PHYSICAL ACTIVITY PATTERNS FROM ADOLESCENCE TO YOUNG ADULTHOOD AND PARENTAL SUPPORT FOR PHYSICAL ACTIVITY IN CHILDREN

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Purpose: The purpose of this study was to examine the association between parental patterns of physical activity (PA) from adolescence to young adulthood and parental beliefs for child PA.

Methods: Of 231 eligible participants, 108 completed a questionnaire (72% female, 27% minority, 29.5 ± 1.2 years) assessing their importance and encouragement beliefs for child PA. Importance and encouragement belief scores were summed to yield two scores, each from 7-35. PA was measured using the same questionnaire during adolescence and young adulthood to yield a summary score in hours per week of PA. Spearman correlations, univariate, and multivariate analyses were used to examine beliefs across categories of PA.

Results: Spearman correlations revealed weak, positive associations between beliefs and PA for both genders. After adjusting for appropriate covariates, moderate levels of adolescent PA were positively associated with encouragement beliefs in males ($p=0.02$), and moderate levels of young adult PA was positively associated with encouragement beliefs in females ($p=0.04$). Multivariate analyses also showed that females with persistently moderate levels of PA from adolescence to young adulthood had higher encouragement beliefs than females with persistently low levels of PA ($p=0.04$). No significant differences were found for importance beliefs.

Conclusions: Overall, moderate levels of PA appear to be positively associated with encouragement for child PA. The association was moderated by parent gender and PA behavior. These results add an important element to previous research that has examined the link between parental encouragement and child PA, and may be useful for interventions that focus on improving parental encouragement for child PA.

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PREFACE

I am very grateful for the guidance provided from my dissertation advisor, Dr. Deborah J. Aaron. Even though her health was not the best, she made my dissertation a priority, and in doing so has inspired me to continue my research efforts with the same dedication and tenacity she has shown. I am also in a debt of gratitude to Dr. Jere D. Gallagher for her encouragement, valuable editorial reviews, and for serving as my co-advisor when Dr. Aaron was unable. I am thankful for Dr. Vincent C. Arena's statistical help with the methods of this research, and for Dr. Robert J. Robertson and Dr. Mary E. Duquin's continued support and reviews during overview.

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The unwavering and often sublime support that my spouse, Stephanie Hull, provided will forever remind me that love knows no bounds. It is to all of you that I dedicate this research, because it is with your help that this was possible.

1.0 INTRODUCTION

This study will examine the association between parental patterns of activity from adolescence to young adulthood and parental beliefs for physical activity (PA) in their children. The following sections comprise this chapter: (1) Rationale (2) Purpose (3) Significance (4) Specific Aims (5) Research Hypotheses.

1.1 RATIONALE

Research shows that increased levels of PA protect against chronic disease [181] and produce better physical and psychological health outcomes [181]. Although the benefits of PA for adults are well known, they are less clearly documented for children [13, 23, 170]. Unfortunately, children now suffer from many of the same diseases that adults do, such as obesity, heart disease, type II diabetes, sleep apnea, high blood pressure, fatty liver disease, and orthopedic problems [144, 171]. The incidence of these preventable diseases result form sedentary lifestyles coupled with unhealthy diets [180]. The U.S. Department of Health and Human Services [42, 180] has documented that child PA appears to improve musculoskeletal, cardiovascular, and mental health by increasing muscular strength and bone mineral density, improving fitness, lowering blood pressure and stress, and reducing depression. Despite these benefits, not enough children participate in PA. National surveys have reported that 44% to 64% of

children do not meet "recommended" PA levels [37, 38, 42, 43, 124, 181]. These low levels of child PA are not just a current concern, but could become a long-term health issue.

Parental beliefs and parental support play a major role in child PA [19, 32, 88, 92, 100, 102, 155, 157]. Numerous studies indicate that children whose parents have high belief and support levels for PA are more active than children with parents with low belief and support levels [11, 20, 24, 32, 56, 76, 163, 193]. Even though it appears that child PA is a function of parental beliefs and support, no research has been located that examines the correlates of adult beliefs and support for PA. Thus, the driving influence behind parental PA beliefs and support remains unknown [100, 176]. Theories [7, 14], studies [105, 160], and a model [71] have linked beliefs formed from prior experiences with those beliefs that drive behaviors. It is likely that parental PA experiences are a driving factor for parental beliefs for child PA. The focus of this study is to examine whether a parent's activity level in adolescence and young adulthood is associated with parental beliefs for child PA.

1.2 PURPOSE

This study will examine the association between parental patterns of activity from adolescence to young adulthood and parental beliefs for PA in their children.

1.3 SIGNIFICANCE

The empirical results obtained from this study will provide a better understanding of how parental patterns of PA influence parental beliefs for child PA. This information will add

to the literature, which has not examined this association, and may help explain why some studies have not found an association between parental PA and child PA. This research may help create more effective interventions and strategies toward increasing parental beliefs for child PA. For example, if the results show an association between current levels of PA and beliefs for PA, interventions may want to try to increase current PA of parents. If, however, parental beliefs are higher in parents who were more active in their youth, interventionists may want to retrospectively assess parent's adolescent PA behaviors. By increasing the efficacy of interventions focusing on parental beliefs, this study may help promote PA in future generations.

1.4 SPECIFIC AIMS

The specific aims of this study are:

1. To examine the association between adolescent PA and importance beliefs, adolescent PA and encouragement beliefs, young adult PA and importance beliefs and young adult PA and encouragement beliefs.
2. To examine importance and encouragement beliefs across tertiles of adolescent and young adult PA.
3. To examine importance and encouragement beliefs across categories of PA rank change from adolescence to young adulthood.
4. To examine importance and encouragement beliefs across patterns of PA from adolescence to young adulthood.

1.5 RESEARCH HYPOTHESES

The research hypotheses of this study are:

1. A positive association exists between adolescent and young adult PA and parental beliefs.
2. Subjects with higher levels of adolescent and young adult PA will have higher levels of beliefs as compared with subjects who have lower levels of PA.
3. Subjects who increased PA rank from adolescence to young adulthood will have higher belief levels compared to subjects who decreased PA rank levels.
4. Subjects who had persistently high levels of PA in adolescence and young adulthood will have higher belief levels as compared to subjects who had persistently low levels of PA in adolescence and young adulthood.

2.0 REVIEW OF RELATED LITERATURE

This study will examine the association between parental patterns of activity from adolescence to young adulthood and parental beliefs for PA in their children. This chapter, which reviews the literature on the importance of child PA, correlates of child PA, and parental beliefs and support for child PA is organized as follows: (1) Current Statistics and Trends in Child PA (2) Benefits of PA in Children (3) Correlates of Child PA (4) Parental Beliefs and Support for Child PA (5) Supporting Model and Theory. Literature tables accompany each section, but in an attempt to avoid excessive redundancy, not all studies will be shown in the tables.

For the purposes of clarity and accuracy, this paper defines physical activity (PA), exercise, and fitness according to Caspersen et al. [35]. Physical activity is considered "any bodily movement produced by skeletal muscles that result in energy expenditure [35]." Exercise refers to a subset of physical activity that is planned, structured, and repetitive in order to improve or maintain one's physical fitness [35]. Physical fitness embodies either (1) cardio respiratory endurance, muscular strength and endurance, flexibility, and body composition or (2) skilled fitness, which includes balance, agility, power, reaction time, speed, and coordination [35]. Of these three terms, physical activity emerges as the primary topic for this investigation.

2.1 CURRENT STATISTICS AND TRENDS IN CHILD PA

Recommendations and concerns about PA in children are not new [179]. Since the early 1990's, the US Department of Health and Human Services publicly recommended regular weekly bouts of moderate to vigorous PA [179]. The National Association for Sport and Physical Education (NASPE) [44] urges children to accumulate 30 to 60 minutes of age-appropriate PA from a variety of activities on most if not all days of the week. *Healthy People 2010* [178] advocates that adolescents engage in vigorous PA for 20 minutes three times per week. The *Dietary Guidelines for Americans* [182] , which forms the basis of all federal nutrition education and promotion activities, suggests 60 minutes of daily PA for children and adolescents, while the Centers for Disease Control and Prevention (CDC) [41] recommends children engaging in vigorous activities that last at least 20 minutes. The *International Consensus Conference on Physical Activity Guidelines for Adolescents* suggests three or more sessions per week of moderate to vigorous activities that last at least 20 minutes [152]. All of these recommendations share similarities; when combined they suggest that child PA should occur daily for 60 minutes, with the child vigorously active for 20 of those 60 minutes.

After measuring national child PA levels for over 10 years, the data shows that 44%-64% of children do not meet the recommended levels of PA. The National Health Interview Survey (NHIS) in 1996 reported that 13.7% of children were completely inactive, while 53.7% of children fall beneath the optimum level of vigorous activity [181]. More current findings from the Youth Risk Behavior Surveillance Study (YRBSS) conducted by the CDC in 2002 show that 64% of children in grades 9-12 do not meet the recommended levels of 60 minutes of PA per day, while 44% do not reach the suggested levels of vigorous PA [43]. When the YRBSS was conducted in 2005, the percentage of

children not meeting the 60 minutes per day recommendation was again 64%, but those not meeting the recommended of vigorous PA dropped to 31% [42]. Additionally, the Youth Media Campaign in 2002 [39] assessed PA levels of children aged 9–13 years, noting that 61.5% of children do not participate in any organized PA after school and that 22.6% do not engage in any PA at all.

In sum, these national surveys collectively report that nearly two-thirds of all children (64%) do not meet the recommendations for overall PA, almost half (~43%) do not meet recommended levels of vigorous PA, and about one-sixth (~16%) are completely inactive [43, 181]. As adult research implies, a sedentary lifestyle is a leading risk factor for overweight, obesity, and many other preventable diseases [118, 180, 181]. From the late 1990's to 2004, adult obesity has increased from 15% to nearly 33% [40], but even more alarming is the increase in children who are overweight, which rose from 4% in the early 1970's to 19% in 2004 [41]. Although PA tracking is known to be especially poor from adolescence into young adulthood [34, 167, 168], the tracking of overweight is very good from childhood to adolescence [94] and from childhood to adulthood [54, 72]. Thus, children who are currently unhealthy due to their overweight condition are likely to be unhealthy, overweight adults.

Unlike the long term health consequences of obesity and inactivity in childhood, the short term health benefits of PA in children are better documented [38]. The US Department of Health and Human Services has reported that PA has beneficial effects on mental, musculoskeletal, and cardiovascular health in children [38]. This next section reviews these PA benefits, and further categorizes mental health into stress, depression and self-concept; musculoskeletal health into bone health, muscular strength, and

muscular endurance; and cardiovascular health into blood pressure and blood lipid profiles.

2.1.1 Mental Health

Hundreds of studies and dozens of reviews and meta-analyses have examined the association between PA and mental health [70]. Unfortunately, the vast majority have focused on adults, not children [164]. Table 1 presents studies that examined the relation between PA, stress, depression, and self-esteem in children. Overall, the analyses concur that a positive association exists between PA and mental health in children.

The cross-sectional studies have shown that adolescents who are physically active [30], play sports [162] or participate in vigorous activities [162] report lower levels of stress as compared with less active youth. More active youth also tend to have higher levels of self-esteem than their less active counterparts [132]. Longitudinal studies, which link increased PA levels with greater self-perception and fewer depressive symptoms [123], further support these results [48].

The experimental studies in Table 1 tend to agree with the results from the above observational studies. Norris et al.[126], by employing a ten-week exercise intervention, found that overall levels of stress decreased in adolescent exercisers as compared with controls. Furthermore, two six-week aerobic exercise interventions significantly lowered depression in children [47] and adolescents [104]. These analyses have not only reported that PA is effective in reducing stress and depression, but that it also improves self-perceptions and self-esteem in children [47] and adolescents [104, 110]. However, an analysis by Walters et al. [185] found that a thirteen week exercise intervention did not significantly

improve self-esteem in children in grades 3-5. Because this particular cohort of children already had relatively high self-esteem levels, it left little room for esteem improvement following exercise and may have decreased the chances for finding an association between PA and self-image [185].

Not only is the connection between PA and mental health less observable than other physiological markers, such as muscular strength or muscular endurance, but fewer studies examine this relation in children. An extensive review by Strong et al. [164] stated that due to the paucity of prospective studies a link between PA and mental health cannot be made in children. However, there appears to be enough experimental-based research to support a causal relation in adults [78]. In fact, because PA has shown comparable results to conventional psychotherapy treatments [140], it is even prescribed in the treatment of clinical depression in adults [70, 131] and youth [104].

Despite the minimal research examining the PA-mental health association in children, the few studies that have explored this association appear to show a positive correlation between PA and mental health and that PA may predict lower depression and stress while improving self-esteem. Before definitive conclusions can be made, however, more research will need to explore PA and mental health in children.

Table 1: Physical activity and mental health

Author and Date	Subjects	Methods	Results
Steptoe et al. 1996 [162]	n=5061, 44% male, 16 yrs	Cross-sectional. PA questionnaire, General Health Questionnaire (GHQ) and Malaise inventory	Sport and vigorous activities were positively related with emotional well-being independent of sex, SES, and health
Brown et al. 1986 [30]	n=220 females, 15-18 yrs	Cross-sectional. Report of stressful events, physical and mental well-being, and PA	Females reporting higher levels of stress and exercised less frequently than those reporting lower levels of stress
Parfitt et al. 2005[132]	n=70, 50% male, 10yrs	Cross-sectional. 1 wk PA pedometer diaries, questionnaires	Habitual PA was positively associated with self-esteem. Partial correlations removed sig. for depression and anxiety
Motl et al. 2004[123]	n=4594, 51% male, 12.7 yrs	2 yr. longitudinal. PA questionnaire and depression scale completed 3 times in the 2 year period	After controlling for sex, SES, smoking, alcohol, perceived health, appearance, and achievement, changes in PA were neg. correlated with changes in depressive symptoms
Crocker et al. 2003[48]	n=631 females, 15-16yrs	1 year longitudinal. PA and self-perceptions questionnaires	Change in PA was positively associated with change in self- perceptions
Walters et al. 2000[185]	n=67 Children, gender not specified, grades 3-5	13 wk intervention. self-perception profile for children (SPPC) and Behavior Rating Index (completed by parents)	PA did not significantly improve any of the SPPC scores as compared to controls. Self-esteem was already high in this group of children
Norris et al. 1992 [126]	n=147, 48% male, 14yrs	10 wk intervention. PA, stress, depression and anxiety, life events, and illness questionnaires	High intensity group had significantly less stress than subjects in other three groups (moderate intensity, flexibility, controls)
Crews et al. 2004 [47]	n=66, 50% male, 10 yrs , Low SES, 100% Hispanic	6 wk intervention. Trait Anxiety Inventory, Beck Depression and Rosenberg Self-esteem	Children in aerobic groups reported significantly less depression and greater self-esteem than controls. No differences were found on trait anxiety
Koniak-Griffin et al. 1994 [104]	n=58 pregnant females, 14-20yrs	6 wk intervention. Pre- and post-questionnaires	Depression decreased and self-esteem increased in experimental group after the program

2.1.2 Musculoskeletal Health

This section focuses on bone health, muscular strength, and muscular endurance. The importance of bone health cannot be understated in children and youth. Researchers agree that peak bone mass is obtained at approximately thirty years of age, after which

peak bone mass does not increase [36]. The higher the peak bone mass at thirty, the higher it will be in later life, thereby reducing the risk of developing osteopenia and osteoporosis [36]. By obtaining a high peak bone mass when young, children may offset disease risk later in life.

Table 2 presents studies that examined the relation between PA and bone mineral density (BMD) or bone mineral content (BMC). For the purposes of brevity, not all studies are detailed in the literature tables. Overall, the research appears to agree that children with higher levels of PA have greater bone mineral density (BMD) [26, 28, 74, 87, 109, 114, 121, 166, 183, 189]. Additionally, all four longitudinal studies in Table 2 either show significantly greater BMD or BMC in more active children [83, 166, 188] or a positive trend [119]. The study that produced a trend [119] may have reduced the likelihood of finding significance because activities were not categorized as weight bearing or non-weight bearing. When exercises are differentiated as weight or non-weight bearing, results appear to indicate a significant positive association between PA and BMD [83].

Furthermore, exercise interventions that incorporate weight bearing activities such as running, jumping, or weight lifting either show significant increases in BMC and BMD over controls [28, 74, 87, 109, 114, 121, 183] or infer a positive trend [27, 119, 189]. A one year intervention by Valdimarsson et al. [183] reported that PA markedly increased BMD over controls. A seven month [74] and two eight month interventions [28, 114] yielded similar BMD and BMC increases. Thus it appears that preadolescent children can improve BMD and BMC with weight bearing activities that involve running, jumping, and resistance training.

Table 2: Physical activity and bone health

Author and Date	Subjects	Methods	Results
Welten et al. 1994 [188]	n=182, 46% male, 13 to 27 yrs	15 yr longitudinal. 6 anthropometric measurements were taken, along with weight bearing activity and calcium intake by interview	Weight bearing activities and body weight were the only significant predictors of BMD at 27yrs. The strongest predictors in males was WBA and body weight in females.
Gunnes et al. 1996 [83]	n=470, 50% male, 8-16yrs	8 yr longitudinal. BMD assessed through single photon absorptiometry. Weight-bearing PA via questionnaire.	Weight-bearing PA predicted cortical as well as trabecular BMD.
Sundberg et al. 2002[166]	n=86, 51% male, 9-16yrs	3yr longitudinal. Bone mass and bone size were evaluated longitudinally by dual-energy X-ray absorptiometry	Girls and boys (aged 9-13yrs) with higher levels of PA had higher Femoral Neck BMD and higher volumetric BMD than girls and boys with low PA
Molgaard et al. 2001[119]	n=332, 42% male, 5-19yrs	1 yr longitudinal. BA and BMC were examined by dual-energy X-ray absorptiometry at baseline and 1 year later.	BMC was borderline associated with average physical activity level in boys ($p = 0.07$) but not in girls ($p = 0.7$).
Valdimarsson et al. 2006[183]	n=53 females, 7-9yrs	1yr intervention. The intervention increased PE time from the controls level of 60 min/wk to 200 min/wk. Activities were not designed to be osteogenic.	Girls significantly increased BMC by 5% in lumbar spine and 9.5% in L3 when compared to controls . Areal BMD was also sig. higher in experimental group.
Witzke et al. 2000 [189]	n=71 females, 14-15yrs	9 mo exercise intervention. Program was 30-45 min 3x/wk consisting of squats, lunges, calf raises, and plyometrics (hopping, jumping, bounding)	Even though differences were not significant, a trend was noticed. Exercisers had higher levels of BMC than controls for all measured areas.
McKay et al. 2000 [114]	n=194, 62% male, 7-10yrs	8 mo exercise intervention. Program included 10 tuck jumps 3x/wk and incorporated jumping, hopping, and skipping into PE class.	Exercise group showed significantly greater change in femoral trochanteric aBMD ($p<.05$). No differences were found at other sites, such as the lumbar spine and femoral neck.
Bradney et al. 1998 [28]	n=20 males, 8-12yrs	8 mo exercise intervention. Program was 30 min 3x /wk of weight bearing activities: basketball, weight training, aerobics, soccer, volleyball, gymnastics	The increase in areal BMD in the exercise group was twice that in the controls. Femoral midshaft cortical thickness and volumetric BMD increased when compared to controls
Fuchs et al. 2001 [74]	n=45, 55% male, 6-10 yrs	7mo exercise intervention. Program was 3x/wk, 100 two footed jumps off 61cm boxes.	Jumpers had significantly higher BMC in the femoral neck and lumbar spine and higher BMD in the lumbar spine and as compared with controls

Table 3 presents studies that examined the relation between PA and muscular strength and muscular endurance. A considerable amount of literature regarding the

effects of training on muscular strength in children exists; the results appear to indicate that children can gain muscular strength and endurance in a safe manner.

Children who perform resistance training at least twice a week have greater muscular strength and endurance as compared to children who do not train [26, 67, 69, 84, 136, 141]. However, researchers question the benefit of training more than twice per week. A study by Stahle et al. [161] found no significant strength differences between children who trained twice a week and those who trained three times per week. Both groups were significantly stronger than controls. Furthermore, muscular strength and endurance gains appear to be greater in children when training focuses on higher repetition rather than lower repetition exercises [69].

Even though resistance training improves muscular strength and endurance, concerns exist about the practicality of using resistance training with children due to the increased risk of injury [67]. The National Electronic Injury Surveillance System (NEISS) reports that approximately 1000 children between the ages of 2 and 12 are annually hospitalized for injuries relating to weight lifting or exercising [124]. Unfortunately, by not separating injuries that may be due to lack of supervision from those due to overuse [124], the NEISS research does not distinguish probable cause of injury.

Even if some injuries do occur, the professional positions of the American College of Sports Medicine [66], the American Academy of Pediatrics [8], the American Orthopedic Society for Sports Medicine [9], and the National Strength and Conditioning Association [65] support youth strength training as a safe, beneficial activity when professionally supervised. Moreover, two reviews [67, 84] and a meta-analysis [136] conclude that children can safely increase muscular strength and muscular endurance through resistance training, as long as a professional is present. Not only does resistance training

increase muscular strength and endurance in children, but it also has the approval of established medical and sports training organizations.

Table 3: Physical activity and muscular strength and endurance

Author and Date	Subjects	Methods	Results
Faigenbaum et al. 2003[68]	n=96, 66% male, 6-12 yrs	Cross Sectional. 1 rep max testing on 1 upper and 1 lower body exercise observed by professionals	No injuries occurred post testing and testing protocol was well tolerated. No gender differences existed for the tests
Stahle et al. 1995[161]	n=55 males, 7-16 yrs	9 mo program occurred 2-3x/wk. Reps went to exhaustion at 75% of max	Significant strength increases in subjects who trained 2-3x/wk as compared to controls. No between group differences
Ramsay et al. 1990 [141]	n=13 males, 9-11 yrs	20 wk resistance program, 3x/wk. Cross-sectional and motor unit activation were measured	Strength gains appeared to be independent of muscle size, but were dependent upon neurological adaptations such as motor unit activation
Faigenbaum et al. 1999[69]	n=43, 74% male, 5-12 yrs	8 wk program, 2x/wk. Exercise lasted 40 minutes. Low rep = 6-8 repetitions; High rep =13-15 repetitions	Leg strength and endurance significantly increased in exercisers verse controls. The higher rep program produced greater strength and endurance gains than the low rep program
Ozmun et al. 1994 [130]	n=32, 50% male, 9-12yrs	8 wk resistance program, 3x/wk .Weights were lifted for 3 sets between 7-10 reps/set	Significant strength gains were made as compared with controls. Strength gains appeared to be a result of greater neuromuscular activation

2.1.3 Cardiovascular Health

This section reviews literature which examines the relation between PA and cardiovascular health such as blood pressure and blood lipid profiles. Table 4 presents studies that explored the association between PA and cardiovascular health in children. A review by Thomas et al. [170] reported that decisive conclusions cannot be made with the current lack of cardiovascular research in children. While there may not be enough research to draw out definitive associations, a few studies (Table 4) not only indicate a positive association between PA and cardiovascular health, but also suggest that PA appears to improve cardiovascular health in children.

Table 4: Physical activity and cardiovascular health

Author and Date	Subjects	Methods	Results
Schack-Nielsen et al. 2005[158]	n=93, 47% male, 10 yrs	Cross-sectional. PA measured by 24 hr recall, arterial stiffness by infrared transduction	Arterial stiffness was inversely associated with PA
Kavey et al. 1997[95]	n=42 males, 10-18 yrs	Cross-sectional. BP was measured before, during, and after a Bruce treadmill exercise test	Children with increased LDL cholesterol had an exaggerated blood pressure response before, during, and after exercise when compared with normolipidemic control subjects
Craig et al. 1996[46]	n=49 females, 8-11-yrs	Cross-sectional. Daily energy expenditure, resting metabolic rate, cholesterol levels, and PA recall	Children with higher total PA and PA >4 METS had significantly lower LDL-C and apolipoprotien B concentration
Gidding et al. 2005[77]	n=663, 55% male, 7-11yrs	3yr longitudinal. PA interview-questionnaire, BP, and LDL measured at 0, 1 and 3 yrs	For every 100 MET hrs of PA there was a decrease of 1.15 mm Hg of SBP and a decrease of 1.28 mg/dL of LDL levels
Ewart et al. 1998[64]	n=99 females, 15 yrs	4 mo aerobic intervention. BP pre and post	The aerobic exercise group had a greater decrease in systolic blood pressure than the standard physical education group
Danforth et al. 1990 [49]	n=11 children, 8-12 yrs	4 mo aerobic intervention. BP pre and post	SBP and DBP were significantly lower after the exercise program

The cross-sectional studies reported a positive association between cardiovascular health markers and PA. One marker of cardiovascular health is arterial stiffness (AS) or arterial compliance. Adults with elevated levels of AS also have high SBP and lipid values, putting them at greater risk for more advanced stages of atherosclerosis [57, 107]. Whether a similar relation exists in children is unclear, but the little research that has been done has shown that children with high levels of blood cholesterol also have greater arterial stiffness [107]. Further, Schack-Nielsen et al.[158] reported a negative association between PA and AS. More research is needed to corroborate these findings.

PA also appears to have a favorable impact on lipid profiles. This effect becomes more significant as the intensity level of the activity increases [46]. In fact, as reported by Kavey et al. [95], lipid levels or cholesterol may interact with blood pressure during

exercise. These researchers found that children with elevated low-density-lipoproteins (LDL) levels had exaggerated blood pressure responses to exercise as compared to children with low LDL levels. Interestingly, a three year prospective study, which examined the influence of PA on LDL and blood pressure, reported that children who increased their PA over the three year period lowered both their LDL levels and their blood pressure [77].

Aerobic exercise interventions also yielded similar results. Two interventions of adolescents [64] and pre-adolescents [49] indicated that four months of aerobic exercise significantly lowers systolic blood pressure [49, 64] and diastolic blood pressure [49] in children as compared with controls.

Although there may not be enough research to make definitive statements, the present research correlates PA with numerous beneficial effects on cardiovascular health in children. Specifically, PA appears to lower blood pressure, decrease blood lipid values, and possibly lower arterial stiffness.

2.1.4 Summary of PA and Health

Besides the musculoskeletal research, the data linking child PA with health is sparse. Although convincing evidence indicates PA increases both muscular and skeletal health in children, there is a need for more research to confirm the few studies which have shown a positive association between PA and mental and cardiovascular health. These few longitudinal and experimental studies suggest that PA increases self-esteem, decreases stress and decreases depression in children. They have also shown that PA decreases blood pressure and improves lipid profiles in children.

Unfortunately, national surveys reveal that 44%-64% of children do not meet the recommendations for PA. With half of all children not receiving the health benefits of PA, their current and future health status may be less than optimal. This next section explores the factors associated with child activity level.

2.2 CORRELATES OF PHYSICAL ACTIVITY IN CHILDREN

Extensive reviews of child PA by Heitzler et al. [88], Sallis et al. [156, 157] and Olaughlin et al. [127] have focused on the following correlates (1) Demographic (2) Psychological and Emotional (3) Environmental and (4) Sociological. The following section examines each of these correlates as they relate to child PA.

2.2.1 Demographic Correlates

This section explores the association between gender and SES and PA. Tables 5 and 6 present those studies that examined demographics. The vast majority of studies reveal PA differences across gender and SES. Of the studies that examined gender, all show that boys are significantly more active than girls [75, 76, 101, 115, 135, 137, 174]. A review of nine studies reported that boys average about 15-25% more activity per year than similarly aged females [147]. The higher PA levels of boys may be a result of the greater support parents provide [176]; also, boys have a slight speed, strength, and motor skill advantage during childhood and adolescence than girls [169]. These components translate into higher male fitness levels which may keep boys physically active longer than girls during the teenage years [147]. A cross-sectional study by Aaron et al. [2] indicated that not only are

boys more active than girls, but boys are also 2.1 times as likely to participate in vigorous activities and 2.6 times as likely to participate in competitive sports than girls [2]. Two other longitudinal studies reported similar findings [76, 115], verifying that multiple factors result in boys being more active than girls.

Table 5: Demographic correlates

Author and Date	Subjects	Methods	Results
Aaron et al.1993 [2]	n=1175, 52% male, 12-16yrs	Cross-sectional. PA questionnaire administered twice, one year apart	Males were significantly more active and more vigorously active; they also participated in more competitive sports than females
Pate et al. 1997[135]	n=361, 49% male, 11yrs	Cross-sectional. Questionnaire to measure beliefs about PA	Boys were more active than girls
Trost et al. 1996[174]	n=334 children, 11yrs	Cross-sectional. Child reported after-school PA	Boys had greater self-efficacy in being active, greater TV watching, and higher levels of sports than girls
Garcia et al. 1995 [75]	n=286, 48% male, 10-14yrs	Cross-sectional. Measured health and behavioral variables	Compared to males, females reported less prior and current exercise, lower self-esteem, poorer health status, and lower exercise self-schema
Poest et al. 1989[137]	n=514, 52% male, <6yrs	Cross-sectional. Questionnaires on child and parental PA	Boys are more physically active than girls. Preschool children are not engaged in enough vigorous PA year round
Klesges et al. 1986 [101]	n=30, 50% male, 2-4 yrs	Cross-sectional. Observation of child PA for 1 hour along with parental influences	Boys were significantly more active than girls
McKenzie et al. 1997[115]	n=287, 56% male, 4-6yrs	2yr longitudinal. Observation of teacher and peer prompts to be physically active during recess	Girls complied better to the prompts than boys, but boys tended to be more active than girls
Garcia et al. 1998 [76]	N=132, 42% male, 30% nonwhite, 11-14yrs	~1yr longitudinal. Questionnaire and PA activity log measured PA beliefs and behaviors	Girls were less active than boys even though boys and girls reported decreased efficacy and social support to be physically active across the transition

Few studies have examined the association between socioeconomic status (SES) and physical activity in the context of child populations. Table 6 shows those studies that addressed this relation. Overall, the results present a positive association between PA and SES. Of the cross-sectional studies in Table 6, four reported that children of higher SES have greater levels of PA as compared to children of lower SES [61, 92, 117, 142], while two did not [151, 157]. Because these two studies, both by Sallis et al. [151, 157], applied similar

methodologies as the other analyses in Table 6, and because they sampled both a generalizable [157] and a minority sample [151], it is unclear why no association between SES and PA was found.

Supporting the research that did find a positive relation, a six-year longitudinal study by Yang et al. [191] reveals that the father's education level and employment status positively correlates with higher child sports participation [191]. Furthermore, girls from higher SES families are more likely to continue PA than girls from lower SES households [191].

The reasons why SES affects child PA could stem from proximity and access to safe facilities within the community [63], cost of participation [92], and the support and transportation for PA from parents [157]. A study by Estabrooks et al. [63] reports that higher SES neighborhoods have significantly more PA resources than moderate and lower SES settings. However, even though it appears that children with greater access to facilities have higher PA, as the cost to use the facility increases, the PA levels decrease [92].

Therefore, it appears that children of low SES are generally less active than children of higher SES. The research suggests that this may be because children of higher SES have more parental support, more transportation, more facilities, and greater financial means to be physically active.

Table 6: Demographic correlates (SES specific)

Author and Date	Subjects	Methods	Results
Humbert et al. 2006 [92]	n=160, 50% male, 12-18yr, 47% Low SES	Cross-Sectional. Small focus group interviews	Low SES youths have lower PA than high SES youths. Safety of facilities was important for low SES children. Facility proximity was important for all children
Raudsepp et al. 2006[142]	n=326, 51% male , 100% Estonian, 14yrs	Cross-Sectional. PA was measured using a 7-day recall. Questionnaire assessed SES	Social class was significantly related to adolescent PA. Surprisingly, economic status was not related to self-reported PA
McVeigh et al. 2004[117]	n=381, 100% nonwhite	Cross-Sectional. Interview assessed PA and SES	Children in the highest SES quartile were more physically active and watched less television but weighed more
Estabrooks et al. 2003[63]	No human subjects	Cross-Sectional. Communities were categorized by SES and then facilities were identified	Low and medium-SES neighborhoods had significantly fewer resources than high-SES neighborhoods
Sallis et al. 1999[157]	n=1,504, 10-18yrs	Cross-Sectional. Telephone interview for correlates and PA behavior	SES was not significantly associated with PA
Epstein, Paluch et al 1996[61]	n=59 34% male, 10.5 yrs	Cross-Sectional. Self-reported and TriTrac accelerometer measured PA	SES level and parent self-report of activity accounted for 14.8% of the incremental variance in child activity
Sallis et al. 1993[151]	n=201,gender unspecified, 58% nonwhite 4yrs	Cross-Sectional. Children's PA observed 4x for 1hr each using the BEACHES observation technique	Demographics accounted for 11% of the variance in child PA. SES was not associated with child PA
Yang et al. 1996[191]	n=598, 50% male 9 - 15yrs,	6 yr longitudinal. Every 3yrs child and parents completed a PA, SES, and educational status questionnaire	Boys' sports PA was associated with father education. Girls' PA was higher if SES was higher

2.2.2 Psychological and Emotional Correlates

This next section reviews literature examining the association between child psychological and emotional correlates and PA behavior. Table 7 presents studies that examined this relation. Although not enough data exists to make definite conclusions, all of the studies in Table 7 indicate a positive association between child self-efficacy and PA. The cross-sectional studies report a negative relation between PA and depression [61], but a positive relation between PA and self-efficacy [135, 163, 190], self-esteem [163], and perceived benefit of PA [190]. Since a child's self efficacy is connected with parental and peer support for PA, it is probable that self-efficacy acts as an intermediary between

support and child PA [32, 176, 187, 190]. From a gender standpoint, girls seem to have lower levels of self-efficacy [45, 174] and lower levels of self-esteem than boys [75]. The lower perceived athletic ability among girls may be why girls participate in less sports than boys [59].

Table 7: Psychological and emotional correlates

Author and Date	Subjects	Methods	Results
Beets et al. 2006[20]	n=363, 48% male, 11-13yrs	Cross-sectional. Questionnaire by adolescents only measured PA and Social support	Boys reported greater amounts of praise, transport, do-activity-with, and watching. Peers, transportation, and praise affected PA
Wu et al. 2002[190]	n=832, 55% male, 13.5 yrs	Cross-sectional. PA recall by questionnaire along with perceptions of barriers, benefits, social support, and modeling	PA was + assoc w/ self-efficacy, perceived benefits, social support of peer and then family. Peer support acted through self-efficacy
Strauss et al. 2001 [163]	n=92 children, 10-16yrs	Cross-sectional. PA measured 1 wk with Actitrac motion detector. Questionnaire measured self esteem/ efficacy, and support	High-level PA correlated with self-efficacy scores and self-esteem. Higher health beliefs scores were not correlated with PA levels
Sallis et al. 1999[157]	n=1,504, children and parents, 10-18yrs	Cross-sectional. Telephone interview of 22 potential determinants along with an 11 item child PA index	One of the variables that showed the most support for child self-efficacy of PA was family support for physical activity
Pate et al. 1997[135]	n=361, 49% male, 11yrs	Cross-sectional. Questionnaire to measure beliefs about PA, PA	Low self-efficacy with respect to seeking support for PA was significant correlates of low activity status
Craig et al. 1996 [45]	n=305, 53% male, 11-14yrs	Cross-sectional. Heights and weights were measured and questionnaires were completed during physical education class	Girls reported being less good at vigorous PA than did boys. Children who perceived they are good or have fun at an activity were more likely to engage in it
Epstein et al. 1996 [61]	n=59, 34% male, 10.5yrs	Cross-sectional. Self-report and TriTrac accelerometers measured PA	Child and parent psychological symptoms such as depression significantly decreased accelerometer and self-reported PA
Trost et al. 1996[174]	n=334 children, 11yrs	Cross-sectional. Child reported after-school PA	Relative to girls, boys demonstrated higher self-efficacy in overcoming barriers to PA
Garcia et al. 1995[75]	n=286, 48% male, 10-14yrs	Cross-sectional. Questionnaire measured health and behavioral variables	Compared to males, females reported lower PA self-esteem and poorer health status. Adolescents reported less social support for PA and fewer PA role models
DiLorenzo et al. 1998[55]	n=111, 51% male, 11-15yrs	3 yr longitudinal. PA interviews of (1) fifth and sixth grades and (2) eighth and ninth grades. Children and parents completed PA questionnaires	The child's enjoyment of PA was the only consistent predictor of PA during Phase 1. At Phase 2 important predictors were child's exercise knowledge, mother's PA, child's self-efficacy
Garcia et al. 1998 [76]	n=132, 42% male, 30% nonwhite, 11-14yrs	2yr longitudinal. Questionnaire and PA activity log measured PA beliefs and behaviors	Boys and girls reported decreased efficacy, social support, and expectations (norms) for PA across the transition. Girls reported exposure to fewer active role models

Girls may also have lower PA levels than boys because boys receive more parental support for PA [20]. Possibly, the type and amount of support children receive from social influences, such as from parents and peers, impact their self-efficacy for activity. Studies report a positive association between peer [190] and family [157] support and child self-efficacy for PA, suggesting that support may act through self-efficacy to influence PA [157, 190].

One of the longitudinal studies [55], presented in Table 7, reports that the PA of younger children is influenced by the child's enjoyment of the activity; however, as the child matures into adolescence, the determining factors for child PA shift to PA knowledge and self-efficacy [55]. A similar longitudinal study reports that child PA decreases concomitantly with child self-efficacy [76], further supporting the relation between self-efficacy and PA.

These results suggest that child self-efficacy may not only be positively associated with PA, but may also predict PA. Further research is needed to resolve the relation between additional psychological and emotional correlates and PA, such as child self-efficacy, self-esteem, and perceived social support from parents and peers as pathways to PA participation [53, 59, 156, 176, 187, 190].

2.2.3 Environmental Correlates

This next section examines the relation between environmental factors and child PA; and Table 8 presents studies that focused on this correlate. Overall, study results tend to report a positive association between facility access and child PA. Cross-sectional designs show either a positive association [17, 75, 122, 145, 147] or no association [146, 157] between child PA and facility access. It is not clear why the latter two studies, both by Sallis et al.

[146, 157], discovered no association since they used similar methodologies as the studies which found an association. It is possible that because the subjects were up to 18 years old, age confounded the findings. Nonetheless, reviews conclude that children who have access to recreational facilities have higher levels of physical activity, whether moderate [52, 150, 156] or vigorous [151], than those children without access.

Additional cross-sectional studies report that time spent outdoors strongly influences child physical activity [17, 98, 151]. This result, however, appears to be dependent on seasonal temperatures. National data show that Canadian and U.S. children are more active during summer months [31, 181], except if they live in hotter geographic areas, such as the southwest United States, where they are generally less active during the hot, summer months [17]. Therefore, it stands to reason that children's activity increases when they are outdoors in a temperature conducive for activity.

Besides facility access and the outdoor temperature, other factors that affect children and their PA include neighborhood crime [79, 80] and community deprivation [29]. It is not surprising that children who feel unsafe in their neighborhood are less likely to be active and play outside [79]. After sampling nearly eighteen thousand children, The National Study of Adolescent Health (Add Health) [80] reported that 58% of African Americans and 42% of Hispanics living in the highest crime areas also had the lowest levels of moderate to vigorous PA. In contrast with these results, a 20 month longitudinal study found no relation between perceived neighborhood safety and baseline PA or change in PA [148]. Researchers must interpret this result with caution since parental perception and not the child's perception, measured safety, and because no objective crime statistics were acquired for this analysis [148]. Methodologies that use experimenter

observation or government statistics produce more consistent and reliable results than those drawn from subjective perceptions alone [146, 157].

Table 8: Environmental correlates

Author and Date	Subjects	Methods	Results
Roemmich et al. 2006 [145]	n=59, 52% male, 4-7 yrs ol	Cross-sectional. PA by accelerometers for 3 weekdays and 1 weekend day. Geographical information to assess neighborhood environmental variables	Housing density, the interaction of housing density by gender, and percentage park and recreation area were positively associated with PA
Gomez et al. 2004 [79]	n=177, 43% male, 13 yrs	Cross-sectional. PA via questionnaire, facilities and crime by local statistics	Boys PA inversely related to distance to facilities. Girls PA inversely related to crime and safety
Brodersen et al. 2005 [29]	n=4320, 60% male, 11-12 yrs	Cross-sectional. PA and neighborhood deprivation were assessed via survey	Negative association between PA and neighborhood deprivation
Mota et al. 2005 [122]	n=1123, 47% male, 14.6 yrs	Cross-sectional. PA and environmental facilities by questionnaire	PA was + associated with facilities and aesthetics of area. Higher PA subjects gave a higher importance to facilities and proximity
Gordon-Larsen et al. 2000 [80]	n=17,766, 51% male, 11-21 yrs, 33% non-white	Cross-sectional. PA measured through 7 day recall. Crime measured via crime reports and FBI	Negative relation between PA and neighborhood crime
Sallis et al. 2002[146]	n=779, 48% male, 6-18yrs	Cross-sectional. PA measured through monitors and a 7 day log book. Questionnaires assessed environmental correlates	The environmental domain, such as the distance to a nearby park, explained no variance in the regressions
Sallis et al. 1999[157]	n=1,504, 10-18yrs	Cross-sectional. Telephone interview of 22 potential determinants along with an 11 item child PA index	Physical and environmental barriers/access was not significant in any model.
Garcia et al. 1995 [75]	n=286, 48% male, 10-14yrs	Cross-sectional. PA and beliefs were measured	Access to exercise facilities and programs directly predicted exercise
Baranowski et al. 1993[17]	n=191 children, 3-4 yrs	Cross-sectional. PA assessed using direct observation according to the Children's Activity Rating Scale for up to 12 hrs	PA was higher outside than inside and greater in locations that had a place to be active. The season and location also impacted PA
Sallis et al. 1993[151]	n=201children, gender unspecified, 58%nonwhite 4yrs	Cross-sectional. Children's PA was directly observed using the BEACHES observation technique	Time spent outdoors at PA facilities predicted child PA level
Klesges et al. 1990 [98]	n=222 children, 3-8yrs	Cross-sectional. Direct observation measured PA activity levels in the natural environment	Children who were more active outdoors had higher levels of PA and lower weight status
Sallis et al. 1999 [148]	732, 50%male, 10-11yrs, 16% nonwhite	20 mo. longitudinal. Child and parent report along with accelerometer for PA. Parent completed perceptions of neighborhood safety	No association between perception of neighborhood safety and child PA

Although not enough research exists to supports conclusive remarks, it appears as though child PA is higher when there are facilities that encourage activity; the outside temperature is conducive for activity; the neighborhood is safe; and when there are low levels of neighborhood deprivation.

2.2.4 Sociological Correlates

This section focuses on social correlates and child PA. Table 9 cites studies which examined this relation. The CDC [181] in its 1996 report of the Surgeon General stated that the correlates which appear to have the greatest influence on child PA arise from the social support children receive from family and peers. Upon reviewing the literature, there appears to be very little data on other sociological correlates of child PA such as from teachers or coaches. Therefore, this section explores social support for child PA from both parents and from peers.

The cross-sectional studies in Table 9 report that children with high social support also have high levels of PA. In fact, all the cross-sectional studies find a positive association between child PA and parental support [32, 50, 55, 86, 88, 92, 101, 115, 116, 125, 127, 138, 142, 146, 149, 165, 176, 187, 190] and/or peer support [20, 86, 92, 115, 125, 138, 146, 165, 190]. This support takes the form of encouragement, participating with the child, transportation, praise, and watching the child be active. The only longitudinal studies that examined this relation also identified a positive association between social support and PA [55, 115], but did not find that parental social support predicted child PA [55].

Table 9: Sociological correlates

Author and Date	Subjects	Methods	Results
Beets et al. 2006[20]	n=363, 48%male, 11-14yrs	Cross-sectional. PA and social support measured by self-report from child only	Peers and parents both affected PA
Heitzler et al. 2006[88]	n=29k, 51%male, 9–13yrs	Cross-sectional. 2002 Telephone survey of parent and child PA and social support	Parental PA and support was sig. related to child PA
Humbert et al. 2006[92]	n=160, 50%male, 12-18yr, 47% Low SES	Cross-sectional. Small focus group interviews (5-7 youths). Groups were according to SES	Parental support and peers influenced PA in both groups of high and low SES children
Raudsepp et al. 2006 [142]	n=326, 51%male, 14yrs, SES tertiles	Cross-sectional. PA was measured using a 7-day recall. Questionnaire measured SES and social supports	Parental support was greater for daughters, but was important for both genders' PA
Haverly et al. 2005[86]	n=202, 54%male, 13yrs,	Cross-sectional. Child completed PA motivation questionnaire	Peer support, then parents, most influence adolescent PA
Norman et al. 2005 [125]	n=76, 45%male, 13yrs, 50%nonwhite	Cross-sectional. Child completed measures of self-efficacy, family and peer influences, enjoyment and PA	Peer and then parental support were ranked as influential factors over child PA
Davison et al. 2003[50]	n=180 females, 9yrs	Cross-sectional. Questionnaires measured PA	Only mothers' level of support was associated with higher daughters' PA
Trost et al. 2003[176]	n=380, 45%male, 15yrs	Cross-sectional. Questionnaire measured PA and support	Parental support was an imp. correlate of youth PA, acting direct or indirectly via self-efficacy
Welk et al. 2003[187]	n=994, 51%male, 10yrs	Cross-sectional. Parents and children completed PA questionnaires	Parental support predicted child PA and competence (20% and 28% of variance)
Prochaska et al'02[138]	n=138, 35% male, 12yrs, 61% nonwhite	Cross-sectional. Child completed support and PA via questionnaire	The parent and peer support scales correlated significantly with PA over 8 of 9 items
Sallis et al. 2002[146]	n=779, 48% male, 6-18 yrs	Cross-sectional. CSA monitors and 7-day diaries measured PA	Parent and peer support significantly influenced PA
Wu et al. 2002[190]	n=832, 55% male, 14yrs, 100% Tai	Cross-sectional. Child surveys on PA, support, benefits, barriers, and efficacy	PA was influenced by peer then parent support, which acted through self-efficacy
O'Loughlin et al'99[127]	n=2285, 50%male, 11yrs	Cross-sectional. PA measured with 7-day recall and activity record	Parental support was associated with PA in both genders
Brustad et al. 1996[32]	n=107, 45% male, 11yrs	Cross-sectional. Child completed questionnaires assessing competence, attraction to PA, and parental variables	Parental support was associated with children's competence and attraction to PA
Stucky-Ropp et al'93[165]	n=245, 50%male, 10yrs	Cross-sectional. Parents and children completed physical activity interviews	Friend and family support was associated child PA
Sallis et al. 1992[149]	n=297, 50%male, 9yrs	Cross-sectional. Self report and accelerometer (child only) measured PA	Parental support was associated with child PA
McKenzie et al 1991[116]	n=42, 40%male, 4-8yrs	Cross-sectional. Children and Parents were observed 8x over 8wks	Support from both parent and peers were important for child PA
Klesges et al.1986[101]	n=30, 50%male, 3yrs,	Cross-sectional. Observation of child PA and parental prompts for 1 hour	Parental support positively correlated w/ intensity of PA
DiLorenzo et al. 1998[55]	n=111, 51%male, 11-14yrs	3 yr longitudinal. Child and parents completed PA questionnaires	Parental support for PA was associated with child PA, but did not predict it
McKenzie et al. 1997[115]	n=287, 56%male, 4.4-6.6 yrs	2 year longitudinal. 12 observers recorded PA using the BEACHES protocol during outdoor recess	Encouragements for PA, whether from peers or teachers, were complied with 93% of the time. Girls complied > boys

The child's age appears to moderate the influence parents and peers have on a child's PA. Younger children report greater levels of parental support as compared with older children [20, 90, 186]. Peers, rather than parents or family, primarily motivate older children to be active [20, 86, 138, 190]. This relationship between peer influence and child PA, tends to strengthen as the child matures into adolescence [20, 58, 146]. Even though the data suggest that peer influence is stronger in adolescence, parental support in the form of praise, transportation, and parental participation still functions as a necessary component of adolescent physical activity [20, 138].

The results of these studies conclusively show a positive association between parental and peer support for PA and child PA levels. The strength of PA support appears to undergo a shift from parent to peer as the child ages into adolescence.

2.2.5 Summary of Correlates of PA

Thus far, this review has examined correlates that include demographic, psychological and emotional, environmental, and sociological. While the data shows that boys are more active than girls, this relation may be mediated by higher male fitness levels and increased support from parents. Greater social support may improve child self-efficacy and self-esteem, thereby paving a pathway to higher child PA. Parents appear to have the greatest influence over their young child's PA level, but as the child ages into adolescence, peer influence appears to become as important, if not more, than that of the parents. Children of higher SES appear to have greater support and greater access to safe facilities than children of low SES. Despite SES discrepancies, children are more active when they are outdoors, when the climate is conducive for activity, and when they have access to safe, low crime facilities.

2.3 PARENTAL INFLUENCES OF CHILD PHYSICAL ACTIVITY

Parents influence their child's PA through their support and role-modeling of PA. Strong evidence shows that parental beliefs and support highly influence child PA. Still, researchers debate whether parental role modeling is an important and reliable correlate of child PA. The following section reviews literature pertaining to parental role modeling, beliefs, and support for child PA.

2.3.1 Parental Role Modeling

As Table 10 shows, numerous studies have examined parental role-modeling of PA and child PA levels. Four of the listed studies were prospective, while nineteen were cross-sectional. Sixteen used questionnaires to assess PA, four used accelerometers, and three employed 7-day recalls. The age ranges of the sample population varied from four years to 21 years, with three studies examining children younger than eight, eleven studies examining children from nine to twelve years, and nine studies researching adolescents 13 years or older.

Overall, the results indicate that a significant amount of the variance in child PA is attributable to parental role-modeling of PA, which helps to explain why children of active parents are more likely to be active than children of inactive parents [120]. However, not all studies agree. Of the 23 studies, nearly three-quarters [32, 50, 61, 73, 82, 120, 127, 137, 142, 143, 153, 154, 165, 172, 184, 187, 191] but not all [12, 53, 55, 97, 149, 176] find a significant positive association between parental role modeling of PA and child PA.

Table 10: Parental PA role modeling and child PA

Author and Date	Subjects	Methods	Results
Raudsepp et al. 2006[142]	n=326, 51% male, 14yrs	Cross-sectional. 7-day recall measured PA	Fathers', but not mothers' PA predicted both male and female child PA
Davison et al. 2003[50]	n=180 females 9yrs,	Cross-sectional. Questionnaire measured PA	Only father modeling predicted daughter PA
Trost et al. 2003[176]	n=380, 45% male, 15yrs	Cross-sectional. Questionnaire measured PA	Parental PA did not correlate with child PA
Welk et al. 2003[187]	n=994, 51% male, 10yrs	Cross-sectional. Parents and children completed PA questionnaires	Parental PA was correlated to child PA
Trost et al. 2001[172]	n=187, 29% Obese, 11yrs	Cross-sectional. PA measured over 7 days w accelerometers. Social factors via survey	Obese children had lower levels of PA and reported their fathers had low levels of PA
O'Loughlin et al. 1999[127]	n=2285, 50% male, 11yrs	Cross-sectional. 7-day recall and activity record measured PA	Father PA had more influence over son PA, and mother PA had more over daughter PA
Kimiecik et al. 1998[97]	n=81, 68% male 13yrs	Cross-sectional. Questionnaire and recall measured PA	No relationship existed between parental MVPA and child MVPA
Vilhjalmsson et al. 1998[184]	n=1131, 51% male, 15yrs	Cross-sectional. PA measured by child on 3-point scale= (never, <1x/wk, ≥1x/wk)	Father PA was related to child involvement in exercise activities
Brustad 1996[32]	n=107, 45% male, 11yrs	Cross-sectional. Only child completed PA questionnaires	Parents who appeared to enjoy PA had more active children
Epstein et al. 1996[61]	n=59, 34% male 10yrs	Cross-sectional. Self-report and accelerometers measured PA	Parent self-report of activity predicted child activity (14.8% of the variance)
Dempsey et al. 1993[53]	n=71, 50% male 10yrs	Cross-sectional. Parents completed PA questionnaires	Parental PA did not correlate with child PA
Stucky-Ropp et al 1993[165]	n=245, 50% male 11yrs	Cross-sectional. Parents and children completed PA questionnaires	Parental PA and perception of parental PA predicted PA in girls and boys, respectively
Sallis et al. 1992[149]	n=297, 50% male 9yrs	Cross-sectional. Self report and accelerometer (child only) measured PA	Parental PA was not associated with child PA
Freedson et al. 1991[73]	n=30 children 5-9yrs,	Cross-sectional. PA measured w/ accelerometer for 3 days	Father and mother PA correlated with child PA
Poest et al. 1989[137]	n=514, 52% male, 6-7yrs,	Cross-sectional. Questionnaires on child and parent PA	Parents who are active sig. increase the likelihood that their children are active
Sallis 1988 et al. [154]	n=33, 39%male, 4yrs, low SES	Cross-sectional. Parental PA questionnaire. Child PA levels were observed at school	Parent PA correlated with child PA even outside the home setting
Sallis 1988 et al. [153]	n=30, 52% male 12yrs, 54% Mexican	Cross-sectional. PA by standardized interview in adults and children	Parent PA predicted child PA. Mother-child correlations were higher than father-child correlation
Gottlieb et al. 1985[82]	n=2695,48% male, 13yrs, 38% nonwhite	Cross-sectional. Parents and child completed an exercise activity questionnaire	Parental exercise was significantly related to the overall frequency of child exercise
Reynolds et al. 1990[143]	n=743, 52% male, 14-16yrs	Cross-sectional. PA of youth and parent through questionnaire	Parental PA was associated only with daughter PA
Anderssen et al. 2006 [12]	n=557, 47% male 13 to 21yrs	8yr longitudinal. Child PA = hrs/wk (2 questions), Parental PA = 5 categories of times/wk (1 question)	Weak associations between changes in parents' PA and changes in adolescent PA from 13-21yrs
DiLorenzo et al. 1998[55]	n=111, 51% male, 11-14yrs	3 yr longitudinal. Child and parents completed PA questionnaires	Parental PA appeared to be important, but was not a sig. predictor of child PA
Yang et al. 1996[191]	n=598, 50% male, 9-15yrs	6 yr longitudinal. Every 3yrs children and parents completed a PA questionnaire	Father and mother PA correlated with child PA and child sports PA
Moore et al. 1991[120]	n=100, 51% male 4-7yrs	1 yr longitudinal. PA measured w/ accelerometer. Data collected 8 times for 10 hrs/day over a 1 yr. period	Children w/ active mothers or fathers or both were respectively 2.0X or 3.5X or 5.8X as likely to be active, comparatively

Of the cross-sectional studies, only four report no relation between parental and child PA [53, 97, 149, 176]. These four studies used similar methodologies and did not have any more limitations than any of the other cross-sectional analyses in Table 10.

Of the four longitudinal studies in Table 10, [12, 55, 120, 191], two found a relation, one did not, and one had mixed results. The two longitudinal analyses which found a relation between parental and child PA examined young children. Yang et al.[191], who examined children from nine to fifteen years, reported that children with active parents are much more likely to participate in sports than children with inactive parents. A well designed prospective study of children four to seven years old, by Moore et al.[120], shows similar results. Moore et al. [120] reported that children are 5.8 times more likely to be active if both parents are active. Those analyses that did not find a relation, examined older children. Specifically, an eight year study by Anderssen et al. [12], which dealt with children from 13 to 21 years, revealed weak to non-existent associations between changes in parental PA and changes in adolescent PA. This result is not altogether surprising since PA tracks poorly across time [1, 18, 133, 134, 168, 177]; tracking is also known to be especially poor from adolescence into young adulthood [34, 167, 168]. The other longitudinal study of children 11-14 years and of 14-16 years, did not find a significant relation either [55]. It appears that this analysis suffered from methodological issues such as lack of father participation in the study, and high participant drop out (54%), which reduced the sample to educated, middle class Caucasians [55]. The results from these prospective analyses suggest that the age of the child and the time period over which a child is examined may moderate the results. Parental PA may influence younger children more than older children, especially if the children are transitioning from adolescence to early adulthood.

Therefore, the likelihood of finding a significant relation between parental and child PA should be higher if the measurement period is shorter and if it covers a younger age span.

The parent's gender may differentially influence a child's PA. That is, many studies suggest that the father's PA is a stronger predictor of child PA as compared to the mother's PA [50, 120, 142, 172, 184, 191]. Specifically, Moore et al. [120] reports that children of active fathers are 3.5 times as likely to be active as children of inactive fathers, while children of active mothers are only twice as likely to be active. Only Sallis et al.[153] argued that children of active mothers are more likely to be active than children of active fathers. Even though these analyses yield a difference across parental gender, many studies report no disparity between mother or father PA and child PA [32, 61, 73, 82, 137, 154, 165, 187]. Thus, the relation between child PA and mother and father PA has not been fully characterized; it most likely requires further exploration.

In addition to the child's age and the parent's gender, another reason why studies may not find an association or causal relation between parental and child PA may be because parents are simply not active with their children. Including a measure of whether the parent participates with his or her child would produce a better understanding of the relation between parental and child PA. Furthermore, parental role modeling neither describes why the parents are active nor what the parents' beliefs or support behaviors are for their child's PA. Measures of parental beliefs and support for child PA may help explain the link between parental and child PA [176].

In sum, the literature supports a relation between parental and child PA. It also shows that the likelihood of finding a positive association appears to be higher in younger children, who are more influenced by their parents than older children. A moderating effect of parental gender may also exist; one-third of studies report that child PA is higher

if the father is active as compared with the mother. While the effects of child age and parental gender may add to the child PA model, they do not explain why many studies (25%) do not find an association. It is possible that parental role modeling is not always associated with the reasons behind parental or child PA. Factors which may mediate this relation include parental beliefs and parental support for child PA, which the next section explores.

2.3.2 Parental Beliefs and Support for Child Physical Activity

Table 11 presents 27 studies which examined parental beliefs and support for child PA. The vast majority of studies included subjects between the ages of 10 and 14, with only two studies focusing on children above 14 years and two studies on children five years or younger. Three studies used all female samples, while the rest had an approximately equal gender distribution. Eight studies examined minority populations of 50% or more, four were between 25% and 50%, six were between 15% and 25%, and the rest (nine studies) had samples with fewer than 10% minority subjects. Three studies examined low SES, three studied mid SES, and the rest were either equally distributed across SES or did not mention SES in their subject demographic sections.

The vast majority of the methodologies were cross-sectional with only three prospective designs. Only five studies measured parental PA, while all evaluated child PA. Child PA was measured by questionnaire (twelve studies), seven-day recall (ten studies), accelerometers (four studies) or pedometers (one study). Two analyses used observation as an additional means to measure child PA. All analyses relied on questionnaire to determine

Table 11: Parental beliefs and support for child PA

Author and Date	Subjects	Methods	Results
Beets et al. 2006[20]	n=363, 48%male, 4%nonwhite, 11-14yrs	Cross-sectional. 7 day recall measured PA, Support via survey	Peers, transport, and praise affected PA. Boys reported greater support from both parents (Support = transport, praise, do with, watch)
Heitzler et al. 2006[88]	n=29K, 51%male, 39% nonwhite, EqDist SES, 9–13yrs	Cross-sectional. 2002 Telephone survey of parent and child PA and social support	Parental PA, participation w/, importance beliefs, and child's perception of parental support all were sig. related to child PA
Raudsepp 2006[142]	n=326, 51%male, Estonia, 14yrs	Cross-sectional. 7-dy recall and survey measured PA and support	Parental support was associated with adolescent PA. Support > in daughters
Duncan et al. 2005[56]	n=372, 50%male, 24%nonwhite, EqDist SES, 10-14yrs	Cross-sectional. Child PA-7dy activity and pedometer log. 5 types of support on a Likert Scale	Children w/ friends and family who watched PA had sig. higher PA. No other support correlates were related to child PA
Davison et al. 2003[50]	n=180 females, 0%nonwhite, Mid SES, 9yrs	Cross-sectional. Questionnaires measured PA	Mother's importance beliefs, watching, and transportation were associated with higher daughter PA
Trost et al. 2003[176]	n=380, 45%male, 16% nonwhite, 15yrs	Cross-sectional. Five questions measured support and 7day recall measured PA	Parental support was an important correlate of youth PA, acting directly or indirectly through self-efficacy
Welk et al. 2003[187]	n=994, 51%male, 32%nonwhite, 10yrs	Cross-sectional. Child completed questionnaire of child PA and Parent Support	Parental support positively related to child PA and competence (20% and 28% of variance)
McGuire et al. 2002 [113]	n=900, 47%male 71%nonwhite, EqDist SES, Adolescent age	Cross-sectional. Child PA via 7day recall (LTEQ) and support via one question	Parents' encouragement was positively related to PA in boys (black and white) and girls (all races)
Prochaska et al. 2002[138]	n=138, 35%male, 61%nonwhite, 12yrs	Cross-sectional. Child completed support via questionnaire and PA via 7day recall and accelerometers	Praise, transportation, participation with, and watching, but not verbal encouragements were positively associated with child PA
Strauss et al. 2001 [163]	n=92, 48%male, 17%nonwhite, 13yrs	Cross-sectional. Accelerometer measured PA and two questions measured social support	High-PA correlated with esteem. Support was associated with high PA, not mod PA
Hoeffer et al. 2001 [89]	n=1678, 42%male, 49% nonwhite, 12-14 yrs	Cross-sectional. PA via 7-day recall. Parental transportation by parent survey	Transportation contributed to boys' and girls' sports participation, but only girls' total PA. Boys were transported more than girls
O'Loughlin et al. 1999[127]	n=2285, 50%male, 67% nonwhite, Low SES, 11yrs	Cross-sectional. 7-day recall and activity record measured PA	Self-efficacy and encouragement were independent correlates of PA in both genders
Kimiecik et al. 1998[97]	n=81, 68%male, 18%nonwhite, 13yrs	Cross-sectional. Questionnaire and recall measured PA	Parental competence beliefs of the child predicted child MVPA
Bungum et al. 1997 [33]	n=852 females, 73% black, 60%Low SES, 14-18yrs	Cross-sectional. Child completed 7dy activity recall, and support via survey :measures vague	Verbal encouragements were associated with greater PA in children but not youth
Biddle et al. 1996 [24]	n=147, gender % unspecified, Assumed EqDist SES, 13-14yrs	Cross-sectional. Child PA via 7day recall (LTEQ)of strenuous activities. One measure of parental support	Parent and teacher encouragements for PA were strongly predictive of PA level
Brustad 1996[32]	n=107, 45%M, 68% nonwhite, Low SES, 11yrs	Cross-sectional. Child completed CAPA survey to assess attraction to PA, not actual PA. One measure of parental support	Parent encouragements for PA was higher in children with greater attraction to PA

Table 11: (Continued)

Author and Date	Subjects	Methods	Results
Hovell et al. 1996[91]	n=486, 50%male, 18% nonwhite, Mid SES, 9-10yrs	Cross-sectional. Accelerometer measured child PA and survey measured parental support	Parental participation with child was, but transportation and encouragement were not related to child PA
Garcia et al. 1995[75]	n=286, 48%male, 37%nonwhite, 10-14yrs	Cross-sectional. Questionnaire measured PA and beliefs	Family support for exercise was not associated with child exercise
Zacharian et al. 1994[193]	n=1634, 49%male, 79% nonwhite, 15-17yrs	Cross-sectional. Multiple PA questions. 2 measures of family support for PA via survey	Parental encouragement and participation w/ was assoc. with girls but not boys
Dempsey et al. 1993[53]	n=71, 50%male, 9-12yrs	Cross-sectional. Parent PA and child PA via questionnaires	Parental perception of child competence sig. predicted child PA
Sallis 1993[151]	n=347, gender % unspecified, 58% nonwhite, 4yrs	Cross-sectional. Observation and survey measured PA and support (BEACHES protocol)	All prompts, except from parents, to be active were sig. assoc. w/ PA. Whites were more active than Hispanics
Anderssen et al. 1992 [11]	n=904, 55%male, 13yrs	Cross-sectional. Support and PA via simple one question surveys by child	Parental encouragements and support was associated with child PA
Sallis et al. 1992 [149]	n=297, 50%male, 15%nonwhite, 9yrs	Cross-sectional. Child PA = accelerometer + self report, Parental PA and support via questionnaire	Verbal encouragements were not for either child, but transport and participation with predicted child PA
Klesges et al. 1986[101]	n=30, 50%male, 0%nonwhite, Low to Mid SES, 3yrs	Cross-sectional. Observation of child PA and parental prompts for 1 hour using FATS system	Parental support and prompts correlated with intensity of PA, and negatively correlated with child weight
Trost et al. 1997 [175]	N=202, 45% male, 64% nonwhite, 12 yrs	1 year longitudinal for PA data only. PA via previous day recall. Social support completed by child	Social influences were only assoc with son PA, but did not predict PA in either child
Davison et al. 2006[51]	n=174, 100%female, 5% nonwhite, Mid SES, 9-11yrs	2 yrs longitudinal. PA, girls competence and parental support via survey	Girls with higher PA had higher levels of parental support. Parental support tracked moderately (r=.49) over the 2 yrs
Sallis et al. 1999[148]	n=732, 50%male, 9.5yrs	20 months longitudinal. PA and support via child and parent survey	Baseline data indicated participation w/ child + assoc. w/ both children, but change data indicated participation w/ and encouragement only increased son PA. Change data indicated transport increased both children's PA

parental beliefs and support for child PA. Parents completed questionnaires regarding parental beliefs (5 studies) and parental support (12 studies), while children also responded to questionnaires regarding parental support (15 studies). Three studies examined parental support from both the parents' and the children's perspective.

The overall results from all the studies indicate a strong association between parental beliefs and support and child PA. Twenty-six out of 27 studies (96%) find a positive

association between parental beliefs and support and child PA. Only Garcia et al. [75], whose study suffers from methodological limitations such as using a convenience sample and a potentially unreliable questionnaire designed to measure social support for exercise in adults, does not show an association between parental support and child PA.

However, parental support may be distributed unequally. Multiple studies report differences between the gender of the children and the support they receive. The results indicate that although parental support is significant for both genders, it is higher for boys [11, 20, 89, 175, 176, 187], and boys who receive more encouragements to be active also have a higher attraction to PA, which is not the case in girls [32]. Additionally, boys receive more transportation [89] and perceive more parental support than girls [20], and those parents who participate with or play with their children typically have more active boys [148, 149]. Although these results suggest that parental support may produce more PA or greater attraction to PA in boys, not all studies are in agreement. Raudsepp et al. [142] reports that parental support is greater for daughters, while others indicate that parental participation [193] and encouragements [138, 193] are only associated with daughter PA. This may be because daughters are more compliant than sons with prompts and encouragements to be active [115].

Other studies have found no parental support differences [75] and no parental belief differences for either child [97]. Interestingly, O'loughlin et al.[127] reports an association between father support and son PA as well as between mother support and daughter PA. With many conflicting results regarding gender specific support, general conclusions cannot be made.

The child's age emerges as an additional moderator between parental support and child PA. The literature shows support differences across age groups. Studies that have examined 3-4 year olds find strong correlations between parental [100], peer [151], and other adult

[151] encouragements and child PA. However, studies of older children indicate that 10-14 year old children receive less overall support [56] or no support [75] compared with younger children. Furthermore, as the child ages from 14 to 18, parental support continues to diminish [33]. Even if support wanes as the child ages, many studies still show a positive association between parental support for PA and child PA in children older than 13 years [11, 20, 24, 88, 89, 142, 163, 176, 193]. Whether age confounds the relation between parental support and child PA is unclear because not enough studies have examined large age ranges or prospectively followed subjects from childhood through the teenage years.

Eight studies in Table 11 examine subjects with minority percentages from 58% - 79% nonwhite [32, 33, 113, 127, 151, 163, 175, 193]. The study results suggest that Caucasian children receive more parental support for PA than children of other races. McGuire et al. [113] reports that the strongest relations between parental support and child PA exist first for Caucasians, next for African Americans, and then for Asians and Hispanics. In support of this, Sallis et al.[151] reports that Hispanic children, independent of other demographics, receive less parental prompts to be active and are generally less active as compared with Caucasian children.

Although gender, age, and race demographics appear to moderate the parental support for child PA pathway, little has been researched on SES. In fact, only one study, by Duncan et al. [56], focuses on SES. The results suggest that children from higher SES backgrounds perceive greater parental support in the form of transportation, participation, and watching as compared with children of lower SES [56]. No other studies reveal a relation between parental support and SES.

Since cross-sectional studies are not able to infer causality, this paper also reviews longitudinal designs. Unfortunately, only three studies were located which examined parental support prospectively [51, 148, 175]. Two of the three analyses report that parental

support predicts child PA. The twenty-month study by Sallis et al.[148] finds that parental transportation significantly predicts son and daughter PA, while parental participation with the child only predicts son PA. Davison et al.[51] adds that daughters with high PA at nine years predicts parental PA support at eleven years, which then predicts higher daughter PA at eleven years. The final prospective analysis by Trost et al. [175] combines parental encouragement with seven other support items, which appeared to complicate the results, and may be the reason why Trost reports only an association, but not a prediction between support and PA.

These results show that parental support is not only associated with child PA, but may also predict child PA. However gender, age, and race seem to moderate this relation. Specifically, support, which appears to be higher in sons, may decrease as children age and it may differ across races. The next section examines the elements of parental support and beliefs for child PA.

The studies examined are separated based on their methodology for assessing parental beliefs and support into Tables 12, 13, and 14. These tables present the specific measures used by the studies in Table 11 to assess parental beliefs (Table 12) or parental support (Tables 13 and 14) for child PA. Table 13 shows the parental support as perceived by the parent, while Table 14 shows parental support as perceived by the child. Analyses that queried both the parent and the child are displayed in more than one table.

The five studies in Table 12 examine parental beliefs for child PA. After analyzing the studies in Table 12, it appears that parental beliefs can be separated into the following three categories: (1) importance of PA (2) child success and competence at PA and (3) why PA is important. Overall, an association between parental beliefs and child PA appears to exist; all five studies find at least one positive association between parental

beliefs and child PA [50, 53, 88, 97, 176]. Specifically, those measures that positively relate to child PA encompass parental beliefs about the importance of PA [88, 176], the child's competence in performing PA [53, 97], and the child's success at PA [97]. Although the study by Dempsey et al.[53] does not show an association between PA importance beliefs and child PA, methodological limitations preclude finding an association with this measure.

Table 12: Parental Beliefs as Completed by the Parent(s)

Belief Measure	Result	Authors
1. Physical activity improves physical and mental health	(0)	Kimiecik '98[97]
2. Physical activity improves fitness	(0)	Kimiecik '98[97]
3. Physical activity improves overall health	(0)	Heitzler '06[88]
4. It is important for my child to participate in physical activities	(+) (+) (0)	Trost '03[176] Heitzler '06[88] Dempsey '93[53]
5. Physical activity is more important than _____ (*16 alternative activities*).	(0)	Kimiecik '98[97]
6. Child's competence in performing physical activities	(+) (+)	Dempsey '93[53] Kimiecik '98[97]
7. My child can be (*Dempsey*) / is *(Kimiecik)* successful in performing physical activities.	(0) (+)	Dempsey '93[53] Kimiecik '98[97]
8. Physical activity prepares my child for sports	(0)	Kimiecik '98[97]
9. Physical activity develops my child's life skills	(0)	Kimiecik '98[97]
10. Physical activity controls my child's weight	(0)	Kimiecik '98[97]
11. Physical activity provides my child with a fun experience	(0)	Kimiecik '98[97]
12. It is important that the parent is actively involved with the child	(+)	Davison '03[50]

Association between measure and child PA: (-) = negative, (+) = positive, (0) = none

The parental belief measures that found an association are classifiable as beliefs which address the reasons behind PA's value: "PA improves physical and mental health," or "PA develops life skills." These beliefs, which address PA's value, do not actually assess the parent's perception of the child's PA level. Belief correlates that examine

competence and *success* may be significantly associated with child PA because they more closely connect with the parent's beliefs about the child's actual ability.

Although not enough research states this conclusively, the following research suggests that child PA is positively associated with parental beliefs for (1) the overall importance of PA (2) the child's competence and (3) the child's success at PA.

The next section examines parental support as perceived by the parent (Table 13) and by the child (Table 14). The items are presented individually in the same manner as in Table 12. The vast majority of these individual items assessing parental support as completed by either the parent or the child return a positive association with child PA. A thorough review of the literature reveals that parental support for child PA is examined through the five main elements: (1) verbal encouragement (2) watching the child during activity (3) participating with the child (4) transporting the child and (5) praising the child's efforts. Each element is discussed below.

Parental verbal encouragement is positively related to child PA [100, 113, 151, 176] and for child involvement in sports [127]. This association holds for both parent measured [100, 113, 127, 151, 176] and child measured [11, 24, 32, 113, 163, 176, 187, 193] levels of parental encouragement; yet five studies do not find an association when the child is queried about parental encouragement [20, 33, 56, 75, 138]. The reason why these five studies found similar results could be because they used similar methodologies for assessing child PA and child perceptions of parental encouragements. The methods for assessing PA consist of 7-day recalls [20, 33, 75, 138], pedometers[56], and accelerometers [138], and the methods for assessing child perception of adult encouragement all consist of simple questionnaires of only one or two questions.

Table 13: Parental support (completed by the parents)

Support Measure	Result	Study Authors
1. Verbally encourages child to be physically active	(+)	Trost '03[176]
	(+)	McGuire '02[113]
	(+)	Klesges '86[100]
	(+)	Sallis '93[151]
2. Verbally encourages child to play sports	(+)	O'Loughlin '99[127]
3. Verbally encourages child to be physically active or to play sports	(0)	Sallis '92[149]
	(0)	Sallis '99[148]
	(0)	Hovell '96[91]
4. Watches child be physically active or play sports	(+)	Trost '03[176]
	(+)	Heitzler '06[88]
	(+)	Davison '03[50]
5. Participates with the child in the physical activity	(+)	Hovell '96[91]
	(+)	Sallis '99[148]
	(+)	Sallis '92[149]
	(+)	Heitzler '06[88]
	(+)	Davison '06[51]
6. Transports child to places to be physically active	(+)	Trost '03[176]
	(+)	Sallis '99[148]
	(+)	Sallis '92[149]
	(+)	Davison '03[50]
	(+)	Davison '06[51]
	(+)	Heitzler '06[88]
	(+)	Hoeffer '01[89]
	(0)	Hovell '96[91]
7. Tells child physical activity is good for his/her health	(+)	Trost '03[176]

Association between measure and child PA: (-) = negative, (+) = positive, (0) = none

Interestingly, when parents are measured for verbal encouragement for PA *or* for sports (item 3 in Table 13), no association is reported [91, 148, 149]. The use of the word "or" in this item precludes knowing whether the parent is encouraging general PA or encouraging sports. Coupling this with the fact that the three studies, in item 3 of Table 13, use identical methods may contribute to the insignificant findings [91, 148, 149].

Three studies which queried parents and three studies which queried children (Table 14) assessed the parent watching item. All three parent-queried analyses report a

positive association between watching and child PA [50, 88, 176], while two [56, 138] of the three [20] that queried the child find the same. Although the analysis by Beets et al. [20] does not find an association between watching and child PA, a negative relation does emerge between watching and child BMI. Due to the known connection between child PA and BMI [21, 62, 99, 128], a positive association should exist between watching and PA, but possibly this study's methodology was not sensitive enough to detect it [20].

Thirteen studies examine participation with the child; either measured from the parent's perspective (five studies) or the child's (nine studies). Hovell et al. [91] queried both parent and child. The five parental queried studies all report a positive association between parental participation with the child and child PA [51, 88, 91, 148, 149]. However, only six studies that queried children show a positive association [88, 138, 163, 176, 187, 193], while three do not [20, 33, 56]. The studies which do not find a relation between parental participation with the child and child PA appear to be limited by the methods of collecting child responses. Beets et al. [20] suggests that no association was found between parental participation and child PA because of underreporting of parental activities by the child, while Bungum et al. [33] and Duncan et al. [56], who also did not find an association, appear to use insensitive instruments to measure parental support.

Twelve studies measured transporting the child, eight queried the parent, five questioned the child, and one evaluated both. Nearly all the studies which measured the parent's response for transportation [50, 51, 88, 89, 148, 149, 176] found a positive association with child PA, while only one did not [91]. Although Hovell et al.[91] did not find an association between transportation and child PA, they did report a negative relation between transportation and child BMI and child body fat. Since the relation between PA and BMI in children is better known [21, 62, 99, 128], the results reported from Hovell et al. [91] suggest

Table 14: Parental support (completed by the child)

Support Measure	Results	Study Authors
1. Parent verbally encourages you to do physical activities	(+)	McGuire '02[113]
	(+)	Biddle '96[24]
	(+)	Trost '03[176]
	(+)	Zakarian '94[193]
	(+)	Brustad '96[32]
	(+)	Strauss '01[163]
	(+)	Welk '03[187]
	(+)	Anderssen '92[11]
	(+)	Trost '97 [175]
	(0)	Duncan '05[56]
	(0)	Beets '06[20]
	(0)	Garcia '95[75]
	(0)	Prochaska '02[138]
	(0)	Bungum '97[33]
2. Parent watches you take part in physical activities	(+)	Duncan '05[56]
	(+)	Prochaska '02[138]
	(0)	Beets '06[20]
4. Parent does physical activity with you	(+)	Zakarian'94[193]
	(+)	Heitzler '06[88]
	(+)	Prochaska '02[138]
	(+)	Trost '03[176]
	(+)	Strauss '01[163]
	(+)	Welk '03[187]
	(0)	Duncan '05[56]
	(0)	Beets '06[20]
	(0)	Bungum '97[33]
8. Parent provides transportation to places to be physically active	(+)	Trost '03[176]
	(+)	Welk '03[187]
	(+)	Beets '06[20]
	(+)	Prochaska '02[138]
	(0)	Duncan '05[56]
7. Parent praises physical activity efforts	(+)	Beets '06[20] Prochaska
	(+)	'02[138] Heitzler '06[88]
	(+)	
2. Parent feels PA is important	(0)	Anderssen '92[11]
3. Parent provides direct help for organizing physical activities	(+)	Anderssen '92[11]
6. Parent talks with you about your physical activity (*Duncan*) or exercise (*Bungum*)	(0)	Duncan '05[56]
	(0)	Bungum '97[33]

Association between measure and child PA: (-) = negative, (+) = positive, (0) = none

that a relation between transportation and child PA still exists. Four of five studies that queried the child for parental transportation also report a positive association [20, 138, 176, 187], while only Duncan et al.[56] did not. It is unclear why Duncan et al.[56] did not find an association with transportation since they asked the question in multiple formats to include not only parents, but also the siblings, and friends of the child.

Only three studies assessed parental praise for child PA from the child's perspective. All three studies reported a positive relation between parental praise and child PA [20, 88, 139].

The overall findings from Tables 12-14 indicate strong associations between individual items of parental beliefs and parental support for PA in their child. It appears that the two most frequently studied parental belief items are the overall importance of PA and the child's competence and success at PA. Although the research is limited, it suggests that no relations exist between parental beliefs about child PA and the reasons behind why PA is important. The parental support items most commonly explored include encouragement, watching, participating with, transportation, and praise. Unfortunately, only two studies examined both beliefs and support [88, 176], and no analyses focused on all the above mentioned beliefs or support items. Since these belief and support items are positively associated with child PA, present knowledge of correlates of child PA would improve if future studies include more, if not all, of these measures.

2.3.3 Summary of Parental Influence for Child PA

The literature supports a positive association between parental and child PA; however, since one-quarter of studies indicate no association between parental and child PA, other correlates clearly need to be added to the model of child PA. Moderating

factors include child age and parental gender, while mediating factors consist of parental beliefs and support for PA. The literature suggests a positive association exists between parental beliefs and child PA. The significant components of parental beliefs include (1) the importance of PA (2) the child's competence and (3) the child's success. A strong positive relation also exists between child PA and parental support measures, which includes (1) verbal encouragements (2) watching (3) participating with the child (4) transportation and (5) praise. To date, no one study has examined all of these components, and further, no study has researched the influential factors behind parental beliefs or parental support for child PA. This next section presents a model and theory for the research hypotheses outlined in chapter one.

2.4 MODEL AND THEORY

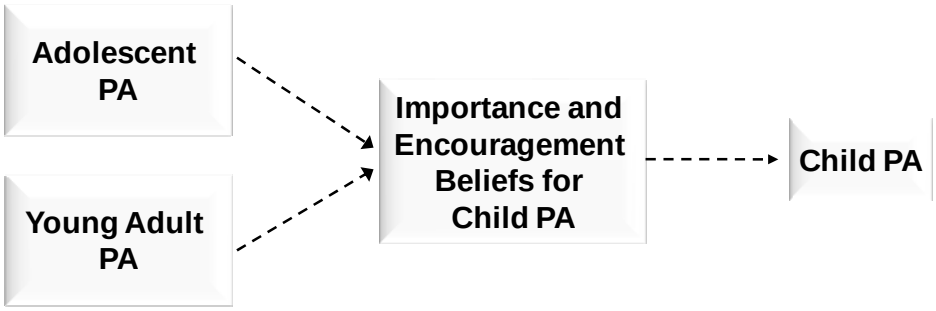
Several psychologically-based theories have been employed to explain the process and factors that influence decisions to be physically active. These include the Health Belief Model [93], the Theory of Reasoned Action [6], the Theory of Planned Behavior [5, 7], the Transtheoretical Model [139], and the Social Cognitive Theory (SCT) [14, 15]. Although the SCT has shown some success in children [81, 96], these theories primarily focus on adult decision pathways [16, 173]. Furthermore, because these behavior change theories require reflective and prospective thought, more often found in adults, they do not appear to be applicable in younger populations [16]. For this reason, this dissertation uses a model specifically designed to describe child behavior.

The expectancy-value model by Eccles et al. [59] theorizes that parents predict their child's success. The Eccles' model consists of a socialization and a psychological

component. The socialization component states that the parent's perceptions of the child's ability determines the child's perceived ability and expectation for success [60]. The psychological component suggests that the child's expectation for success and appraisal of task difficulty affects the child's decision to be active [60]. Although this dissertation study does not address the psychological element, it is the socialization component that makes the connection between parental beliefs and the child's PA level. According to the model, parental messages about the child's ability and the importance of participating in such activities form the child's perceptions. Therefore, Eccles' model states that the child's sense of competence and self-efficacy result from parental messages which stem from the parent's beliefs about the child's chances for success [60]. In support of Eccles' model, a study by Eccles and Harold in 1991 [59] reports that girls' perceptions of their parents' beliefs about their ability was lower than boys' perceptions. In accordance with this theory, girls had lower perceptions of their physical abilities than boys [59].

This dissertation study adds two elements to Eccles' model. The first element suggests that parental messages to the child appear in the form of parental support for PA. This includes parental encouragement, watching, participation with the child, praise, and transportation. The second element hypothesizes that parental beliefs about the importance of PA, which potentially motivate parental support for PA, result from previous experiences with PA. Specifically, this dissertation examines how PA experiences from adolescence to young adulthood impact parental PA beliefs. In order to visually show how parental beliefs mediate the pathway from parental PA to child PA, the model in Figure 1 has been created. Previous PA and current PA are an addition to Eccles' model and represent a potential correlate of parental beliefs.

Figure 1: Theoretical model depicting the pathway from parental PA experiences to child PA



Although it has been suggested that very little research has been done to examine the formation of parental beliefs regarding PA [176], a thorough review of the literature located no studies. Nonetheless, some research exists that substantiates the theory that memories of past experience form parental beliefs. A model of development, by Skinner et al. [160], states that childhood experiences set the stage for later development and that the development of the child is a function of the child's perceptions formed from previous experiences [160]. Applying this model to parental beliefs implies that perceptions about PA result from previous experiences with PA.

In conclusion, Figure 1 shows the combination of a development model and an expectancy-value model leading to child PA. Since there is very little research on how parental beliefs or support are formed, Figure 1 hypothesizes that previous parental experiences shape parental beliefs about PA. This suggests that parental support follows from parental beliefs, which are transmitted to the child through various mechanisms of support. Thus, child PA may be a function of the PA experiences of their parents.

2.5 SUMMARY OF CHAPTER TWO

This literature review has attempted to build a case for examining potential influences of parental beliefs and support for child PA. In order to accomplish this, this review has established the necessity of examining child PA. First, current child PA statistics were reported; they indicate that about 64% of all children fall below the recommended level of PA and about 43% are below the recommended level of vigorous PA. Although not much data indicate the long term health effects of childhood inactivity, the case is made that physical activity has important short term health benefits. More specifically, childhood PA increases bone mineral density and muscular strength, and it appears to decrease stress, depression, and blood pressure while improving self-esteem and blood lipid profiles.

Next, the correlates of childhood PA were reviewed. Overall, boys are more active than girls, children of higher SES have greater support and greater access to safe facilities than children of lower SES, and children are more active when they are outdoors, when the climate is conducive for activity and when they have greater access to safe, low crime facilities. Even more importantly, higher levels of social support from parents and peers have a strong influence over child and youth PA. Of all the correlates, parents may have the greatest influence over their child's PA.

It appears that parents influence their child through two main pathways: role-modeling PA and providing support for PA. Although nearly 75% of studies indicate a positive association exists between parental and child PA, mediating factors such as parental beliefs and support might explain why 25% of studies do not indicate a relation between parental and child PA. This review of the literature makes it clear that parental beliefs and support are positively associated with child PA. Parental beliefs associated

with child PA are composed of (1) the importance of PA (2) the child's competence, and (3) the child's success. Those factors comprising parental support include (1) verbal encouragement (2) watching (3) participating with the child (4) transportation, and (5) praise.

After establishing the association between parental influences and child PA, this review presents a hypothetical model that suggests that previous PA experience forms parental beliefs and support. The model, supported by earlier models and research, shows the pathway from parental PA experiences through parental beliefs and support to child PA.

To date, no study has examined the influential factors behind parental beliefs or parental support for PA. The main purpose of this dissertation is to examine whether the pattern of parental physical activity is associated with parental beliefs and encouragement (support) for child PA.

3.0 METHODS

3.1 INTRODUCTION

The purpose of this study was to examine the association between parental physical activity (PA) from adolescence to young adulthood and parental beliefs and encouragement for child PA. For purposes of simplicity, the term "support" from chapter two is synonymous with the term "encouragement", which will be used throughout the remainder of this study. This chapter is composed of the following sections: (1) Sample (2) Data Collection, and (3) Statistical Analysis.

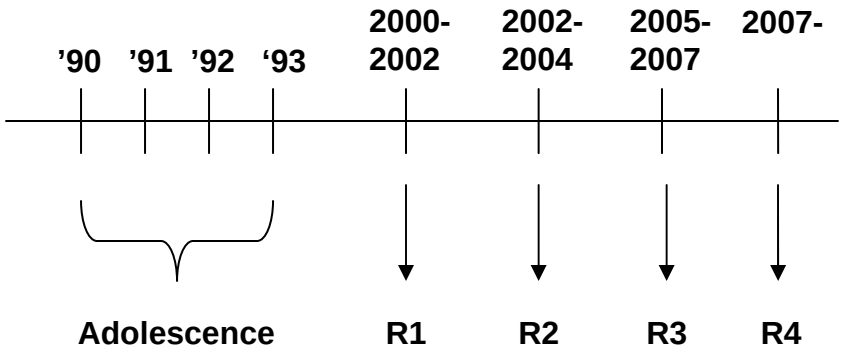
3.2 SAMPLE

3.2.1 Overview

The sample for the current analysis was identified from an ongoing longitudinal study of physical activity from adolescence through adulthood. Beginning in 1990, a cohort of 1245 adolescents, consisting of seven to ninth graders, was recruited from a metropolitan school district located within Allegheny County of western Pennsylvania. As shown in Figure 2, data were collected yearly from 1990 to 1993 on adolescents and beginning in 2000 data were collected on young adults. Fifty-two percent of the original

sample was male and the ethnic proportions were 73% White, 24% African-American, and 3% Hispanic and Asian. Both the parent longitudinal study and the present analysis were approved by the Institutional Review Board of the University of Pittsburgh and informed consent was obtained from all participants.

Figure 2: Data collection period for the parent longitudinal study



3.2.2 Sample for the Current Analysis

A total of 552 participants completed Round 3. Participants qualified for the current study if they completed Round 3 and had a child between the age of 3 and 18 years. Of the 552 participants in Round 3, 231 qualified for the current study. Overall, the demographics examined in this sample (Table 15) included age (29.6 ± 1.2 years), gender (35% male, 65% female), ethnicity (73% white, 24% African American, 3% other), educational level (71% less than a Bachelors Degree, and 29% have at least a Bachelors Degree), relationship status (26% single, 74% married/cohabitating), primary residence (53% own, 33% rent, and 14% live with parents/relatives), location where they live (11% large city, 48% suburb, 9% medium city, and 32% rural/farm/small town), current employment (66% full time/active military, 13% part time, 7.5% unemployed, 11.5% full

time homemaker, and 2% full time student). These demographics have also been stratified by gender (Table 15).

Table 15 : Demographics of parental sample (n=231)

	Baseline Parental Sample		
	Overall (n=231)	**Males (n=81)**	**Females (n=150)**
Age (years)			
Mean ± SD	29.6 ± 1.2	29.6 ± 1.3	29.6 ± 1.2
Median	30	30	30
Minimum	26	27	26
Maximum	33	33	33
Education (%)			
Less than B.S.	71	65	74
B.S. or greater	29	35	26
Race (%)			
White	73	80	70
African American	24	18	28
Other Minority	3	2	2
Relationship Status (%)			
Married / Cohabitating	74	80	71
Single	24	20	29
Current Employment (%)			
Full Time / Active Military	66	87	54
Part Time	13	8	16
Unemployed	7.5	4	10
Full Time Homemaker	11.5	0	18
Full Time Student	2	1	2
Primary Residence (%)			
Own	53	53	53
Rent	33	31	34
Live with parents/relatives	14	16	13
Location of Residence (%)			
Large City	11	13	11
Suburb	48	55	44
Medium City	9	11	8
Rural/Farm/Small Town	32	21	38

3.2.3 Contact

Participants were mailed a packet containing: (1) an introduction letter about the study from the principal investigator, (2) two consent forms, (3) parental belief questionnaire(s), and (4) a prepaid return envelope. The letter informed the subject of the intended purpose of the questionnaire and asked them to sign and return one consent form along with the completed questionnaire in the return envelope. A separate questionnaire was included in each packet for each child in the eligible age range.

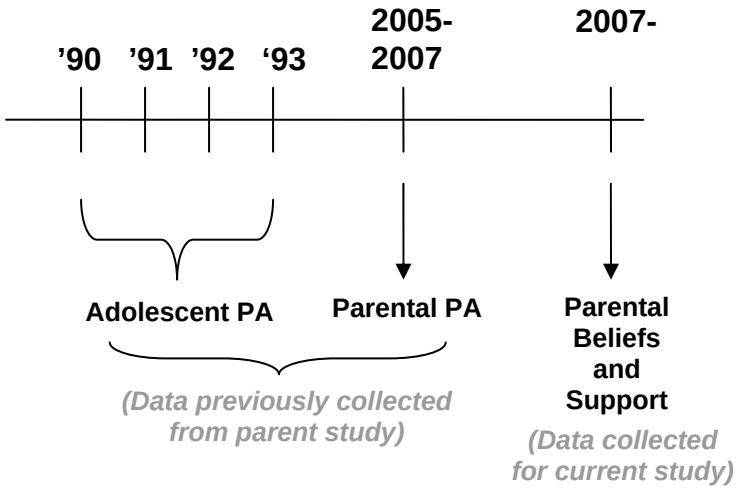
If the questionnaire was not returned within 21 days, trained research personnel attempted to make phone contact with the participant to ensure the initial questionnaire was received. If necessary, a second questionnaire was mailed to participants. If phone contact could not be made after 3 attempts, a second questionnaire was mailed to the participant. If after another 21 days no questionnaire was received, another 3 attempts will be made to contact the participant over the phone. If no contact was made, participants were classified as non-respondents. If a mailed questionnaire came back labeled as an incorrect address, commercial tracking services were used in an attempt to find the correct address. If no new information was obtained, the participant was considered lost to follow-up.

3.3 DATA COLLECTION

This study examined physical activity (PA) data that were collected during adolescence and again in adulthood from the parent study. Additional data collected for the present study includes parental beliefs and support regarding their child's PA. The parental belief and support data were linked with the previously collected adolescent and

adulthood PA data. To illustrate when data collection occurred, see Figure 3. Physical activity and parental belief and support data are discussed further in the following sections.

Figure 3: Timeline for data collection for the parent and current study



3.3.1 Physical Activity Questionnaire

In order to assess physical activity, the same questionnaire [2, 3] has been utilized throughout both the adolescent and adult phases of the study. The questionnaire (Appendix A) and has been shown to be reliable and valid [3, 106]. The questionnaire asks participants to recall all leisure-time activities in which they participated in at least 10 times during the past year. For each activity indicated, participants were asked how many months per year they participated in this activity, how many days per week, and how many minutes per day. An average number was calculated in hours per week of physical activity for each activity. Summing all activities yielded the total average hours

per week of activity. Figure 4 shows the equation used to calculate average hours of PA per week over the past year.

Figure 4: Equation used to calculate average hours of PA over the past year (hrs/wk)

$$PastYearPA\left(\frac{Hours}{Week}\right)=\left(\frac{Months}{Year}\right)\times\left(\frac{Days}{Week}\right)\times\left(\frac{4.3Weeks}{Month}\right)\times\left(\frac{Minutes}{Day}\right)\times\left(\frac{1Hour}{60Minutes}\right)\times\left(\frac{1Year}{52Weeks}\right)$$

Adolescent PA data were collected at least once and up to four times between 1990 and 1993. Summary measures (hrs/wk) over multiple years were averaged to yield an adolescent PA score (hrs/wk). If PA was measured once during adolescence, this single summary measure was used as the adolescent PA score. Parental physical activity data were collected once from 2005 to 2007 and represents the parental PA score. In order to categorize PA from adolescence to adulthood, two different methods were employed.

The first method ranked each individual's adolescent and young adult PA score. The young adult PA rank was then subtracted from the adolescent PA rank to yield a change in rank value. This new set of values was ranked and placed into tertiles labeled high tertile, moderate tertile and low tertile. Individuals in the high tertile mostly increased their rank from adolescence to young adulthood, while those in the low tertile mostly decreased their rank, respective of the other subjects.

The second method created tertiles of adolescent and young adult PA. Individuals who were in the lowest tertile during adolescence and young adulthood were labeled "persistently low", while subjects who were in the moderate tertiles or highest tertiles during the same time were respectively labeled "persistently moderate" and "persistently high." Subjects who increased tertiles, either from low to moderate, low to high, or moderate to

high, were placed in the increasing group, and subjects who decreased tertiles from high to moderate, high to low, or moderate to low, were placed in the decreasing category.

Previous longitudinal studies have calculated PA change variables in a similar manner by subtracting baseline measures from follow-up PA [12, 112], and by categorizing individuals based on whether they increased physical activity, decreased physical activity or remained stable across time [22, 112, 133, 168]. Studies that tertiled PA [168], quintiled PA [22], or sorted PA by another method [112, 133] did not provide justification for their method of PA categorization.

3.3.2 Parental Beliefs Questionnaire

The parental beliefs questionnaire (Appendix C) has been shown to be valid for measuring the importance and encouragement beliefs of parents [10]. This questionnaire assessed (1) parental importance beliefs for child PA and (2) parental encouragement beliefs for child PA. Both parental importance and encouragement could range from 7 to 35. Parental beliefs were included for the eldest child in each family.

3.3.2.1 Importance Beliefs

Parental importance was assessed through seven questions with Likert-scale ratings ranging from 1 to 5, such as, “It is important that my child be active in several sports/physical activities,” and “It is important that my child loves to play active sports.” The range of importance belief scores could vary from 7 to 35.

3.3.2.2 Encouragement Beliefs

Parental encouragement was also assessed through seven questions with Likert-scale ratings from 1 (Not at all like me) to 5 (Extremely like me). Parental encouragement was assessed through questions, such as, "I exercise or work out with my son or daughter," or "Spend time teaching my son or daughter how to play a sport or do a physical activity." The total encouragement score range could vary from 7 to 35.

3.3.3 Sociodemographic and Lifestyle Factors

The demographic questionnaire (Appendix B) assessed sociodemographics and lifestyle factors such as age, number of children, gender (male, or female), marital status (married/living with partner, or single/divorced/separated/widowed), and employment status (full-time/active military, part-time, unemployed/disabled/retired, full time homemaker, or full time student). Of those who are employed, their job activity will also be classified (mostly sitting, mostly walking, or heavy labor). Also collected were ethnicity (white, or minority), education (less than a Bachelors Degree, or at least a Bachelors Degree), cigarette use (yes, or no), alcohol use (average number of drinks per month), binge drinking (yes, or no), self-reported height and weight, which will be used to calculate Body Mass Index (BMI) (under normal weight (<18.5), normal weight (18.5-24.9), overweight (25-29.9), or obese (≥30)), primary residence (own, rent, or live with parents/relatives), location of residence (large city, suburb, medium city, or rural/open country/farm/small town), and organized physical activity (yes, or no).

3.4 STATISTICAL ANALYSIS

Completed parental belief questionnaires were entered into SPSS, version 15.0. To check for errors, frequency distributions were performed on each variable to check for outliers. Additionally, 10% of all the records were randomly chosen and checked for errors by comparing survey data with electronic input data. Participant physical activity and sociodemographics data were merged from the existing data base.

Descriptive statistics were calculated for all variables. Categorical variables, such as PA categories, were examined using frequency distributions. Measures of central tendency (mean, median, and percentiles) and dispersion (standard deviation and ranges) were computed for continuous variables such as importance beliefs, encouragement beliefs, and hours per week of PA. Graphical displays including histograms and box plots were used to examine distributions. Parametric (t-test, ANOVA) and nonparametric (Kruskal-Wallis, Spearman signed rank) tests were used to identify potential covariates and to examine differences in beliefs and PA by sociodemographics such as gender, education, ethnicity, and age. The alpha level for the following study was set at 0.05.

3.5 SPECIFIC AIMS

3.5.1 Specific Aim #1

This analysis examined the association between (1) adolescent PA and importance beliefs, (2) adolescent PA and encouragement beliefs (3) young adult PA levels and importance beliefs, and (4) young adult PA levels and encouragement beliefs. Adolescent and young adult PA levels were recorded in hrs/wk, and importance and

encouragement beliefs have a total score from 7 to 35. Due to the non-normal distribution of PA data, a two-tailed bivariate Spearman's rho correlation was employed. These associations examined all subjects and then separately by gender.

3.5.2 Specific Aim #2

This analysis explored whether importance beliefs and encouragement beliefs differed across tertiles (low, moderate, high) of adolescent PA and young adult PA. PA data were categorized into tertiles based on hrs/wk of PA. Belief data remained a continuous variable with a total score range from 7 to 35. This analysis was performed on all subjects and then separately by gender.

Studies have reported that parental belief and support data fit the necessary assumptions for normality and have employed linear statistical tests such as ANOVAs [51, 53, 187]. The current study verified whether the assumptions of the ANOVA were met. Had the belief data been skewed, a Kruskal-Wallis test would have been employed in the place of the ANOVA. Significant covariates, previously identified, were adjusted for through the use of an ANCOVA. Where the overall main effects p-value (α=.05) was significant, additional post hoc tests were performed, such as the Tukey test.

3.5.3 Specific Aim #3

This analysis examined whether importance beliefs and encouragement beliefs differed across three categories of PA change (low, moderate, and high). The change categories were calculated by separately ranking adolescent and young adult PA by gender. The ranks were then subtracted (young adult rank – adolescent rank) and were categorized

into three new tertiles of PA change (lower, moderate, and upper). An ANOVA was utilized to compare the mean values of importance and encouragement beliefs across the three tertiles of PA change. Where the ANOVA analysis showed a significant main effect ($p<.05$), an ANCOVA was used. Tukey's post hoc analysis was performed if the main effects p-value was still significant after adjusting for appropriate covariates.

3.5.4 Specific Aim #4

This analysis used three different categories of PA and examined whether importance beliefs and encouragement beliefs differed across these categories (persistently low, persistently moderate, and persistently high). The change categories were calculated by separately placing males and females into tertiles of adolescent and young adult PA. Subjects who were in the lowest tertile in adolescence and young adulthood were placed into the persistently low category. Subjects who were in the moderate tertile in adolescence and young adulthood were placed into the persistently moderate category. Subjects who were in the highest tertile in adolescence and young adulthood were placed into the persistently high category. Subjects who increased or decreased tertiles across the same time period were respectively placed into an increasing or decreasing category.

An ANOVA was utilized to compare the mean values of importance and encouragement beliefs across the three tertiles of PA change. Where the ANOVA analysis showed a significant main effect ($p<.05$), an ANCOVA was used. Tukey's post hoc analysis was performed if the main effects p-value was still significant after adjusting for appropriate covariates.

4.0 RESULTS

4.1 OVERVIEW

The purpose of this study was to examine the association between parental patterns of activity from adolescence to young adulthood and parental beliefs and encouragement for physical activity in their children. This chapter is composed of the following sections: (1) Sample (2) Identification of Covariates (3) Results of Specific Aims (4) Summary of Results.

4.2 SAMPLE

A total of 231 individuals were eligible for this study. Of these, 47% completed the parental belief questionnaire. The demographic and behavioral characteristics of the 108 participants and the 123 non-participants of this study are shown in Table 16. This table examines age, BMI, gender, race, education, relationship status, number of children, full time employment, primary residence, residence location, and drinking and smoking behaviors. Of these factors, significantly more ($p=0.03$) of the females participated in the study than males (72% vs. 28%). Other than gender, there were no differences between participants and non-participants for the other demographic or behavioral characteristics in Table 16.

Table 16: Demographic and behavioral characteristics of participants and non-participants

	Participants (n=108)	Nonparticipants (n=123)	p-value
Baseline Age (Yrs, Mean, SD)	13.8 ± 1.1	13.7 ± 1.1	0.80 [α]
Parental Age (Yrs, Mean, SD)	29.5 ± 1.2	29.7 ± 1.2	0.19 [α]
BMI (Mean, SD)	27.3 ± 5.6	28.3 ± 7.3	0.27 [α]
Gender (%)			
Male	28	42	0.03
Female	72	58	
Race (%)			
White	73	73	1.00
African American / Minority	27	27	
Education (%)			
< B.S.	67	74	0.28
≥ B.S.	33	26	
Relationship Status (%)			
Single	24	27	0.61
Married / Cohabitating	76	73	
Number of Children (%)			
One	45	36	0.27
Two	35	39	
≥Three	20	25	
Full Time Employment (%)			
No	33	36	0.65
Yes	67	64	
Primary Residence (%)			
Own	58	48	0.25
Rent	31	36	
Live with Parents / Relatives	11	16	
Residence Location (%) *			
Large City	10	12	0.32
Suburb	51	45	
Medium City	6	12	
Rural / Farm / Small Town	33	30	
Drinks per Month (Median)	3.0	4.3	0.80 [€]
Binge Drinking (%)			
No	71	71	1.00
Yes	29	29	

Smoking (%)			
No	63	63	0.96
Yes	37	37	

Comparisons were chi-square, except for the:
[α] Independent sample t-tests and [€] Mann-Whitney U test
* Total sample size is reduced by 7% due to subjects choosing the "other" category

Table 17 shows that there were no differences between participants and non-participants for adolescent physical activity (PA), young adult PA, organized PA, or job activity level. The lack of differences between participants and nonparticipants indicates that there is little follow-up bias associated with this sample.

Table 17: Physical activity of participants and nonparticipants

	Participants (n=108)	**Nonparticipants (n=123)**	**p-value**
Adolescent PA (hrs/wk)			
Median	8.9	11.8	
Minimum	0.0	0.5	0.18 [€]
Maximum	89.4	50.7	
Young Adult PA (hrs/wk)			
Median	3.1	3.2	
Minimum	0.0	0.0	0.92 [€]
Maximum	36.3	41.1	
Young Adult Organized PA (%)			
No	76	79	0.59 [β]
Yes	24	21	
Young Adult Job Activity (%) *			
Mostly Sitting	56	56	0.49 [β]
Mostly Standing	33	28	
Mostly Heavy Labor	11	16	

[β] chi-sqaure, [€] Mann-Whitney U Test
* Examined only employed subjects, which reduced total sample size by 27%

Due to the difference between male and female participation in the study as shown in Table 16, participants were stratified by gender and examined for demographic and behavioral differences, shown in Table 18. Table 18 revealed that male participants were significantly more likely ($p<0.01$) to be full time employed than females (96% vs. 57%). No other demographic differences appeared to exist between genders. Behavioral characteristics show that males have more drinks per month than females (8 vs. 3 drinks (median), $p=0.03$) and binge drink more often than females (43% vs. 23%, $p=0.04$).

Table 18: Demographic and behavioral characteristics of male and female participants

	Males (n=30)	**Females (n=78)**	**p-value**
Baseline Age (Yrs, M, SD)	13.5 ± 1.0	13.9 ± 1.1	0.17 [α]
Parental Age (Yrs, M, SD)	29.2 ± 1.1	29.6 ± 1.3	0.12 [α]
BMI (Mean, SD)	28.4 ± 5.3	26.9 ± 5.7	0.22 [α]
Race (%)			
White	77	72	0.61
African American / Minority	23	28	
Education (%)			
< B.S.	57	71	0.14
≥ B.S.	43	29	
Relationship Status (%)			
Single	20	26	0.52
Married / Cohabitating	80	74	
Number of Children (%)			
One	50	44	0.31
Two	40	33	
≥Three	10	23	
Full Time Employment (%)			
No	1	43	<0.01
Yes	96	57	
Primary Residence (%)			
Own	57	59	0.90
Rent	30	31	
Live with Parents / Relatives	13	10	

Residence Location (%) *			
Large City	17	8	
Suburb	59	47	
Medium City	3	6	0.19
Rural / Farm / Small Town	21	39	
Drinks per Month (Median)	8.0	3.0	0.03 €
Binge Drinking (%)			
No	57	77	0.04
Yes	43	23	
Smoking (%)			
No	63	63	0.96
Yes	37	37	

Comparisons were chi-square, except for the:
[α] Independent sample t-tests and [€] Mann-Whitney U Test
* Total sample size is reduced by 5% due to subjects choosing the "other" category.

Since parental beliefs for PA can vary based on the gender and age of the child, the demographics and activity levels of children are shown in Table 19. Data on children were obtained through parental proxy at the same time parental beliefs were measured. There were no differences between male and female children across age, BMI, parent-child living arrangement, physical education enrollment, participation in organized PA, or comparative physical activity levels. There was a borderline significance of $p=0.06$ for the "PA on a typical day " variable which showed that male children may be more active than female children (40 % vs. 21%) and females may be more sedentary than males (23% vs. 11%).

Table 20 presents the age differences between the children chosen for this study. The eligible age range for this study was between 3-18 years, and the eldest child was chosen from each family. Families with more than one child were significantly ($p<0.01$) more likely to have an older child compared to families with only one child.

Table 19: Demographics and physical activity levels of participant's children (n=108)

	Child Gender		
	Males (n=55)	**Females (n=53)**	**p-value**
Age (yrs, Mean, SD)	8.6 ± 3.7	9.1 ± 4.1	0.53 [α]
BMI (kg/m^2, Median)	17.5	19.1	0.63 [€]
Live with Parents (%) *			
No	2	8	0.19 [§]
Yes	98	92	
Enrolled in Physical Education (%)			
No	29	32	0.74
Yes	71	68	
Organized PA (%)			
No	42	49	0.45
Yes	58	51	
PA on a Typical Day (%)			
Sedentary	11	23	
Slightly Active	49	56	0.06
Active	40	21	
Compared to other children's PA (%)			
Less	11	21	
About the same	47	40	0.36
More	42	39	

Comparisons were chi-square except for the [α] Independent sample t-tests, [€] Mann-Whitney U Test, and [§] Fisher's Exact Test

* Total sample size is reduced because 6% of subjects chose the "part of the time " category

Table 20: Age ranges of the oldest child in families with multiple children

Number of children in family	**N = 108**	**Age Range of Selected Child**	**Age Range of Child Not Selected**	**Average Age of Selected Child Mean ± SD**	**p-value**
1	49	3.0-18.0	Ψ	7.2 ± 3.5	
2	38	3.0-14.6	3.0-12.4	9.0 ± 3.5	
3	16	7.2-15.3	3.0-11.4	12.1 ± 2.1	<0.01 [Ω]
4	4	11.3-16.3	4.5-10.5	13.4 ± 2.1	
5	1	Θ	3.6-14.1	15.7	

[Θ] There is only one child in this category, [Ψ] All families with only one child were included in the study, [Ω] One-Way ANOVA

Table 21: Physical activity levels of male and female parents

	Males (n=30)	Females (n=78)	p-value
Adolescent PA (hrs/wk)			
Median	20.6	6.5	
Minimum	3.2	0.0	<0.01 €
Maximum	89.4	36.7	
Young Adult PA (hrs/wk)			
Median	6.3	2.6	
Minimum	0.7	0.0	<0.01 €
Maximum	36.3	35.1	
Young Adult Organized PA (%)			
No	53	85	<0.01 β
Yes	47	15	
Young Adult Job Activity (%) *			
Mostly Sitting	48	60	0.37 β
Mostly Standing	35	32	
Mostly Heavy Labor	17	8	

β chi-square, € Mann-Whitney U Test

* Examined only employed subjects, which reduced total sample size by 27%

PA differences between male and female participants are shown in Table 21. As the data indicate, males were more physically active as adolescents, as young adults, and participated in more organized PA in adulthood as compared to females. No difference was observed across job activity levels. Parental beliefs were examined between male and female participants in Table 22. No differences were observed for importance beliefs or encouragement beliefs between male and female participants.

Table 22: Parental belief levels (importance and encouragement) of male and female participants

	Males (n=30)	Females (n=78)	p-value
Importance Beliefs (7-35)			
Mean ± SD	26.9 ± 5.6	27.4 ± 4.1	0.57 [α]
Median	27.0	27.5	
Minimum	12.0	17.0	
Maximum	35.0	35.0	
Encouragement Beliefs (7-35)			
Mean ± SD	29.6 ± 4.0	29.0 ± 4.2	0.50 [α]
Median	30.0	29.6	
Minimum	19.0	15.0	
Maximum	35.0	35.0	

[α] Independent Sample T-Test

4.3 IDENTIFICATION OF COVARIATES

In order to assess for potential covariates, importance beliefs, encouragement beliefs, adolescent PA, and young adult PA were examined across demographics characteristics. These variables, except for adolescent PA, are shown in Table 23. Covariates with a p-value ≤ 0.10 were included in all multivariate analyses. Table 23 was further stratified into males and females in Tables 24 and 25.

Table 23: Potential demographic and child covariates of parental beliefs (importance and encouragement) and young adult PA

	N	Importance Beliefs (7-35)		Encouragement Beliefs (7-35)		Young Adult PA (hrs/wk)	
		Mean ± SD	p-value	Mean ± SD	p-value	Median	p-value
Race							
White	79	27.6 ± 4.4	0.24 [α]	29.8 ± 3.4	<0.01 [α]	3.6	0.23 [¥]
Nonwhite	29	26.4 ± 4.9		27.4 ± 5.3		3.0	
Education Level							
< B.S.	72	27.1 ± 4.2	0.59 [α]	28.8 ± 4.2	0.25 [α]	3.6	0.69 [¥]
≥ B.S.	35	27.6 ± 5.3		29.8 ± 3.8		2.5	
Relationship Status							
Single	26	26.7 ± 4.9	0.53 [α]	27.5 ± 4.9	0.02 [α]	3.0	0.29 [¥]
Married/ Cohabitating	81	27.4 ± 4.4		29.6 ± 3.7		3.3	
Full Time Employment							
No	34	26.1 ± 4.0	0.10 [α]	28.9 ± 4.3	0.82 [α]	1.3	<0.01 [¥]
Yes	70	27.7 ± 4.7		29.1 ± 4.1		4.1	
BMI							
<25.0	40	27.2 ± 4.4		29.5 ± 3.7		3.0	
25.0 - 30.0	40	*26.8 ± 5.2*	0.47 [Ω]	28.8 ± 4.7	0.77 [Ω]	4.4	0.24 [¥]
>30.0	70	28.2 ± 3.9		29.1 ± 4.0		1.8	

[α] Independent Sample T-Test, [Ω] One-Way ANOVA, [¥] Kruskal-Wallis Test

Table 22: (Continued)

	N	Importance Beliefs (7-35)		Encouragement Beliefs (7-35)		Young Adult PA (hrs/wk)	
		Mean	p-value	Mean	p-value	Median	p-value
Number of Children							
One	49	26.6 ± 4.8		28.5 ± 3.8		3.7	
Two	38	27.7 ± 4.6	0.36 [Ω]	30.3 ± 4.0	0.10 [Ω]	1.9	0.26 [¥]
≥Three	21	28.1 ± 3.8		28.7 ± 4.7		3.3	
Child Gender							
Male	55	28.2 ± 4.2	0.04 [α]	29.6 ± 4.0	0.23 [α]	3.3	0.90 [¥]
Female	53	26.3 ± 4.8		28.7 ± 4.3		3.0	
Child Age (years)							
3 - 5.9	37	27.4 ± 4.3		29.2 ± 3.4		3.7	
6 - 8.9	19	28.1 ± 3.6	0.10 [Ω]	30.5 ± 3.3	0.11 [£]	2.0	0.60 [¥]
9 - 12.9	32	28.0 ± 4.9		29.5 ± 3.8		3.9	
13-18.9	20	25.1 ± 4.9		27.2 ± 5.8		3.0	
Live with Child*							
No	5	24.6 ± 3.1	0.15 [α]	25.8 ± 4.1	0.06 [α]	5.7	0.31 [¥]
Yes	97	27.4 ± 4.3		29.3 ± 4.0		3.0	

[α] Independent Sample T-Test, [Ω] One-Way ANOVA, [¥] Kruskal-Wallis Test, [£] Brown-Forsythe

[*] Sample size is reduced because 5% of subjects choose the "part of the time" category

4.3.1 Importance Beliefs

Importance beliefs were only related to full time employment, child gender and child age. Race, educational level, relationship status, BMI, number of children, and the parent-child living arrangement were not related to importance beliefs. Parents who were full time employed had an importance belief of 27.7 ± 4.7 which was not significantly higher ($p=0.10$) as compared with the importance belief of 26.1 ± 4.0 from parents who were not full time employed. The child gender variable showed that the importance belief for male children (28.2 ± 4.2) was significantly higher, ($p=0.04$), as compared to female children (26.3 ± 4.8). Importance beliefs were not statistically different ($p=0.10$) across child age categories. Post hoc analysis did not find any differences in importance beliefs between the child age categories.

4.3.2 Encouragement Beliefs

Encouragement beliefs were related to race, relationship status, number of children, and whether the parent lived with the child. Educational level, full time employment, BMI, child gender, and child age were not related to encouragement beliefs. Ethnic differences revealed that nonwhite parents had an encouragement belief of 27.4 ± 5.3 which was significantly lower ($p<0.01$) than the white encouragement belief of 29.8 ± 3.4. Parents who were married or cohabitating had a significantly higher ($p=0.02$) encouragement belief (29.6 ± 3.7) as compared to the encouragement belief of single parents (27.5 ± 4.9). Although the number of children variable met the requirement of $p \leq .10$ for multivariate

analysis, post hoc analysis did not reveal any differences in encouragement beliefs between different numbers of children at a p value of less than 0.05. Parents who lived with the child had encouragement beliefs which were approaching a significantly higher value as compared to parents who did not live with their child (29.3 ± 4.1 vs. 25.8 ± 4.1, $p=0.06$).

4.3.3 Adolescent and Young Adult Physical Activity

Ethnic differences showed that nonwhites had lower levels of adolescent PA (not shown in Table 23) as compared with whites (5.2 vs. 9.6 median hrs/wk, $p<0.01$). Parents who were full time employed had higher levels of young adult PA as compared to parents who were not full time employed (4.1 vs. 1.3 median hrs/wk, $p<0.01$). Educational level, relationship status, full time employment, BMI, number of children, child gender, child age, and the parent-child living arrangement were not related to either adolescent or young adult PA.

4.3.4 Summary of Overall Covariates

To summarize Table 23, full time employment, child gender, and child age were related to importance beliefs. Race, relationship status, number of children, and parent-child living arrangement were related to encouragement beliefs. Race was significantly related to adolescent PA and full time employment was related to young adult PA.

4.3.5 Covariates of Male Beliefs and PA

Table 24 shows importance beliefs, encouragement beliefs, and young adult PA across demographic characteristics for male parents. Male importance beliefs were related to race and child gender only. Male ethnicity revealed that nonwhite males had an importance belief of 22.6 ± 5.2, which was approaching a significantly lower value ($p=0.02$) than the importance belief of whites (28.2 ± 5.1). The child gender variable showed that no significant differences existed in importance beliefs for male parents ($p=0.05$).

Male encouragement beliefs were only related to ethnicity, relationship status, and whether they lived with the child. Male ethnicity showed that nonwhite males had an encouragement belief of 25.4 ± 4.2 which was significantly lower ($p<0.01$) than the encouragement belief of white males (30.9 ± 3.1). Male parents who were single did not have significantly lower encouragement beliefs than married male parents ($p=0.10$). Male parents who lived with their child had significantly higher encouragement beliefs ($p=0.01$) compared with male parents who did not live with their child (30.4 ± 3.1 vs. 25.8 ± 4.1).

Male adolescent PA and young adult PA were only related to race. Nonwhite males had an adolescent PA level of 13.5 median hrs/wk which was significantly lower ($p=0.04$) than the PA levels of white males (25.4 median hrs/wk, not shown in Table 24). Non white males also had significantly lower levels ($p=0.03$) of young adult PA (1.7 median hrs/wk) as compared with the young adult PA of white males (6.5 median hrs/wk). No other demographic variables were associated with male belief or PA levels.

Table 24: Male parental beliefs, adolescent PA, and young adult PA and potential demographic and child covariates

Males	N	Importance Beliefs (7-35)		Encouragement Beliefs (7-35)		Young Adult PA (hrs/wk)	
		Mean ± SD	p-value	Mean ± SD	p-value	Median	p-value
Race							
White	23	28.2 ± 5.1	0.02 [α]	30.9 ± 3.1	<0.01 [α]	6.5	0.03 [¥]
Nonwhite	7	22.6 ± 5.2		25.4 ± 4.2		1.7	
Education Level							
< B.S.	17	26.4 ± 4.1	0.64 [α]	29.5 ± 2.8	0.86 [α]	6.3	0.83 [¥]
≥ B.S.	13	27.5 ± 7.2		29.8 ± 5.3		6.4	
Relationship Status							
Single	6	27.0 ± 5.1	0.95 [α]	27.2 ± 5.1	0.10 [α]	6.8	0.76 [¥]
Married/Cohabitation	24	26.8 ± 5.8		30.2 ± 3.6		6.3	
Full Time Employment							
No	1						
Yes	27	26.3 ± 5.4		29.2 ± 4.0		5.8	
BMI							
<25	8	28.4 ± 5.2		31.3 ± 3.4		10.1	
25.0 - 30.0	15	25.4 ± 6.3	0.36 [Ω]	28.6 ± 4.9	0.33 [Ω]	5.8	0.25 [¥]
>30	7	28.3 ± 3.7		29.9 ± 3.4		1.8	

[α] Independent Sample T-Test, [Ω] One-Way ANOVA, [¥] Kruskal-Wallis Test

Table 23: (Continued)

Males	N	Importance Beliefs (7-35)		Encouragement Beliefs (7-35)		Young Adult PA (hrs/wk)	
		Mean	p-value	Mean	p-value	Median	p-value
Number of Children							
One	15	26.4 ± 6.2		29.0 ± 3.8		7.3	
Two	12	27.8 ± 5.5	0.72 [Ω]	30.9 ± 4.4	0.29 [Ω]	5.8	0.13 [¥]
≥Three	3	25.3 ± 2.1		27.3 ± 3.1		1.5	
Child Gender							
Male	14	28.6 ± 4.1	0.10 [α]	30.4 ± 4.3	0.30 [α]	5.0	0.36 [¥]
Female	16	25.3 ± 6.3		28.9 ± 3.8		6.9	
Child Age (years)							
3 - 5.9	13	28.9 ± 3.8		31.1 ± 2.5		5.8	
6 - 8.9	7	27.6 ± 4.6	0.11 [Ω]	29.1 ± 3.8	0.34 [£]	1.8	0.52 [¥]
9 - 12.9	7	24.7 ± 6.7		29.6 ± 3.7		7.8	
13-18.9	3	21.3 ± 8.3		24.3 ± 7.6		7.3	
Live with Child*							
No	5	24.6 ± 3.1	0.26 [α]	25.8 ± 4.1	0.01 [α]	5.7	0.73 [¥]
Yes	20	27.3 ± 5.0		30.4 ± 3.1		5.4	

[α] Independent Sample T-Test, [Ω] One-Way ANOVA, [¥] Kruskal-Wallis Test, [£] Brown-Forsythe

[*] Sample size is reduced because 5% of subjects choose the "part of the time" category

4.3.6 Covariates of Female Beliefs and PA

Table 25 shows importance beliefs, encouragement beliefs, and young adult PA across demographic characteristics for female parents. Female importance beliefs were related to full time employment and child age. Females who were full time employed had an importance belief of 28.5 ± 4.1 which was significantly higher (p=0.01) than the importance belief of females who were not full time employed (25.8 ± 3.8). There was a significant difference in importance beliefs across the ages of the child (p=0.05). Post hoc analysis revealed that females with a child between the ages of 9 and 12.9 years had an importance belief which was approaching a significantly higher value as compared with the importance belief of females with a 13-18 year old child (28.9 ± 4.0 vs. 25.7 ± 4.1, p=0.07). No other differences in importance beliefs were found between child age categories.

Female encouragement beliefs were related to relationship status and child age. No significant difference in encouragement belief was found between married and single women (p=0.09). There was also no significant difference in encouragement beliefs between child age categories (p=0.10).

Although not shown in Table 25, ethnicity was significantly related to female adolescent PA. Nonwhite female has an adolescent PA level (3.1 median hrs/wk) which was significantly lower (p<0.01) than white female adolescent PA (7.7 median hrs/wk.)

Female young adult PA was only significantly related to full time employment. Females who were full time employed had a higher (p<0.01) young adult PA level of 3.3 median hrs/wk as compared with females who were not full time employed (1.2 median

hrs/wk). No other demographic variables were associated with female belief or PA levels.

4.3.7 Summary of Beliefs and PA by Gender

Covariates of male importance beliefs were race and child gender, while they were full time employment and child age for female importance beliefs. Male encouragement beliefs were related to race, relationship status and the parent-child living arrangement. Female encouragement covariates were relationship status and child age. Adolescent PA was significantly related to race in both males and females. Male young adult PA was related to race while female young adult PA was related to full time employment.

Table 25: Female parental beliefs, adolescent PA, and young adult PA and potential demographic and child covariates

Females	N	Importance Beliefs (7-35)		Encouragement Beliefs (7-35)		Young Adult PA (hrs/wk)	
		Mean ± SD	p-value	Mean ± SD	p-value	Median	p-value
Race							
White	56	27.3 ± 4.2	0.78 [α]	29.4 ± 3.5	0.32 [α]	1.9	0.84 [¥]
Nonwhite	22	27.6 ± 4.2		28.1 ± 5.5		3.0	
Education Level							
< B.S.	55	27.3 ± 4.2	0.72 [α]	28.6 ± 4.6	0.26 [α]	3.0	0.41 [¥]
≥ B.S.	22	27.6 ± 3.9		29.8 ± 2.8		1.6	
Relationship Status							
Single	20	26.7 ± 5.0	0.37 [α]	27.6 ± 5.0	0.09 [α]	2.8	0.41 [¥]
Married/Cohabitating	57	27.6 ± 3.8		29.4 ± 3.8		2.0	
Full Time Employment							
No	33	25.8 ± 3.8	<0.01 [α]	28.8 ± 4.2	0.73 [α]	1.2	<0.01 [¥]
Yes	43	28.5 ± 4.1		29.1 ± 4.2		3.3	
BMI							
<25	32	26.9 ± 4.2		29.0 ± 3.7		1.7	
25.0 - 30.0	25	27.6 ± 4.3	0.56 [Ω]	28.9 ± 4.9	0.99 [Ω]	3.0	0.59 [¥]
>30	20	28.2 ± 4.1		28.9 ± 4.2		1.7	

[α] Independent Sample T-Test, [Ω] One-Way ANOVA, [¥] Kruskal-Wallis Test

Table 24: (Continued)

Females	N	Importance Beliefs (7-35)		Encouragement Beliefs (7-35)		Young Adult PA (hrs/wk)	
		Mean	p-value	Mean	p-value	Median	p-value
Number of Children							
One	34	26.7 ± 4.2		28.2 ± 3.8		3.0	
Two	26	27.6 ± 4.2	0.29 [Ω]	30.0 ± 4.0	0.26 [Ω]	1.6	0.20 [¥]
≥Three	18	28.6 ± 3.9		28.9 ± 5.0		3.5	
Child Gender							
Male	41	28.0 ± 4.3	0.20 [α]	29.4 ± 4.0	0.42 [α]	2.9	0.47 [¥]
Female	37	26.8 ± 4.0		28.6 ± 4.4		2.5	
Child Age (years)							
3 - 5.9	24	26.6 ± 5.0		28.3 ± 3.5		1.9	
6 - 8.9	12	28.4 ± 3.0	0.05 [Ω]	31.3 ± 2.8	0.10 [Ω]	2.5	0.79 [¥]
9 - 12.9	25	28.9 ± 4.0		29.5 ± 3.9		3.3	
13-18.9	17	25.7 ± 4.1		27.7 ± 5.6		2.7	
Live with Child							
No	0						
Yes	77	27.5 ± 4.1		29.0 ± 4.2		2.7	

[α] Independent Sample T-Test, [Ω] One-Way ANOVA, [¥] Kruskal-Wallis Test

4.4 RESULTS OF SPECIFIC AIMS

The four specific aims of this study attempted to examine the association between PA (adolescent and young adult) and beliefs (importance and encouragement). The results of these specific aims are shown in the following sections.

4.4.1 Results of Specific Aim #1

This analysis examined the association between (1) adolescent PA and importance beliefs, (2) adolescent PA and encouragement beliefs (3) young adult PA levels and importance beliefs, and (4) young adult PA levels and encouragement beliefs. Due to the non-normal distribution of PA, the association between adolescent and young adult PA levels and parental importance and encouragement beliefs were examined using a two-tailed bivariate Spearman's rho correlation. Table 26 shows the overall spearman correlations for PA and parental beliefs.

The spearman correlation between adolescent PA and importance beliefs was rho =.11 (p=0.25), and the correlation between adolescent PA and encouragement beliefs was rho =.18 (p=0.06). This indicates that a positive, yet weak, association exists between adolescent PA and beliefs. The correlation between young adult PA and importance beliefs was rho=.13 (p=0.18), and the correlation between young adult PA and encouragement beliefs was rho =.26 ($p<0.01$). This also indicates that a positive, weak association exists between young adult PA and parental beliefs. Table 27 presents a statistical comparison between the correlations of importance and encouragement beliefs

with adolescent and young adult PA. There were no differences between the importance or encouragement belief correlations across adolescent or young adult PA at either the $p<0.05$ or $p<0.10$ levels.

Table 26: Overall spearman rank order correlations (two-tailed) between PA and beliefs

	All Subjects (n=108)			
	Adolescent PA	**Young Adult PA**	**Importance**	**Encouragement**
Adolescent PA	1.00			
Young Adult PA	.38**	1.00		
Importance	.11	.13	1.00	
Encouragement	.18$^{\kappa}$	.26**	.56**	1.00

$^{\kappa}$ 0.05<p<0.10, *p≤0.05, **p<0.01

Table 27: Overall spearman rank order correlations between activity levels and parental beliefs

	All Subjects (n=108)		
	Adolescent PA	**Young Adult PA**	**z_{obs}**
Importance	.11	.13	0.15
Encouragement	.18	.26	0.61

$^{\kappa}$ 0.05<p<0.10, *p≤0.05, **p<0.01

Due to the differences between male and female PA, separate tables examine male and female spearman correlations. Table 28 shows the spearman correlations for male parents. The correlation between adolescent PA and importance beliefs was rho=.22 (p=0.24), and the correlation between adolescent PA and encouragement beliefs

was rho=.33 (p=0.08). The correlation between young adult PA and importance beliefs was rho=.15 (p=0.42), while the correlation between young adult pa and encouragement beliefs was rho=.19 (p=0.32).

Table 29 shows the spearman correlations for female parents. The correlation between adolescent PA and importance beliefs was rho=.13 (p=0.28), while the correlation between adolescent PA and encouragement beliefs was rho=.11 (p=0.36). The correlation between young adult PA and importance beliefs was rho=.17 (p=0.13), while the correlation between young adult pa and encouragement beliefs was rho=.27 (p=0.02).

Table 30 presents a statistical comparison between male and female correlations for adolescent and young adulthood PA. Even though it appears that the correlations for male beliefs are higher during adolescence than female correlations, no differences existed at either the $p<0.05$ or the $p<0.10$ level. Although female correlations appear higher than male correlations during young adulthood, these differences were also not significant.

Table 28: Spearman rank order correlations between activity levels and parental beliefs for males

	Male Parents (n= 30)			
	Adolescent PA	**Young Adult PA**	**Importance**	**Encouragement**
Adolescent PA	1.00			
Young Adult PA	.42*	1.00		
Importance	.22	.15	1.00	
Encouragement	.33$^{\kappa}$	.19	.72**	1.00

$^{\kappa}$ 0.05<p<0.10, *p≤0.05, **p<0.01

Table 29: Spearman rank order correlations between activity levels and parental beliefs for females

	Female Parents (n= 78)			
	Adolescent PA	**Young Adult PA**	**Importance**	**Encouragement**
Adolescent PA	1.00			
Young Adult PA	.18	1.00		
Importance	.13	.17	1.00	
Encouragement	.11	.27*	.51**	1.00

κ 0.05<p<0.10, *p≤0.05, **p<0.01

Table 30: Comparison between gender for spearman rank order correlations between activity levels and parental beliefs

	Adolescent PA			**Young Adult PA**		
	Males (n=30)	**Females (n=78)**	z_{obs}	**Males (n=30)**	**Females (n=78)**	z_{obs}
Importance	.22	.13	.41	.15	.17	.09
Encouragement	.33	.11	1.04	.19	.27	.38

κ 0.05<p<0.10, *p≤0.05, **p<0.01

4.4.2 Results of Specific Aim #2

This analysis explored whether importance beliefs and encouragement beliefs differed across tertiles (low, moderate, high) of adolescent PA and young adult PA. Importance and encouragement beliefs were first examined overall, and then by gender. Males and females were placed in separate PA tertiles, as shown by the cut points in Table 31, and

then recombined to create the three PA categories. Tables 31 - 34 show beliefs across adolescent PA, and Tables 35 - 38 show beliefs across young adult PA.

Table 31 shows the separate cut points for male and female levels of adolescent PA. There was no difference in importance beliefs (p=0.19), however the results are in the expected direction. That is, individuals in the moderate and high PA categories had higher beliefs than individuals in the low PA categories. There was a significant difference in encouragement beliefs (p=0.04) across tertiles of adolescent PA. Although post hoc analysis found no significant differences in encouragement beliefs between the low tertile of adolescent PA and the moderate tertile (p=0.07) or between the low tertile and the high tertile (p=0.08), results were in the expected direction.

Table 32 examines the association between adolescent PA and beliefs in males only. There were no differences in importance beliefs (p=0.50) or encouragement beliefs (p=0.14) across tertiles of adolescent PA, yet the results were in the predicted direction. Controlling for appropriate covariates, as shown in Table 33, revealed a significant difference in encouragement beliefs across tertiles of adolescent PA in males (p=0.02). Post hoc analysis revealed that the encouragement belief of the low tertile was significantly less ($p<0.01$) than the moderate tertile (27.3 ± 0.9 vs. 31.3 ± 1.0, adjusted mean ± SE). The encouragement belief of the low tertile was not significantly lower than the high tertile (p=0.09). After adjusting for covariates, no significant differences were found in importance beliefs; although the results were in the expected direction.

Table 34 shows female importance and encouragement beliefs across tertiles of adolescent PA. No differences were found for importance (p=0.10) or encouragement (p=0.21) beliefs across tertiles of adolescent PA. Results between the low and the moderate tertiles were in the expected direction, but the high tertiles showed slightly

lower beliefs than the moderate tertiles. After controlling for appropriate covariates no differences were found between importance beliefs (p=0.17) or encouragement beliefs (p=0.15) and adolescent PA. The direction of the results indicated that the moderate tertile was higher than the low tertile and slightly higher than the high tertile.

Table 31: Parental importance and encouragement beliefs by tertiles of overall adolescent PA

	Adolescent PA			
	Low Tertile (n=36)	**Moderate Tertile (n=36)**	**High Tertile (n=36)**	**p-value**
Cut Points (hrs/wk)				
Male	3.2 – 13.0	13.5 – 25.5	28.9 – 89.4	
Female	0.0 – 3.9	3.9 – 9.0	9.3 – 36.7	
Importance Beliefs				
Mean ± SD	26.1 ± 4.1	27.9 ± 5.0	27.8 ± 4.4	0.19 $^{\theta}$
Encouragement Beliefs				
Mean ± SD	27.8 ± 4.7	29.8 ± 4.1	29.8 ± 3.2	0.04 $^{\theta}$

$^{\theta}$ One-Way ANOVA

Table 32: Male parental importance and encouragement beliefs by tertiles of adolescent PA

	Adolescent PA (Males)			
	Low Tertile (n=10)	**Moderate Tertile (n=10)**	**High Tertile (n=10)**	**p-value**
Importance Beliefs				
Mean ± SD	26.0 ± 5.1	26.0 ± 7.1	28.6 ± 4.3	0.50 $^{\theta}$
Encouragement Beliefs				
Mean ± SD	27.6 ± 4.4	30.1 ± 4.2	31.1 ± 2.9	0.14 $^{\theta}$

$^{\theta}$ One-Way ANOVA

Table 33: Male importance and encouragement beliefs by tertiles of adolescent PA after adjusting for appropriate covariates

	Adolescent PA (Males)			
	Low Tertile (n=10)	**Moderate Tertile (n=10)**	**High Tertile (n=10)**	**p-value**
Importance Beliefs [(a)]				
Adjusted Mean ± SE	25.9 ± 1.7	26.9 ± 1.7	27.7 ± 1.8	0.76 [φ]
Encouragement Beliefs [(b)]				
Adjusted Mean ± SE	27.3 ± 0.9	31.3 ± 1.0	29.9 ± 1.0	0.02 [φ]

[φ] One-Way ANCOVA, Covariates for (a) are Race and Child Gender and for (b) are Race, Relationship Status, Live with Child

Table 34: Female parental importance and encouragement beliefs by tertiles of adolescent PA

	Adolescent PA (Females)			
	Low Tertile (n=26)	**Moderate Tertile (n=26)**	**High Tertile (n=26)**	**p-value**
Importance Beliefs				
Mean ± SD	26.2 ± 3.7	28.7 ± 3.9	27.4 ± 4.5	0.10 [θ]
Encouragement Beliefs				
Mean ± SD	27.8 ± 4.9	29.8 ± 4.1	29.3 ± 3.2	0.21 [θ]

[θ] One-Way ANOVA

Table 35 shows the separate cut points used for the tertiles of male and female young adult PA. Although the results were in the expected direction, there was no significant difference (p=0.35) in importance beliefs across tertiles of young adult PA. However, significant differences were found (p=0.01) in encouragement beliefs across tertiles of young adult PA. Post hoc analysis revealed that the encouragement beliefs of the low tertile were significantly lower than the moderate tertile (27.6 ± 4.4 vs. 30.3 ±

3.0, p=0.01) and approaching a significantly lower value than the high tertile (27.6 ± 4.4 vs. 29.7 ± 4.4, p=0.07). These results were in the expected direction with the moderate tertile showing belief scores that were nearly as great as or greater than belief values in the high tertile. Table 36 shows beliefs across young adult PA levels in male subjects. The data revealed no differences in either importance or encouragement beliefs across levels of young adult PA in males, although the results were in the expected direction. After including appropriate covariates, no differences in importance beliefs (p=0.99) or encouragement beliefs (p=0.30) were found across levels of young adult PA. The direction of these results showed that the beliefs of the moderate tertile appeared to be higher than both the low and the high tertiles.

Table 35: Parental importance and encouragement beliefs by tertiles of overall young adult PA

	Young Adult PA			
	Low Tertile (n=36)	**Moderate Tertile (n=36)**	**High Tertile (n=36)**	**p-value**
Cut Points (hrs/wk)				
Male	.7 – 4.9	5.0 – 7.8	9.3 – 36.3	
Female	0.0 – 1.1	1.2 – 3.7	3.7 – 35.1	
Importance Beliefs				
Mean ± SD	26.4 ± 3.8	27.4 ± 4.8	27.9 ± 4.9	0.35 $^{\theta}$
Encouragement Beliefs				
Mean ± SD	27.6 ± 4.4	30.3 ± 3.0	29.7 ± 4.4	0.01 $^{\theta}$

$^{\theta}$ One-Way ANOVA

Table 36: Male parental importance and encouragement beliefs by tertiles of young adult PA

	Young Adult PA (Males)			
	Low Tertile (n=10)	**Moderate Tertile (n=10)**	**High Tertile (n=10)**	**p-value**
Importance Beliefs				
Mean ± SD	26.4 ± 3.1	26.5 ± 7.0	27.7 ± 6.3	0.85 [θ]
Encouragement Beliefs				
Mean ± SD	28.6 ± 4.6	29.4 ± 4.0	30.8 ± 3.5	0.48 [θ]

[θ] One-Way ANOVA

Table 37 shows female parental beliefs across tertiles of young adult PA. No significant difference was shown in female importance beliefs across young adult PA; however, significant differences were found in encouragement beliefs across young adult PA (p=0.01). Post hoc tests revealed that the encouragement beliefs of females were significantly lower in the lowest tertile as compared with the moderate tertile of young adult PA (27.2 ± 4.3 vs. 30.6 ± 2.5, p=0.01). After adjusting for appropriate covariates, Table 38, female encouragement beliefs were still significantly different (p=0.03) across tertiles of young adult PA. Post hoc adjusted means showed that encouragement beliefs in the low tertile were significantly lower (p=0.01) as compared with encouragement beliefs of the moderate tertile of young adult PA (27.2 ± 0.8 vs. 30.3 ± 0.8, adjusted mean ± SE). No other significant differences in encouragement beliefs existed between the other tertiles of PA in females. The multivariate results and univariate results showed encouragement results with similar directions; where the moderate tertile of subjects had greater beliefs than the low and the high tertiles.

Table 37: Female parental importance and encouragement beliefs by tertiles of young adult PA

	Young Adult PA (Females)			
	Low Tertile (n=24)	**Moderate Tertile (n=25)**	**High Tertile (n=24)**	**p-value**
Importance Beliefs				
Mean ± SD	26.4 ± 4.1	27.8 ± 3.8	28.0 ± 4.4	0.32 [θ]
Encouragement Beliefs				
Mean ± SD	27.2 ± 4.3	30.6 ± 2.5	29.2 ± 4.7	0.01 [θ]

[θ] One-Way ANOVA

Table 38: Female parental importance and encouragement beliefs by tertiles of young adult PA after adjusting for appropriate covariates

	Young Adult PA (Females)			
	Low Tertile (n=24)	**Moderate Tertile (n=25)**	**High Tertile (n=24)**	**p-value**
Importance Beliefs [(a)]				
Adjusted Mean ± SE	26.9 ± 0.8	27.6 ± 0.8	27.6 ± 0.8	0.76 [φ]
Encouragement Beliefs [(b)]				
Adjusted Mean ± SE	27.2 ± 0.8	30.3 ± 0.8	29.2 ± 0.8	0.03 [φ]

[φ] One-Way ANCOVA, Covariates for (a) were Child Age, Full Time Employment and for (b) were Full Time Employment, Relationship Status, and Child Age

4.4.3 Results of Specific Aim #3

This analysis examined whether importance beliefs and encouragement beliefs differed across three categories of PA change (low, moderate, and high). Change in PA from adolescence to young adulthood was calculated by subtracting the rank of adult PA from the rank of adolescent PA. This value was then placed into new tertiles denoted as low, moderate, and high. Thus, subjects in the low tertile would have decreased their PA rank

from adolescence to young adulthood respective of the other subjects. Similarly, subjects in the high tertile would have increased their PA rank, respective of the other subjects.

Table 39 shows beliefs across tertiles of PA rank change. No significant differences were found in importance or encouragement beliefs across tertiles of PA rank change and the results were not in the expected direction. As shown in Table 40, no significant differences were found in either importance (p=0.19) or encouragement (p=0.35) beliefs across tertiles of PA rank change in males. After controlling for appropriate covariates, no significant differences were found in male importance beliefs (p=0.50) or male encouragement beliefs (p=0.25) across PA rank change. Table 41 shows beliefs for female subjects only. No differences were shown in importance (p=0.45) or encouragement beliefs (p=0.72) for females across tertiles of PA rank change. After including covariates in a multivariate analysis, no differences were found in female importance beliefs (p=0.34) or male encouragement beliefs (p=0.80) across PA rank change. Furthermore, in both males and females, the belief results were not in the expected directions.

Table 39: Parental importance and encouragement beliefs by tertiles of PA change

	PA Rank Change			
	Low Tertile (n=36)	**Moderate Tertile (n=36)**	**High Tertile (n=36)**	**p-value**
Importance Beliefs				
Mean ± SD	28.1 ± 4.3	25.9 ± 4.7	27.8 ± 4.4	0.10 $^{\theta}$
Encouragement Beliefs				
Mean ± SD	29.6 ± 3.6	28.5 ± 4.2	29.3 ± 4.5	0.50 $^{\theta}$

$^{\theta}$ One-Way ANOVA

Table 40: Parental importance and encouragement beliefs by tertiles of PA change for males

	PA Rank Change (Males)			
	Low Tertile (n=9)	**Moderate Tertile (n=9)**	**High Tertile (n=9)**	**p-value**
Importance Beliefs				
Mean ± SD	28.9 ± 3.9	24.5 ± 6.1	27.4 ± 5.9	0.19 $^{\theta}$
Encouragement Beliefs				
Mean ± SD	31.1 ± 3.0	28.6 ± 4.1	29.1 ± 4.8	0.35 $^{\theta}$

$^{\theta}$ One-Way ANOVA

Table 41: Parental importance and encouragement beliefs by tertiles of PA change for females

	PA Rank Change (Females)			
	Low Tertile (n=24)	**Moderate Tertile (n=25)**	**High Tertile (n=24)**	**p-value**
Importance Beliefs				
Mean ± SD	27.7 ± 4.5	26.6 ± 3.9	27.9 ± 4.0	0.45 $^{\theta}$
Encouragement Beliefs				
Mean ± SD	29.1 ± 3.7	28.5 ± 4.4	29.4 ± 4.5	0.72 $^{\theta}$

$^{\theta}$ One-Way ANOVA

4.4.4 Results of Specific Aim #4

This analysis used three different categories of PA and examined whether importance beliefs and encouragement beliefs differed across these categories (persistently low, persistently moderate, and persistently high). Subjects in the lowest PA tertile in adolescence and in young adulthood were placed in the "persistently low" tertile. Subjects in the moderate PA tertile in adolescence and in young adulthood were placed in

the “persistently moderate” tertile, and subjects in the highest PA tertile in adolescence and in young adulthood were placed in the “persistently high” tertile. Subjects who changed their PA tertile from adolescence to young adulthood were placed into either “increased” or “decreased” categories.

Table 42 shows importance and encouragement beliefs across three categories of PA. Although no significant difference in importance beliefs were found ($p=0.64$), the results were in the expected direction. There was a significant difference in encouragement beliefs ($p<0.01$) across the three categories of PA. Post hoc analysis revealed that encouragement beliefs of the “persistently low” group were significantly lower compared to the “persistently moderate” group ($p=0.02$), and were significantly lower ($p=0.01$) than the “persistently high” group. After controlling for appropriate covariates, as shown in Table 43, a significant difference was found in encouragement beliefs across categories of PA change ($p<0.01$). Post hoc adjusted means showed that the encouragement belief of the “persistently low” group was significantly lower ($p<0.01$) compared with encouragement belief of the “persistently moderate” group (26.9 ± 0.8 vs. 31.4 ± 1.0, adjusted mean ± SE). The encouragement belief of the “persistently moderate” group was also significantly higher ($p=0.02$) compared with encouragement belief of the “persistently high” group (31.4 ± 1.0 vs. 27.9 ± 1.0, adjusted mean ± SE).

Table 42: Parental importance and encouragement beliefs by tertiles of PA change

	PA Categories from Adolescence to Young Adulthood			
	Persistently Low (n=18)	**Persistently Moderate (n=13)**	**Persistently High (n=15)**	**p-value**
Importance Beliefs				
Mean ± SD	25.8 ± 3.7	26.4 ± 5.8	27.3 ± 4.7	0.64 [θ]
Encouragement Beliefs				
Mean ± SD	26.1 ± 4.3	30.2 ± 3.8	30.1 ± 3.1	<0.01 [θ]

[θ] One-Way ANOVA

Table 43: Parental importance and encouragement beliefs by tertiles of PA change after adjusting for appropriate covariates

	PA Categories from Adolescence to Young Adulthood			
	Persistently Low (n=18)	**Persistently Moderate (n=11)**	**Persistently High (n=13)**	**p-value**
Importance Beliefs [(a)]				
Adjusted Mean ± SE	26.7 ± 1.1	26.0 ±1.3	25.6 ± 1.4	0.83 [φ]
Encouragement Beliefs [(b)]				
Adjusted Mean ± SE	26.9 ± 0.8	31.4 ± 1.0	27.9 ± 1.0	<0.01 [φ]

[φ] One-Way ANCOVA; Covariates for (a) were Race, Full Time Employment, Parental Gender, Child Gender, Child Age and for (b) were Race, Full Time Employment, Parental Gender, Number of Children, Relationship Status, Live with Child

Since known differences exist between male and female PA, Table 43 was stratified by gender. Table 44 shows belief values across PA categories in male subjects. No differences existed in male importance (p=0.41) or male encouragement (p=0.28) beliefs across categories of PA change; although, the results for encouragement beliefs were in the expected direction. After adjusting for appropriate covariates, no differences were found in male importance (p=0.87) or male encouragement beliefs (p=0.24). The

direction of results indicated that importance beliefs did not follow an expected direction as the moderate category had the lowest belief value. Encouragement beliefs did follow an expected direction between the low and the moderate categories, but again the moderate category appeared to be greater than the high category.

Table 45 shows beliefs across categories of PA change in female subjects. No significant differences existed in female importance beliefs ($p=0.19$), but differences were found in female encouragement beliefs across PA change categories ($p<0.01$). Post hoc analysis revealed that the encouragement belief of the "persistently low" group was significantly lower ($p<0.01$) compared with encouragement belief of the "persistently moderate" group (25.8 ± 4.1 vs. 31.3 ± 2.5) and significantly lower ($p=0.05$) than the "persistently high" group (25.8 ± 4.1 vs. 29.4 ± 3.1).

After adjusting for appropriate covariates, Table 46, a significant difference ($p=0.04$) was found between female encouragement beliefs across categories of PA from adolescence to young adulthood. Post hoc adjusted means revealed that the encouragement belief of the "persistently low" group was significantly lower ($p=0.01$) than the encouragement belief of the "persistently moderate" group (26.7 ± 1.1 vs. 31.4 ± 1.3, adjusted mean ± SE). No other significant differences were found between the other PA change categories. The direction of these results indicate that the beliefs of the "persistently moderate" group were greater than either the "persistently low" or the "persistently high" groups.

The previous analyses examined individuals who maintained their respective PA tertile position across time, so an additional analysis was employed to examine individuals who changed PA tertiles. That is, individuals who increased their PA tertile from adolescence to young adulthood were categorized as increased, and those who

decreased their tertile level were labeled as decreased. No significant differences in beliefs were found using either univariate or multivariate analyses for all subjects, males, or females who changed their tertile of PA from adolescence to young adulthood. The belief values were similar between increasing and decreasing categories, and no direction of results was evident for the univariate or multivariate analyses.

Table 44: Male parental importance and encouragement beliefs by tertiles of PA change

	PA Categories from Adolescence to Young Adulthood (Males)			
	Persistently Low (n=6)	**Persistently Moderate (n=5)**	**Persistently High (n=5)**	**p-value**
Importance Beliefs				
Mean ± SD	26.7 ± 3.9	23.0 ± 8.2	28.0 ± 5.3	0.41 $^{\theta}$
Encouragement Beliefs				
Mean ± SD	26.8 ± 5.0	28.4 ± 5.0	31.4 ± 3.0	0.28 $^{\theta}$

$^{\theta}$ One-Way ANOVA

Table 45: Female parental importance and encouragement beliefs by tertiles of PA change

	PA Categories from Adolescence to Young Adulthood (Females)			
	Persistently Low (n=12)	**Persistently Moderate (n=8)**	**Persistently High (n=10)**	**p-value**
Importance Beliefs				
Mean ± SD	25.3 ± 3.7	28.5 ± 2.6	27.0 ± 4.5	0.19 $^{\theta}$
Encouragement Beliefs				
Mean ± SD	25.8 ± 4.1	31.3 ± 2.5	29.4 ± 3.1	<0.01 $^{\theta}$

$^{\theta}$ One-Way ANOVA

Table 46: Female parental importance and encouragement beliefs by PA change categories after adjusting for appropriate covariates

	PA Categories from Adolescence to Young Adulthood (Females)			
	Persistently Low (n=12)	**Persistently Moderate (n=7)**	**Persistently High (n=10)**	**p-value**
Importance Beliefs [(a)]				
Adjusted Mean ± SE	25.7 ± 1.2	28.3 ± 1.4	26.3 ± 1.3	0.39 [φ]
Encouragement Beliefs [(b)]				
Adjusted Mean ± SE	26.7 ± 1.1	31.4 ± 1.3	28.1 ± 1.2	0.04 [φ]

[φ] One-Way ANCOVA; Covariates for (a) were Race, Full Time Employment, Child Age and for (b) were Race, Full Time Employment, Relationship Status, Child Age

4.5 SUMMARY OF RESULTS

The four specific aims of this study attempted to examine the association between PA (adolescent and young adult) and beliefs (importance and encouragement). The results of each of those specific aims are summarized in the following sections and presented in Table 47.

Table 47: Summary of univariate and multivariate analyses

	Adolescent PA	**Young Adult PA**	**PA Rank Change**	**PA Tertile Change**
Males				
Importance Belief				
Encouragement Belief	♦			
Females				
Importance Belief				
Encouragement Belief		+ ♦		+ ♦

[+] Significant Association - Univariate Analyses
♦Significant Association - Multivariate Analyses

4.5.1 Summary Results of Specific Aim #1

This analysis examined the association between beliefs and PA with the use of spearman correlations. The results showed weak, positive associations between beliefs and PA for both genders. Even though there appeared to be a higher positive association between male beliefs and adolescent PA as compared to male beliefs and young adult PA, the differences between the correlations were not significant. Similarly for females, there appeared to be a higher positive association between female beliefs and young adult PA as compared to female beliefs and adolescent PA, but this difference between the correlations was also not significant.

4.5.2 Summary Results of Specific Aim #2

This analysis examined how belief levels might vary across tertiles (low, moderate, high) of adolescent and young adult PA. After adjusting for covariates, males in the low tertile of adolescent PA had a significantly lower encouragement score compared to males in the moderate tertile of adolescent PA. After controlling for covariates, no differences were found in male importance beliefs across adolescent PA, and no differences in either male importance or encouragement beliefs were found across young adult PA. After including covariates, females in the low tertile of young adult PA has significantly lower encouragement beliefs compared to females in the moderate tertile of young adult PA. No differences were found in female importance beliefs in young adult PA, and no importance or encouragement belief differences were shown across adolescent PA in females, even after including covariates.

4.5.3 Summary Results of Specific Aim #3

This analysis examined change in PA rank from adolescence to young adulthood by placing subjects into tertiles of PA rank change (low, moderate, high). No significant differences were found for male or female beliefs across tertiles of PA rank change. After controlling for appropriate covariates in both males and females, no significant differences in beliefs were found across PA rank change categories.

4.5.4 Summary Results of Specific Aim #4

This analysis examined the change in PA tertiles from adolescence to young adulthood by placing subjects into categories of PA (persistently low, persistently moderate, persistently high). After adjusting for appropriate covariates, females in the "persistently low" group had a significantly lower encouragement belief as compared to the females in the "persistently moderate" group. After controlling for covariates, no significant differences were found in male importance or male encouragement beliefs across PA categories. Furthermore, no significant differences in beliefs were found in subjects who increased or decreased their PA tertiles from adolescence to young adulthood.

5.0 DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

5.1 INTRODUCTION

This study was conducted because there is a need to understand why PA is encouraged in children, and because there is a lack of research in this area. The study was cross sectional in nature and examined the association between parental patterns of physical activity (PA) from adolescence to young adulthood and parental beliefs for child PA. Multiple analyses were used in this study, and the overall findings indicate that PA levels are positively associated with parental encouragement for child PA. This chapter is composed of the following sections: (1) Discussion (2) Other Predictors of Beliefs (3) Model and Theory (4) Strengths and Limitations (5) Future Analyses (6) Conclusions (7) Recommendations.

5.2 DISCUSSION

5.2.1 Correlation between PA and Beliefs

Spearman correlations were used to test the hypothesis that a positive association existed between adolescent and young adult PA and parental beliefs in both males and females. The results indicated that there were weak, positive associations between PA and beliefs

in both males and females. The correlations appeared to be the strongest between adolescent PA and encouragement in males (rho = .33), and between young adult PA and encouragement in females (rho = .27). The only correlation that was significant ($p<0.05$) was between young adult PA and encouragement in females. The low number of male subjects (n=30) may have decreased the likelihood of finding significant results, and may have affected the strength of the correlations.

The overall Spearman correlations of 0.11 between adolescent PA and importance beliefs and 0.13 between young adult PA and importance beliefs were not significant. Previous research also found a weak correlation (Pearson's r = 0.05) between importance beliefs for child PA and current parental PA [176]. The current study found that there was a significant and positive association (rho = 0.27) between young adult PA and encouragement level in females. Comparison of the adolescent PA-encour.agement correlation and the young adult PA-encouragement correlation between males and females was not significantly different (adolescent PA-encouragement: 0.33 vs. 0.11, young adult PA-encouragement: 0.19 vs. 0.27). Since the calculation assessing differences between correlations is highly dependent upon the sample size, the lack of a significant difference between the correlations may be a result of a low number of subjects.

The direction of the correlations suggests that this hypothesis is tenable; thus PA experience may influence the importance and encouragement beliefs of parents. This result corroborates theorists who suggest that experiences will create memories, which develop beliefs about those experiences [160]. If the individual's beliefs support PA, it is likely that PA would be high because the individual would value PA [103]. The beliefs for high levels of PA may have led to similar beliefs for child PA, and may be why there is a

positive association between a parent's PA level and their encouragement for their child's PA.

The premise for this study is based on the hypothesis that individuals with high PA levels will believe that PA is important and will encourage their child to be active. Although this study did not assess causality, it is plausible that importance may precede encouragement. If the parent encourages their child to be physically active, it most likely did not occur by random chance, but because the parent choose an act of encouragement. If the act was chosen, it is likely that some manner of thought was behind the action. That is, before a parent acts they probably think and may even deliberate about their choice of action. The process of selecting one action over another implies that the actions were to some degree ranked so that the choice with the most value or importance was chosen. This line of logic suggests that the process of deciding to encourage a child's PA is preceded by a belief that the act of encouragement is important. Recall that the spearman correlation between importance and encouragement beliefs was 0.72 in males and 0.51 in females. This indicates that a strong to moderate positive association exists between importance and encouragement beliefs. Even though encouragement beliefs were related to PA behaviors, the reason why importance beliefs were not associated with PA could be linked to confounding factors that may only influence importance beliefs.

5.2.2 Association between PA Categories and Beliefs

Multivariate analyses were used to examine whether subjects with higher levels of adolescent and young adult PA had higher levels of beliefs as compared with subjects who had lower levels of PA. These analyses found that high adolescent PA was significantly associated with high encouragement beliefs in males, and high young adult

PA was significantly associated with high encouragement beliefs in females. Although these results suggest that parental encouragement for child PA is moderated by the parent's gender, the reasons why males were influenced by their adolescent PA and females by their young adult PA is unclear.

Perhaps adolescent PA is more memorable for males, or male parents are reminded of their childhood activity when they are encouraging their child's PA. Since we know that males are more physically active than females [2, 75, 76, 101, 115, 135, 137, 174], the extra time that males are physically active could be creating a greater number of memories as well as more lasting memories compared to less active children. Male children also play more teams sports compared to females [2, 4], and females participate in more individual activities [4]. The social nature of the team sports may increase the quantity of memories and the impression sports have on males. Thus, the effect of having more PA experiences may increase male encouragement for child PA. Since the young adult PA of males were far lower than their PA when they were adolescents, this may explain why adolescent PA in males was associated with their encouragement for child PA. Even though the association between young adult PA and encouragement beliefs in males was not significant, the results were in the expected direction. It is possible that that the lack of significance could have been a result of the low number of male subjects (n=30).

Remember that female encouragement beliefs were positively associated with their current PA and not their adolescent activity level. One might expect that current levels of PA are easier and clearer to remember than one's PA from adolescence, thus current PA would be more related to current beliefs. It is also possible that female encouragement beliefs are not associated with adolescent PA because females had low

levels of adolescent PA. If the adolescent PA of females was similar to male PA levels, they might have a similar number of memories and their encouragement beliefs may have been associated with their adolescent PA. Not only are overall PA levels lower in females compared to males, but females participate in less organized PA and more individual activities as compared to team sports [4]. The lack of social interaction in individual activities could decrease the quantity and impression of the PA memories. Although adolescent PA was not significantly related to female encouragement beliefs, the results were in the predicted direction. This suggests that there might still be a difference in beliefs across adolescent PA levels, but a larger number of subjects may be needed to detect a significant difference. Because there is a lack of research in this area, these speculations of the association between beliefs and PA should be viewed with caution.

5.2.3 Association of Change in PA to Beliefs

There were two analyses used to test the hypothesis that subjects who increased PA rank from adolescence to young adulthood would have higher belief levels compared to subjects who decreased PA rank levels. Both analyses that examined change in PA found similar results: no significant differences in importance or encouragement beliefs were found across PA rank change categories, implying that there were no differences in beliefs between individuals who changed PA from adolescence to young adulthood. This result is in agreement with the second analysis which examined change in PA tertiles. The present examination showed no significant differences in beliefs between individuals who increased or decreased tertiles of PA, and did not appear to follow a pattern or a direction.

The rationale for this hypothesis was that individuals who made a positive change in their PA from adolescence to young adulthood made the change because they believe PA is important and would therefore encourage child PA more than individuals who decreased their PA from adolescence to young adulthood. However, individuals who increased their respective level of PA did not have different beliefs as compared to those who decreased their respective PA. Although the lack of difference between belief scores suggests that the third hypothesis should be rejected, it is arguable that the PA change categories may not reflect actual changes in PA. This is because the PA change score is a respective change, not an absolute change. Additionally, adolescent PA levels can not be accurately compared with young adult PA levels because PA tracks poorly across this time period in subjects from this study [1]. Similar longitudinal studies have also found low tracking of PA from adolescence to adulthood [34, 108, 111, 168, 177, 192]. Since the vast majority of subjects in the current study decreased their PA from adolescence to young adulthood, this analysis did not compare subjects who increased or decreased as much as it compared subjects who decreased to different extents.

5.2.4 Association of Persistent PA Levels to Beliefs

These analyses tested the hypothesis that subjects who had persistently high levels of PA in adolescence and young adulthood would have higher belief levels as compared to subjects who had persistently low levels of PA in adolescence and young adulthood. Multivariate analyses indicated that individuals who had persistently low PA levels in adolescence and young adulthood had a lower encouragement belief than individuals who had persistently moderate PA levels in adolescence and young adulthood. This association was found in females but not males, which may be attributable to a low

number of male subjects. The results found that the encouragement was higher in females with moderate PA compared to low PA, but encouragement was not significantly higher in females with high PA compared to females of low PA. Since the direction of the results still indicated that higher levels of PA are associated with higher levels of beliefs, the fourth hypothesis is still tenable.

This result, where the moderate category appears to have higher encouragement beliefs than the high category, was also shown in the univariate analyses which examined beliefs across tertiles of adolescent PA (males and females) and across tertiles of young adult PA (females only). One reason for this effect could be that beliefs for PA may not increase above a moderate level of PA. That is, after a certain threshold of PA is reached, encouragement for child PA may not appreciably increase with increasing PA. Another possible explanation behind why the high PA category may not have high beliefs is because of the sociological implications of having high PA. Parents may feel that PA cuts into family time and may consume too much of the child's afterschool and weekend time. The parents may not want to expose their child to the negative aspects of sport, such as drug use, cheating, and unsportsmanlike behaviors. Although these reasons may offer an explanation as to why the high PA category does not appear to have higher encouragement levels than the moderate PA category, multivariate analyses found no significant differences in encouragement beliefs between the high and moderate PA categories.

5.3 OTHER PREDICTORS OF BELIEFS

Examination of other factors that may be related to beliefs indicated that few covariates significantly predict beliefs. Previous research has reported that minority mothers and fathers encourage child PA less than white mothers and fathers. Two [113, 151] of eight studies that examined ethnicity and encouragement for child PA [32, 33, 113, 127, 151, 163, 175, 193], found this result. Although the univariate results of the current study suggest that minority males (96% African American) had lower importance and encouragement scores compared to white males, multivariate analyses did not convincingly show that race was a significant predictor of beliefs. Only one of four multivariate analyses in this study found that race in males significantly predicted importance beliefs ($p=0.04$). No other covariates predicted male importance or encouragement beliefs.

The only covariate that appears be a significant predictor of beliefs in females is employment status. Three of the four multivariate analyses in this study found that full time employment significantly predicted female importance beliefs ($p=0.01$), and on average explained 9% of the variance in female importance beliefs.

5.4 MODEL AND THEORY

The results of this study are supported by models of development [160] and theories of learning [103]. One development theory postulates that interactions with antecedent stimuli initiate changes which can lead to learning and development. That is, learning occurs as a result of interaction with environmental stimuli [25, 160]. Skinner [160] expounded upon this theory of learning to include positive and negative reinforcing stimuli. Positive

reinforcement, in the form of praise and motivational encouragement, has been shown to increase a person's self-efficacy, motivation, and achievement for similar behaviors [85, 159]. This indicates that positive interactions with PA could act as positive reinforcement for PA, which should increase the likelihood of continued PA. The likelihood of persistent PA behaviors is also highly associated with positive affect and intrinsic motivation [129]. This implies that individuals with higher affect and higher motivation will have higher levels of PA. It is possible that higher affect and motivation for PA predisposes a person to have particular beliefs regarding activity. This could translate into their beliefs for their child's PA. That is, parental beliefs regarding PA may form their beliefs for their child's PA. Thus, as a result of having high affect, high self-efficacy, and high motivation for PA, it is possible that parents will have high PA behaviors and also high beliefs for PA. These positive feelings and beliefs for PA may translate into positive beliefs for child PA.

5.5 STRENGTHS

Even though 43% (n=108) of the eligible sample (n=231) completed the questionnaire, and this study had a small number of male subjects (n=30), the ethnic percentages are similar to the national population (73% white, 27% minority). This implies that the results are generalizable to the larger population. However, 97% of fathers were employed full time and 95% of children lived with their parents. These results can not be generalized to fathers who are not employed full time, or to children who do not live with their parents.

The strengths of this study also include the examination of an original research question that pertains to why PA is encouraged. To our knowledge this is one of the first studies to examine the association between PA and beliefs for child PA. This study's results add an important component to the abundant research stating that parental encouragement increases child PA. By adding the adolescent and young adult PA levels of the parents to the model, this study shows that PA is associated with encouragement beliefs, but the association is different for mothers and fathers and varies based on their past and present PA levels. This may help explain why 25% of studies have not found an association between parental and child PA. That is, factors that influence parental encouragement of child PA may be an important piece of the parental-child PA model.

An additional strength is the use of multivariate analyses to control for factors that appear to influence PA and encouragement such as race, relationship status, parental-child living arrangement, child age, and employment status.

5.6 LIMITATIONS

The cross-sectional nature of this study precludes inferences of causality. Since the only measure of encouragement beliefs occurred at young adulthood and not during adolescence, it is difficult to ascertain if encouragement beliefs would change as the result of changes in PA.

Physical activity and beliefs were assessed by questionnaire which may have introduced recall or other bias. An individual may not recall their PA or their beliefs regarding PA accurately, which reduces the validity of such measures. Additionally, an individual's belief score may be biased because the participant may want to appear as a

supportive parent. This desire to be supportive could have artificially inflated parental belief scores, and could be the reason why on a scale from 7-35 the mean importance score was 27.3 ± 4.6 and the mean encouragement score was 29.2 ± 4.1. With the vast majority of parents reporting high belief scores, the likelihood of finding belief differences attributable to PA is decreased. The bias in this study could be decreased if objective measurements of PA were used such as an accelerometer, but it is unlikely that any instrument would remove the bias associated with parental encouragement beliefs.

It is possible that self-completed questionnaires are not as accurate as questionnaires completed via interview. Participants that completed questionnaires at home may have been distracted and may not have provided the same quality of attention for completing the questionnaire that could have been derived from an interview.

Another limitation of this study is the categorization of PA into tertiles. The purpose of such categorization was to compare individuals of higher and lower levels of PA, but the use of the tertile was arbitrary. Quartiles, quintiles, or other separation criteria could have been employed to create PA categories. Although separating PA into tertiles may not be better than another separation method, the results did show significant differences in beliefs between the low and the moderate categories of PA. This implies that either the tertile method is effective in distinguishing between levels of PA, or that the beliefs of parents are highly associated with PA and the method of PA categorization is unlikely to change the result.

Regardless of which method is used, separating subjects into categories can create unequal variability between each category, especially if the data is skewed. Since the PA data from this study was positively skewed, subjects in the low and moderate categories had a much smaller PA range and a much lower variability (Tables 31 and 35). Subjects

in the high PA category had a much larger PA range and thus a higher variability (Tables 31 and 35). It is possible that the high variability within the high PA category may have been a factor for why no belief differences were found between the high and low or high and moderate PA categories.

5.7 FUTURE ANALYSES

This study examined beliefs across categories of PA. The purpose was to assess whether beliefs were different between the highest and lowest categories of PA. Another method to address this question could have focused on examining PA across categories of beliefs. Through this method, the PA of individuals with low beliefs would be compared with the PA of individuals with high beliefs. This method may help to separate individuals with low beliefs and high beliefs, and should be included in future analyses.

This study did not examine all factors that may have confounded the association between PA and beliefs. For instance, life transitions such as marriage, parenthood, home ownership, and employment, could reduce the PA of a person who would prefer to be more physically active. That is, some individuals would like to be active, but because of their lifestyle or changes to their lifestyle, their PA is lower than they would prefer. These individuals may still have high beliefs regarding PA, but their respective PA level does not match their beliefs. Life transitions, such as these, were not assessed in this study and should be included in future analyses.

Previous research has indicated that males are more physically active than females [2, 75, 76, 101, 115, 135, 137, 174]. Similar results were found from the participants in this study; specifically, fathers were significantly more active than mothers in adolescence

and young adulthood. Due to this difference, this study's results were separated by gender to show potential differences between mothers and fathers. However, in order to assess whether parental gender significantly predicts beliefs for child PA, future analyses should combine all subjects and include gender as a covariate.

5.8 CONCLUSION

This study examined the association between physical activity in adolescence and young adulthood and importance and encouragement beliefs for child PA. After adjusting for appropriate covariates, moderate levels of adolescent PA in males and young adult PA in females appear to be positively associated with encouragement for child PA. Additionally, females who maintained moderate levels of PA in adolescence and young adulthood appeared to have higher levels of encouragement than females who maintained low levels of PA in adolescence and young adulthood. Although the results were in the expected direction, no significant associations were found between PA and importance beliefs for child PA.

Previous studies which have examined parental encouragement for child PA have not asked the novel question of why parents encourage their child to be active. This study found results that suggest mothers and fathers may have different driving forces for their encouragement based on their previous PA. In an effort to better understand current parental encouragements for child PA, future studies and interventions may benefit from examining previous PA behaviors in both mothers and fathers.

5.9 RECOMMENDATIONS

1) The lack of relevant research in this area suggests a need to replicate this study.
2) A greater number of male subjects would increase the power of the study.
3) Objective measures of PA, from accelerometers, may improve the reliability and accuracy of PA scores.
4) A longitudinal analysis examining beliefs at separate time points is recommended to examine the cause-effect relation between PA and beliefs.
5) Future analyses should examine reasons behind parental beliefs and PA behaviors.
6) Future studies should examine confounding factors of parental beliefs such as why a person was physically active, their enjoyment of PA, their knowledge of the benefits of PA, or their barriers to PA.
7) Lifestyle transitions that may impact PA change should be included as confounders in multivariate analyses.
8) Interventions that focus on parental and child PA could benefit from including these results to increase program efficacy.
9) The arbitrary nature of using tertiles to categorize PA would be lessened if future analyses employed regression techniques to create cut points between PA categories based on belief levels.
10) Participant responses may be improved if they are interviewed rather than self-completed.

APPENDIX A

PAST YEAR LEISURE TIME PHYSICAL ACTIVITY

PAST YEAR LEISURE TIME PHYSICAL ACTIVITY

APPENDIX A

Activity	Activity done in past year at least 10 times?		Which months in the past year did you do this activity?													On average, how often did you do this activity?	
	No	Yes	JAN	FEB	MAR	APR	MAY	JUN	JLY	AUG	SEP	OCT	NOV	DEC	Months	Days/Wk	Mins/Day
Aerobics																	
Baseball																	
Basketball																	
Bicycling (Mountain)																	
Bicycling (Stationary)																	
Bicycling (Street)*																	
Bowling																	
Dance Class																	
Football																	
Garden/Yard Work																	
Gymnastics																	
Hiking																	
*I*ce Skating																	
Roller Skating																	
Running for Exercise																	
Skateboarding																	
Snow Skiing																	
Soccer																	
Softball																	
Street Hockey																	
Swimming Laps																	
Tennis																	
Volleyball																	
Water Skiing																	
Weight Training																	
Walking for Exercise*																	

Are there other activities that you did at least 10 times in the past year? If yes, list activities below.

APPENDIX B

PARTICIPANT CHARACTERISTICS QUESTIONS

1. Which of the following categories comes closest to the type of place where you presently live? (The city of Pittsburgh would be categorized as a large city.)

1 ❑ In open country but not on a farm
2 ❑ On a farm
3 ❑ In a small city or town (under 50,000 residents)
4 ❑ In a medium-size city (50,000 – 250,000 residents)
5 ❑ In a suburb near a large city
6 ❑ In a large city (> 250,000 residents)

2. Which of the following describes your primary residence?

1 ❑ Live with parents
2 ❑ Live with other relatives
3 ❑ Rent apartment/house/condo
4 ❑ Own house/condo
5 ❑ Other (Specify) _____

3. How many people, <u>including yourself</u>, live at your primary residence on a permanent basis?

A. Number of adults (age 18 or older) _____
B. Number of children (under age 18) _____ Please list ages _____

4. Which of the following best describes your current employment status?

1 ❑ Working full-time for pay
2 ❑ Working part-time for pay
3 ❑ Active Military
4 ❑ Unemployed
5 ❑ Disabled/Retired
6 ❑ Full time homemaker
7 ❑ Full time student

5. Approximately how many hours per week do you work for pay?

0 ❑ Do not currently work for pay
1 ❑ 1-10 hours/week
2 ❑ 11-20 hours/week
3 ❑ 21-30 hours/week
4 ❑ 31-40 hours/week
5 ❑ 41-60 hours/week
6 ❑ 61 hours or more a week

6. What kind of work did/do you normally do? Please list your occupation or job title.

_____

7. When you are working at your usual job, which of the following best describes your activity?

1 ❑ mostly sitting or standing
2 ❑ mostly walking
3 ❑ mostly heavy labor or physically demanding work
4 ❑ not currently working

8. Which of the following categories represents <u>your total income</u> from <u>all</u> sources?

1 ❑ Less than $15,000
2 ❑ $15,000 - $24,999
3 ❑ $25,000 - $39,999
4 ❑ $40,000 - $59,999
5 ❑ $60,000 - $74,999
6 ❑ $75,000 or more

9. Which is the highest grade or year of school you have completed?

1 ❑ Less than 12 years
2 ❑ High school diploma or GED
3 ❑ Trade School
4 ❑ Some college, 2-year degree or diploma
5 ❑ Bachelor's degree
6 ❑ Master's degree
7 ❑ Professional/doctoral degree

10. Are you currently attending a school, college, or university?

0 ❑ No
1 ❑ Yes, → _____ (name of school)

11. Which of these categories best describes your race? Please mark only one.

1 ❑ White
2 ❑ African American
3 ❑ Hispanic
4 ❑ Asian American
5 ❑ Other (specify): _____

12. Are you of Hispanic or Latino origin or descent?

0 ❑ No
1 ❑ Yes

13. What is your date of birth (MM/DD/YYYY)? ___ ___ / ___ ___ / ___ ___ ___ ___

a. How old are you? _____ Years

14. How do you define your sexual identity?

1 ❑ Only heterosexual
2 ❑ Mostly heterosexual
3 ❑ Bisexual
4 ❑ Mostly lesbian/gay/homosexual
5 ❑ Only lesbian/gay/homosexual
6 ❑ Other (specify): _____

15. Which of the following "best" describes your current relationship status?

1 ❑ Never Married
2 ❑ Living with Unmarried Partner
3 ❑ Married
4 ❑ Separated
5 ❑ Divorced
6 ❑ Widowed

16. Do you have any children (biological/foster/adopted/step)?

0 ❑ No
1 ❑ Yes → **a.** How many children do you have? _____

b. What are their ages? (List all) _____

1. How many of these children are you the primary caregiver for? _____

APPENDIX C

PARENTAL BELIEFS QUESTIONNAIRE

University of Pittsburgh Physical Activity Study

PittPAS

Form 4
Parental Beliefs Questionnaire

This survey includes questions about your beliefs about physical activity. There are no right or wrong answers, please answer each question with the answer that most closely matches how you think or feel. **A separate questionnaire will be completed for each child that is between 3 and 18 years of age.**

Mark your answers directly on this questionnaire with a pen. If you make a mistake, please cross it out and sign your initials next to the marking. Please try not to skip any questions. If your answer is zero, please write the number "0" instead of leaving the space empty. If you do not want to answer any question, please write "refused".

Date Completed: __ __/__ __/__ __ __ __

Round: _____

Reviewed by: _____

Date Reviewed: __ __/__ __/__ __ __ __

Please provide the following general information about your son or daughter:

1. Gender of Child (Male/Female)_____
2. Age of Child (Years and Months) _____
3. Date of Birth of Child (mm/dd/yyyy)_____
4. Height of Child (Feet and/or Inches)_____
5. Weight of child (Pounds)_____
6. Does this child live with you? (Yes/No/Part of the Time)_____

Please rate the following statements on how well each one applies to your son or daughter. Place an "X" over the box that indicates the degree to which you agree or disagree with these statements.

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
7. My child looks athletic.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
8. My child has skill in several sports or physical activities.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
9. My child has a lean body.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
10. In comparison to most activities outside of school, it is more important that my child spend time playing sports or being active.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
11. My child could become skilled in most physical activities with effort and practice.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
12. My child looks like a person who exercises.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
13. It is important that my child loves to play active sports.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
14. My child can do several types of sports/physical activities.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
15. It is important that my child puts a lot of effort into sports or exercise.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
16. I'm confident that my child has athletic skill.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
17. It is important that my child really enjoys doing exercise.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
18. My child looks like a person who is in very good physical shape.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
19. It is important that my child be active in several sports/physical activities.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐
20. My child has a lot of athletic ability.	1 ☐	2 ☐	3 ☐	4 ☐	5 ☐

	Strongly Disagree	Somewhat Disagree	Neither Agree nor Disagree	Somewhat Agree	Strongly Agree
21. It is important that my son or daughter does sports or physical activities all year long.	1 8	2 8	3 8	4 8	5 8
22. My child looks like a person who is physically fit.	1 8	2 8	3 8	4 8	5 8
23. My child is good in at least one type of physical activity.	1 8	2 8	3 8	4 8	5 8
24. Making sure that my child experiences a wide variety of physical activities is one of my most important parental goals.	1 8	2 8	3 8	4 8	5 8

Please rate the following statements on how descriptive these behaviors are of you as a parent. Place an "X" over the box that indicates the degree to which you feel the statement is like you.

	Not at all like me	Somewhat like me	Uncertain	Somewhat like me	Extremely like me
25. Encourage my child to exercise or be physically active.	1 8	2 8	3 8	4 8	5 8
26. Exercise or work out with my son or daughter.	1 8	2 8	3 8	4 8	5 8
27. Give my child words of confidence concerning sports or exercise.	1 8	2 8	3 8	4 8	5 8
28. Watch my child closely when he/she is practicing/playing and give them feedback on what they are doing.	1 8	2 8	3 8	4 8	5 8
29. Spend time teaching my son or daughter how to play a sport or do a physical activity.	1 8	2 8	3 8	4 8	5 8
30. Let my child know I am very proud of them when he/she does physical exercise	1 8	2 8	3 8	4 8	5 8
31. Help in every way when it comes to sports or exercise for my son or daughter	1 8	2 8	3 8	4 8	5 8

For the next questions, please keep in mind the following definition of physical activity...

Physical activity is any activity that increases heart rate and causes one to become out of breath at times. Some examples of physical activities are: sports, playing with friends, walking/biking to school, running, brisk walking, rollerblading, biking, dancing, skateboarding, swimming, soccer, football, and basketball

Place an "X" over the box that indicates your answer.

	Much less	A little less	About the same	A little more	Much More
32. Compared with **other children** of the same age and gender, how much physical activity does your son or daughter get?	5 8	4 8	3 8	2 8	1 8
33. When you were the same age as your child, how much physical activity did you get?	5 8	4 8	3 8	2 8	1 8

The following questions are about the time your child spends doing physical activity. Please use a "0" to indicate no minutes or hours.

How much time (minutes/hours) does your son or daughter spend doing each of the following:	**Minutes**	**Hours**
34. In a typical week and not counting school, how much time per day is your son or daughter physically active outdoors?	_____	_____
35 In a typical day, how much time does your son or daughter watch television, movies, play video games, or use a computer?	_____	_____
36 In a typical day, how much time is your son or daughter engaged in physical activity?	_____	_____

37 Does your child take physical education class in school?

1 8 Yes 0 8 No [***Go to Question 38***]

A. On a typical day, how long is the class? Hours: _____ Minutes: _____

B. How many days per week does your child have class? Days per Week: _____

38. Does your child participate in organized sports or physical activities? ***(Organized means that there is a coach and/or instructor present.)***

1 8 Yes 0 8 No [***Go to Question 39***]

A. Please list all organized sports or physical activities that your son or daughter has participated in over the past year.

_____ _____

_____ _____

_____ _____

39. When not in school, how do you classify your child on a typical day?

1 8 **Sedentary** – Gets very little exercise, walks or runs less than 1/2 mile per day, spends most time sitting, watching TV, using a computer, and/or reading.

2 8 **Slightly Active** – Gets some exercise, walks or runs 1/2 mile to 1 1/2 miles per day, spends more time in active play than watching TV, using computer, or reading.

3 8 **Active** – Is involved in programmed exercise or activities at least twice a week. Walks or runs over 1 1/2 miles per day, spends time playing soccer, football, basketball, softball, swimming, etc.

40. Rate the frequency in the past week which you transported this child to a place where she or he could do physical activity or play sports.

1 8 None *2* 8 Once to Twice *3* 8 Three to Four times *4* 8 Five or more times

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