  301-500_5  501 or more_6

   Range = 1-6
   Label: Number of students
*Multiplying ([months x days] x 4.34524), results in the associated days of a calendar year represented by the number of months and days entered into the equation.

Example: A person participates in an activity 7 days a week for 6 months out of the year.

This represents half of a calendar year, or 182.5 days.
To reach this figure, first multiply 6 (months) x 7 (days) = 42.
Then multiply 42 by 4.34524 to find the actual number of days out of a calendar year.