

ABSTRACT

Title of Dissertation: SOCIO-CULTURAL DETERMINANTS OF PHYSICAL
ACTIVITY AMONG AFRICAN AMERICAN AND
WHITE FEMALE ADOLESCENTS

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Low physical activity is a problem for girls, and particularly African American female adolescents. Low physical activity has been associated with increased risks of cardiovascular disease, hypertension, diabetes, cigarette smoking, premature mortality, and overweight and obesity. Families and communities play an important role in influencing adolescent health; however, few studies have examined how these factors influence adolescent physical activity outcomes. Adopting an ecological theoretical framework, the purpose of this study was to examine the relationship between family factors (maternal control, maternal support, mother-child communication, and family cohesion), a community factor (religiosity, defined as attendance at religious services and religious youth activities) and physical activity among African American and White female adolescents.

Wave I data from the National Longitudinal Study of Adolescent Health was analyzed. The sample includes 736 African American and 1,692 White female adolescents in grades seven through 12. Descriptive statistics were computed for all family and community measures. Logit models were used to evaluate family and

community influences on female adolescents achieving five or more bouts of moderate to vigorous physical activity per week (MVPA); and whether the relationship between maternal control, maternal support, mother-child communication, family cohesion, religiosity, and MVPA was moderated by race.

Maternal control was a significant predictor of MVPA for the total sample and the White female sample, with increased levels of maternal control associated with increased adolescent physical activity. Mother-child communication and religiosity were significantly positively associated with MVPA for African American females only. Maternal support and family cohesion were not found to be significant predictors of adolescent girls' physical activity in any of the models. Race significantly influenced the strength of the relationship between mother-child communication and adolescent MVPA, and between religiosity and adolescent MVPA, with findings revealing a stronger relationship for African American female adolescents than for White female adolescents. Strategies to engage female adolescents in physical activity, particularly African American female adolescents, should focus on increasing mother-child communication and girls' involvement with religious institutions.

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AFRICAN AMERICAN AND WHITE FEMALE ADOLESCENTS

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CHAPTER I: INTRODUCTION

Physical activity is recognized as one of the most important health behaviors in the United States because of its role in preventing chronic health problems. Despite the health benefits of physical activity, reports indicate that the majority of Americans do not engage in regular physical activity (Centers for Disease Control and Prevention [CDC], 2006; CDC, 2007; Jones et al., 1998). In 2005, approximately 53% of adult women and 50% of adult men aged 18 and over did not engage in regular physical activity. This number is exacerbated for minorities, especially African American women. Approximately 64% of African American women and 55% of African American men do not engage in regular physical activity (CDC, 2007). While there is some indication that physical activity levels may be on the rise among adults, racial and ethnic disparities still exist.

Promoting physical activity in youth has been highlighted as an important public health priority (Institute of Medicine [IOM], 2005). Among children and adolescents, physical activity plays a critical role in the prevention of chronic diseases that can occur in adulthood (Gordon-Larsen, Adair, Nelson & Popkin, 2004; Ornelas, Perreira & Ayala, 2007). However, the transition into adolescence is marked by dramatic declines in physical activity, particularly in girls (Caspersen, Pereira & Curran, 2000; CDC, 2004; Kelder, Perry, Klepp & Leslie, 1994; Strauss, Rodzilsky, Burack & Colin, 2001; U.S. Department of Health and Human Services, 1996; Wolf et al., 1993). Further, the number of adolescents who are physically inactive is increasing (Allison, Dwyer & Makin, 1999; CDC, 2006; Sallis, Prochaska & Taylor, 2000; Trost et al., 2002b). Strauss, Rodzilsky, Burack, and Colin (2001) found that children and adolescents ages 10-16 spend 75% of

the day inactive watching television, sitting at the computer, and doing homework. Conversely, only 1.4% of the day was spent in vigorous activity.

In 2005, the recommended levels for physical activity for children and adolescents were increased by the U.S. Departments of Agriculture and Health and Human Services from 30 to 60 minutes of moderate to vigorous physical activity on most days of the week, in part, to reduce the risk of negative health outcomes during the transition to adulthood. Approximately 64% of adolescents are not achieving the most recently recommended levels of physical activity (CDC, 2006).

Overall, male adolescents are more likely than female adolescents (43.8% vs. 27.8%) to meet the current recommended levels of physical activity (CDC, 2006). Minority adolescents, particularly African American girls, have consistently lower levels of physical activity (Andersen, Crespo, Bartlett, Cheskin & Pratt, 1998; CDC, 2006; Gordon-Larsen, McMurray & Popkin, 1999; Heath, Pratt, Warren & Kann, 1994; Kimm et al., 2002). Among adolescent racial/ethnic groups, White adolescents (38.7%) have higher levels of physical activity than African Americans (29.5%) and Hispanics (32.9%).

African American female adolescents have the lowest levels of recommended physical activity compared to all other racial/ethnic groups of male and female adolescents. Kimm et al. (2002) found that between the ages of 9-10 and 16-17 years, median habitual leisure physical activity declined by 100% in African American girls, compared with 64% for White girls. Approximately 79% of African American female adolescents do not meet current guidelines for physical activity (CDC, 2006). Further, 18% of African American females are physically inactive, which is also the highest

among all male and female adolescents. When considering previous recommended levels of physical activity, data indicate that African American females continue to have the lowest levels of physical activity (CDC, 2006). Researchers and practitioners have emphasized this racial/ethnic disparity in female adolescent physical activity, as well as the need to identify factors that might contribute to enhanced physical activity among particular groups of adolescent girls.

The purpose of this study was to examine the influence of socio-cultural factors at the family (i.e., maternal control, maternal support, mother-child communication, family cohesion) and community (i.e., attendance at religious services and religious youth activities) levels on the health-promoting behavior of five or more bouts of physical activity among a sample of African American and White female adolescents. This study also explored the influence of race/ethnicity on the relationships of these socio-cultural factors to physical activity behavior in this sample.

Effects of Physical Activity on Child Health

There has been a broad shift over the last 30 years in the United States as American youth and adults have moved from being physically active to being more sedentary. Children and adolescents who do not engage in enough physical activity or are inactive are more likely to face negative health outcomes as youth and adults (Raitakari et al., 1994). In addition, physical activity habits such as inactivity in adolescence tend to carry over into the adult years (Harris, Gordon-Larsen, Chantala, & Udry, 2006). Youth who participate in regular physical activity have increased levels of physical fitness, bone mass, and psychological well-being. Low levels of physical activity or inactivity among youth have been associated with increased risks of cardiovascular disease, hypertension,

diabetes, cigarette smoking, premature mortality, and overweight and obesity (Baranowski et al., 1992; Gordon-Larsen, Adair & Popkin, 2002; Patrick et al., 2004).

The dramatic increase of overweight among youth, influenced, in part, by physical inactivity, has been a prevalent health concern of parents, communities and larger society. Further, the broad shift over the last 30 years from physically active to more sedentary activities is often cited as one of the causes of increased child overweight (Popkin, 2001). Overweight in children has similar health, emotional, and social consequences as in adults. With respect to health, overweight has been significantly associated with an increased risk of diabetes, hypertension, high cholesterol, sleep apnea, menstrual abnormalities, asthma, and arthritis (IOM, 2005; Mokdad et al., 2003). Emotionally, overweight children suffer from lower self-esteem, negative body image, and depression. Socially, overweight children face stigma, negative stereotyping, discrimination, teasing and bullying, and social marginalization (IOM, 2005).

Since 1980, the percentage of overweight children between the ages of six and 11 has more than doubled, rising from 7% in 1980 to 16% in 2002 (Hedley et al., 2004). For adolescents between the ages of 12 and 19, the percentage of overweight has more than tripled during this same period, rising from 5% to 16%. While the prevalence of overweight among children and adolescents has increased in general, disparities also exist. African American adolescent boys ages 12 to 19 had the highest increase (10% to 18.5%) in overweight prevalence between 1988 and 2004 compared to White and Mexican adolescent boys (Ogden, Flegal, Carroll & Johnson, 2002; Ogden et al., 2006).

For African American adolescent girls ages 12 to 19, the disparity is even more pronounced as 25% are considered overweight compared to 15% and 14% among White

and Mexican American adolescent girls, respectively (Ogden et al., 2002; Ogden et al., 2006). Gordon-Larsen, Adair, and Popkin (2003) found that overweight prevalence increased with higher socioeconomic status among African American female adolescents, but decreased among White female adolescents as socioeconomic status rose. The authors suggest that this may be due to ethnic minority youth not receiving the same economic and social benefits at identical socioeconomic levels as White youth. In addition, Patrick et al. (2004) found that African American girls are more likely to be at-risk of overweight or overweight regardless of socioeconomic status. These findings suggest that factors other than income and education may play a larger role in reducing overweight for African American female adolescents.

Many of the health outcomes related to physical activity, including obesity, could also be addressed through diet. However, using a diverse sample of Hispanic, African American, Asian, and White adolescents ages 11 to 15, Patrick et al. (2004) found that physical activity may play a more important factor than diet in addressing health conditions such as overweight and obesity in adolescents. According to this study, only insufficient vigorous physical activity was significantly associated with higher body mass index for boys and girls ages 11 to 15; poor dietary habits were not significantly related to body mass index outcomes. Thus, this study will focus on moderate to vigorous physical activity among a sample of African American and White female adolescents.

Influences on Adolescent Physical Activity

The determinants of participation in physical activity among adolescents are complex and include a number of demographic, physiological, psychological, environmental, socioeconomic (e.g., income and education) and socio-cultural factors

(Kohl & Hobbs, 1998; Lemmon, Ludwig, Howe, Ferguson-Smith & Barbeau, 2007). Demographic factors that influence physical activity among adolescents include age, gender, and race/ethnicity. Several studies have found that older students or adolescents are less likely to engage in physical activity than their younger peers (Allison & Adalf, 1997; Allison et al., 1999; Anderssen, Wold & Torsheim, 2005; Heath et al., 1994; Lemmon et al., 2007; McMurray, Harrell, Bangdiwala & Hu, 2003). Boys are more likely to participate in physical activity than girls. Minority adolescents, with the exception of Asian females, have higher levels of inactivity than White adolescents (Gordon-Larsen et al., 1999; Kimm et al., 2002).

Physiological factors such as pubertal maturation, growth and aerobic fitness have been linked to physical activity behavior in adolescents. Several studies have found that adolescents who had early (versus later) pubertal maturation were more likely to be sedentary or have lower levels of physical activity (Baker, Birch, Trost & Davison, 2007; van Jaarsveld, Fidler, Simon & Wardle, 2007). Using a sample of non-Hispanic White girls, Baker et al. (2007) found that girls experiencing early pubertal maturation at age 11 reported lower levels of physical activity at age 13 compared to their later maturing peers. Another study postulates that greater physical activity participation in boys in comparison to girls may be due to growth related factors such as linear growth, body proportion, and body composition (Kohl & Hobbs, 1998). In addition, studies have found that aerobic fitness in early childhood is related to regular physical activity in adolescents (Hallal, Wells, Reichert, Anselmi & Victora, 2006; Janz, Dawson & Mahoney, 2000; Kemper, Twisk, Koppes, van Mechelen & Post, 2001; McMurray et al., 2003). McMurray et al. (2003) found that, using a sample of African American and

White youth ages eight to 16, African American and White boys and girls who participated in low levels of physical activity at age eight were more likely to have low levels of physical activity at age 16.

Psychological factors such as motivation, enjoyment, self-efficacy for physical activity, perceived benefits of physical activity, health beliefs, perception of one's fitness level, and sense of personal control have been well documented in the physical activity literature and found to be associated with physical activity (Allison et al., 1999; Dishman et al., 2005; Dishman et al., 2006; Felton et al., 2002; Garcia, Pender, Antonakos & Ronis, 1998; Heitzler, Martin, Duke & Huhman, 2006; Kohl & Hobbs, 1998; Lemmon et al., 2007; Motl et al., 2002; Sallis, Prochaska, Taylor, Hill & Geraci, 1999; Strauss et al., 2001; Trost, Pate, Ward, Saunders & Riner, 1999; Trost et al., 2002a; Ward et al., 2006). For example, in a study of 179 White and 252 African American girls ages 14 to 18, Dishman et al. (2006) found that girls with higher levels of self-efficacy had higher levels of physical activity; girls with lower self-efficacy had lower levels of physical activity. Girls who were overweight and African American girls were found to have lower levels of self-efficacy.

Lemmon et al. (2007) found in a study of African American girls ages eight to 12 that girls who reported higher levels of anxiety and lower self-esteem were less likely to engage in physical activity. In addition, according to Heitzler et al. (2006), based on their national study of over 3,000 multi-ethnic children and adolescents ages nine to 13, children and adolescents who have positive outcome expectations or beliefs about the benefits of participating in physical activity were more likely to participate in both organized and free-time physical activity. Racial and ethnic differences in this study were

not examined. In a study of 201 racially diverse high school girls ages 14 to 18, Neumark-Sztainer, Story, Hannan, Tharp, & Rex (2003) found that adolescent girls with higher perceived time constraints were less likely to engage in moderate to vigorous physical activity than their peers with lower perceived time constraints.

Environmental factors including the availability of school programs, community facilities and programs, home access to equipment and facilities, physical environments, physical safety, and exercise opportunities have all been found to be significant determinants of physical activity in adolescents (Felton et al., 2002; Gordon-Larsen, McMurray & Popkin, 2000; Lindquist, Reynolds & Goran, 1999; Nelson, Gordon-Larsen, Song & Popkin, 2006; Strauss et al., 2001; Ward et al., 2006). Gordon-Larsen et al. (2000) found that participation in school physical education was significantly associated with engaging in moderate to vigorous physical activity for a nationally representative sample of over 17,000 adolescents ages 11 to 21. Specifically, having physical education one to four times per week was associated with an increase of 44% in participating in high levels of moderate to vigorous physical activity. However, at the time of this study, most adolescents in the study (approximately 79%) were not enrolled in physical education.

Adolescents who use community recreation centers are also more likely to engage in moderate to vigorous physical activity than those who do not use these centers (Gordon-Larsen et al., 2000). In their study using data from the National Longitudinal Study of Adolescent Health, Gordon-Larsen et al. (2000) found that using a recreation center was associated with a 75% increase in participating in moderate to vigorous physical activity among adolescents. Ward et al. (2006) found that sports team

participation at school and in the community was associated with higher levels of physical activity among White and African American high school female adolescents.

Studies indicate that high crime levels are associated with a decrease in physical activity among adolescents (Pate, Heath, Dowda & Trost, 1996). African American adolescents are at the greatest risk of living in high crime areas when compared to Hispanic and non-Hispanic White and Asian adolescents (Gordon-Larsen et al., 2000). Molnar, Gortmaker, Bull, and Buka (2004) assessed levels of physical activity of youth ages 11 to 16 using parental assessment of neighborhood safety through a community resident survey. The researchers found that among a racially diverse sample of youth ages 11 to 16 in Chicago, children were physically active for an additional 49 minutes a week in safer neighborhoods as compared to less safe neighborhoods. Gordon-Larsen et al. (2000) also examined seasonal influences of physical activity among a national sample of adolescents and found that there was no significant relationship between month and physical activity patterns, and thus, no evidence of a “seasonality effect.”

Socioeconomic factors such as family income and maternal education have also been linked to physical activity levels. Using data from the National Longitudinal Study of Adolescent Health, Gordon-Larsen et al. (2000) found that adolescents with higher family incomes were more likely to participate in moderate to vigorous physical activity and have lower levels of inactivity. Race/ethnicity was not examined as a moderator; however, the study did find that African American and Hispanic adolescents were more likely than White and Asian adolescents to have low family incomes. The higher the level of maternal education for an adolescent regardless of race/ethnicity, the more likely adolescents were to be involved in high levels of moderate to vigorous physical activity

(Gordon-Larsen et al., 2000). In a sample of racially diverse seventh grade students, Schmitz et al. (2002) found that girls are more likely than boys to be physically active when both parents have completed college regardless of race/ethnicity.

Socio-cultural determinants found to be associated with physical activity include characteristics such as having role models (Davison, Cutting & Birch, 2003; Moore et al., 1991) and activity-related support from family and friends (Anderssen & Wold, 1992; Davison, 2004; Prochaska, Rodgers & Sallis, 2002; Sallis et al., 1999; Sallis et al., 2000). Using a sample of 180 non-Hispanic White nine year old girls and their parents, Davison et al. (2003) found that fathers were more likely than mothers to provide modeling for physical activity, and this behavior was associated with higher physical activity among girls.

There have been numerous studies that have examined activity-related parental support and found it to be positively associated with physical activity among adolescents (Anderssen & Wold, 1992; Davison & Schmalz, 2006; Gustafson & Rhodes, 2006; McGuire, Hannan, Neumark-Sztainer, Cossrow & Story, 2002; Moore et al., 1991; Neumark-Sztainer, Story, Hannan, Tharp & Rex, 2003; Ornelas et al., 2007; Sallis et al., 1992; Schmitz et al., 2002; Strauss et al., 2001; Trost et al., 2003; Ward et al., 2006). In general, boys received more activity-related parental support than girls (Gustafson & Rhodes, 2006; Raudsepp, 2006; Trost et al., 1999). One study that examined racial/ethnic differences among a sample of White and African American high school female adolescents found that activity-related family support was positively associated with physical activity for both White and African American female adolescents, but only for

normal weight African American girls as compared to overweight African American girls (Ward et al., 2006).

Family and parental characteristics such as higher levels of parenting engagement, mother-child communication, and family cohesion were found to be significant predictors of higher levels of physical activity among a nationally representative sample of over 13,000 adolescents in grades seven through 12 (Ornelas et al., 2007). Further, the influence of high levels of mother-child communication and family cohesion increased adolescent self-esteem which, in turn, led to adolescent increased physical activity. In addition, Ornelas et al. (2007) found that female adolescents are more likely than male adolescents to have higher levels of mother-child communication; male adolescents are more likely than female adolescents to have higher levels of family cohesion. Race and ethnic differences were not examined in this study.

Few studies have examined the association between maternal parenting styles and adolescent physical activity. However, in one racially diverse sample of over 3,000 seventh grade students, Schmitz et al. (2002) found that young adolescent girls with mothers demonstrating an authoritative style of parenting characterized by high levels of control and support had higher levels of physical activity than those whose mothers adopted other parenting styles. Higher physical activity in boys was associated with mothers' nonauthoritative parenting style (low levels of control and support). No racial/ethnic outcomes were examined.

In sum, girls at all ages are less physically active than boys. African American female adolescents are the population group at greatest risk for low physical activity or inactivity. African American females are also at higher risk for many of the negative

health outcomes that result from poor physical activity habits and these outcomes often carry over into adulthood. These alarming trends in physical activity and its related health outcomes signify the urgency of developing interventions to help prevent or reduce the sharp decline of physical activity among girls. A critical part of these designs must be a better understanding of the factors that influence physical activity behaviors.

Rationale for the Study

While the body of research examining determinants of physical activity among adolescents has grown over the past decade, our understanding of certain determinants, particularly socio-cultural determinants, is limited. Few studies have examined the influence of family and parental characteristics on female adolescent physical activity; thus, limiting our understanding of the association between these factors and physical activity outcomes for female adolescents. While there has been a plethora of studies examining community influences such as community facilities and programs, neighborhood safety, and school programs on female adolescent physical activity, there is a paucity of research examining the influence of religious institutions, which can play a predominant role in the develop of adolescents, on female adolescent physical activity.

In addition, understanding the culture in which an adolescent exists may play a key role in understanding her physical activity behavior beyond such factors as socioeconomic status. Further, because of the diversity of the United States population, racial groups can be uniquely influenced by culture. Few studies have examined racial/ethnic differences in socio-cultural determinants that may help to better address physical activity among female adolescents, particularly African American female adolescents, who have the highest rates of low activity or inactivity in this age group.

As such, the purpose of this study was to examine the influence of socio-cultural factors at the family and community levels on the physical activity behavior of a sample of African American and White female adolescents. Specifically, this study focused on the family variables of maternal control, maternal support, mother-child communication and family cohesion, and the community variable of religiosity, defined as participation in religious services and religious youth activities. This study also explored the influence of race/ethnicity on the relationships of these socio-cultural factors to physical activity behavior in this sample.

The current study utilized data from the National Longitudinal Study of Adolescent Health (Add Health), a nationally representative study of adolescents in grades seven through 12 in the U.S. Add Health was designed as a multi-stage, stratified, school-based, cluster sampling investigation to ensure that the sample of 80 high schools and their corresponding middle schools was representative of the U.S. population. Wave I in-home interviews were conducted from April to December 1995 with a random sample of approximately 12,000 students. The sample included approximately 200 students from each high school and middle school pair. For this study, wave I data were utilized to examine the influence of family and community level variables on moderate to vigorous physical activity among a sample of African American and White female adolescents.

Research Questions

Focusing on current research gaps related to physical activity, this study expanded the literature on socio-cultural determinants of physical activity among female adolescents by using nationally representative data to address the following questions:

1. Is maternal control associated with moderate to vigorous physical activity among African American and White female adolescents?
2. Is maternal support associated with moderate to vigorous physical activity among African American and White female adolescents?
3. Is communication among African American and White female adolescents and their mothers associated with moderate to vigorous physical activity?
4. Is family cohesion in families of African American and White female adolescents associated with moderate to vigorous physical activity?
5. Does African American and White female adolescents' involvement in religious activities predict moderate to vigorous physical activity?
6. Does race influence the strength of the relationship between maternal control, maternal support, mother-child communication, family cohesion, religiosity, and female adolescents' physical activity behavior?

CHAPTER II: LITERATURE REVIEW

This chapter presents a theoretical framework for this study and a review of the literature on the relationships among maternal parenting behavior, mother-child communication, family cohesion, religiosity, and physical activity. The literature review begins with the theoretical model and is followed by a review of the predictor and outcome variables. The chapter concludes with a summary of the hypotheses being investigated.

Theoretical Framework

Due to the nature of their development, adolescents can be heavily influenced by their social environment including their parents, peers, schools, and religious institutions (Maccoby & Martin, 1983). As such, health behaviors of adolescents such as physical activity may be best addressed by understanding these contextual factors. The ecological systems model guided the current study and was used to examine relationships between potential protective socio-cultural factors such as family characteristics and religiosity and the positive health behavior of moderate to vigorous physical activity among African American and White adolescent girls.

The traditional ecological model asserts that there are many systems that influence an individual's developmental and behavioral outcomes (Bronfenbrenner, 1986). According to ecological theory, social systems are represented by nested systems on four levels of analysis: microsystem, mesosystem, exosystem, and macrosystem. The microsystem refers to settings that directly interact with an individual. In early models of the ecological theory, the child was used as the individual of focus to examine developmental issues. For example, parents, peers, and schools are considered to be

systems that directly influence the development and behavior of a child and adolescent. The mesosystem examines the interrelations of two or more microsystems that may influence individual behavior. An example of this relationship is a school-based intervention that encourages parent involvement in physical activity among youth. The exosystem consists of social structures that influence the microsystems of adolescents indirectly or directly. For example, churches, neighborhood safety, availability of community recreation centers, and parental time constraints due to work could directly or indirectly affect an adolescent's ability to participate in physical activity or organized sports. The macrosystem focuses on the cultural and religious ideologies of a society, which are reflected in its legal or political, economic, and educational systems.

The fifth system of the ecological model, chronosystem, adds the dimension of time to the ecological theoretical framework (Bronfenbrenner, 1986). The chronosystem, which is not examined in this study, addresses life transitions, and intersects the microsystem, mesosystem, exosystem, and macrosystem. Further, the chronosystem refers to the patterning of environmental events and transitions over the life course, examining how effects created by time (e.g., sociocultural conditions) or critical periods (e.g., parental influence in early childhood, peer influence in adolescence) affect child/youth development and adjustment.

Ecological models suggest that there are risk and protective factors in the microsystem, mesosystem, exosystem, and macrosystem for children and adolescents who face poor physical activity outcomes. The four levels are interrelated and may act as a system, with protective factors at one level of the system influencing outcomes at other levels. For example, protective factors have the potential to enhance an individual's

ability to resist stressful events, promoting competence and healthy behavior (Bogenschneider, 1996). Conversely, the more risk factors a child is exposed to, and the more levels that are affected by the risk factors, the greater the likelihood of adverse outcomes in children's physical, social, emotional, and cognitive development (Rutter, 1979).

The ecological model presents general concepts about the level of impact; provides a framework for describing individual change within the context of social change, and identifies the system levels most relevant for a range of health behaviors (McLeroy et al., 1988; Sallis & Owen, 1996). Figure 1 presents influences at four typological nested levels in the ecological model.

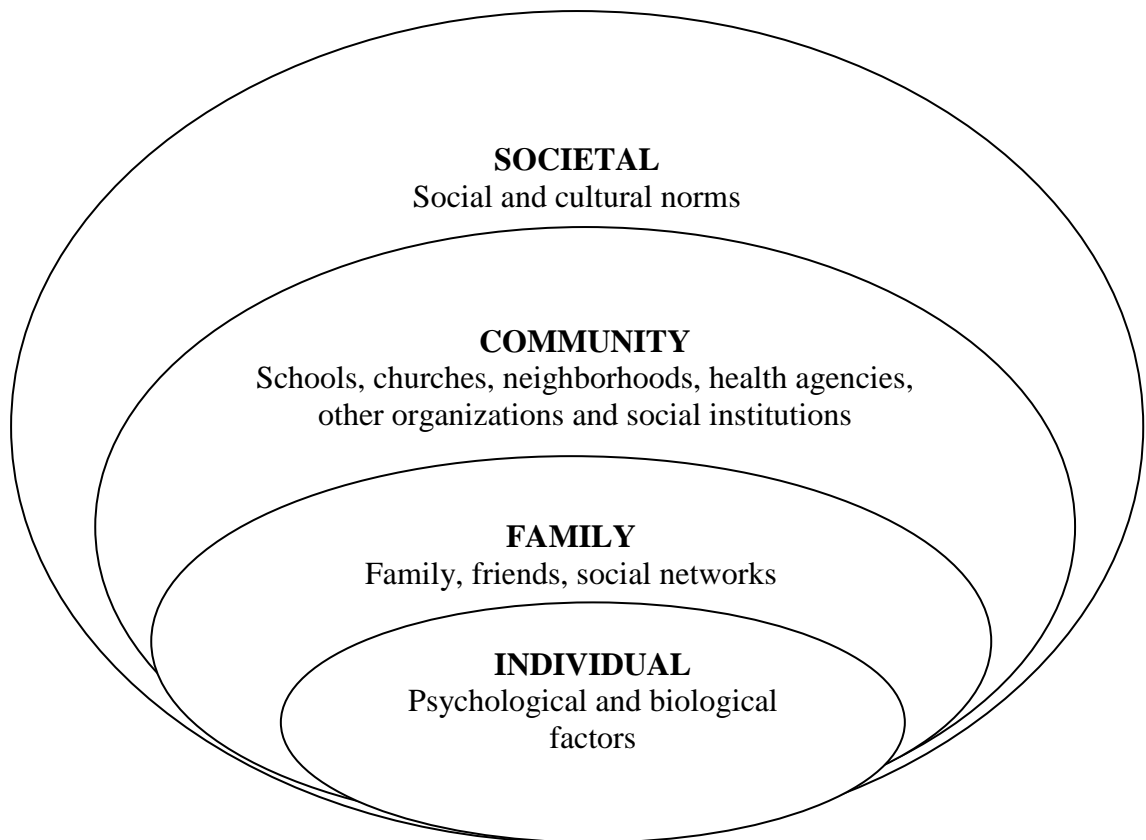


Figure 1. Ecological model.

Research on the determinants of physical activity among adolescents has found that social variables within each of the levels of the ecological model are related to physical activity in adolescents. For example, studies have found that gender, family support, school physical education, and culture (i.e., race) are associated with physical activity levels. However, many studies have neglected to examine the impact of race in broader culture—likened to the societal influences in the ecological model—at the family and community levels. Greater attention to race is important because 1) minority female adolescents, particularly African Americans, face the poorest physical activity outcomes in comparison to other racial-ethnic adolescent groups; and 2) cultural influences of race may have differing effects on physical activity behaviors. Thus, examining racial differences within variables may help to address disparities in physical activity behaviors.

When studying families from different racial/ethnic backgrounds, it is important to consider the broad array of cultural factors that affect individual and family functioning. Garcia Coll et al. (1996) have expanded traditional ecological frameworks by recognizing the impact of macrosystem variables such as race and socioeconomic status. In research examining the developmental competencies of minority children, Garcia Coll et al. integrated variables of social location, including race and ethnicity, into a larger, more culturally sensitive and integrative ecological model. The researchers argued that in order to obtain a more complete understanding of child development and family relationships, one must also consider the effects of such macrosystem influences as racism, prejudice, discrimination, and oppression experienced by families of color (Garcia Coll et al., 1996).

Further, through their work on culturally adapting the traditional ecological model, Garcia Coll et al. posited that health outcomes such as physical activity of minority adolescents are influenced, in part, by an adaptive culture which involves “a social system defined by sets of goals, values, and attitudes that differs from the dominant culture” (p. 1904). Adaptive culture also reflects groups’ prior collective history such as cultural, political, and economic influences and contextual demands placed by promoting and inhibiting environments.

Ogbu (1981) also presented a cultural ecology model which stresses the importance of examining cultural contexts that contribute to individual development, parenting, and family interaction. In studying how family variables influence African American child development, he asserted that researchers must consider the cultural group’s unique cultural and historical roots. For example, African Americans often function as members of extended families or larger kin networks, and these systems influence parents’ ability to parent, nurture, and provide for their children (Ogbu, 1981). The Black church has also been a traditional source of strength and guidance for African American families, fostering spiritual values and providing a social support network (Blank, Mahmood, Fox & Guterbock, 2002).

An ecological framework is useful in conducting research on African American families because it integrates components of ecological theory and risk/protective factors at the individual, family, community, and societal levels (Murry, Bynum, Brody, Willert & Stephens, 2001). This framework can be used in an effort to better understand why some African American female adolescents meet the recommended guidelines for moderate to vigorous physical activity, while other do not.

In sum, this study adopted an ecological model to examine the influence of socio-cultural variables at the family and community levels in predicting moderate to vigorous physical activity of female adolescents, while considering overall cultural norms through use of “race” as a proxy. By examining important factors at the family level including maternal control, maternal support, mother-child communication, and family cohesion, and the community level variable of religiosity (measured by participation in religious services and religious youth activities) within the context of race, this study addressed important research gaps and expanded existing literature examining determinants of physical activity among adolescent females.

Current State of Knowledge

Family Level Characteristics

Adolescence is often characterized as a period marked by growing independence of the child, formation of personal identity, and development of close peer relationships. These transitions can inevitably lead to strained family relations. Yet, studies suggest the family continues to play a key role in adolescent behavioral outcomes despite the growing influence of peer relations (Friedman, 1989; Resnick et al., 1997). Further, using a sample of African American and White adolescents ages 12 to 19, Giordano, Cernkovich, and Demaris (1993) found that African American adolescents maintained more intimate family relationships and less intense peer relations than White teenagers. The researchers concluded that this was due, in part, to African American adolescents’ views that the family offers a safe haven in a world often seen as hostile towards them (Giordano et al., 1993).

Family characteristics that have been found to be associated with adolescent developmental outcomes include parenting behavior, one-on-one parent-child communication, and family closeness (Collins et al., 1997; Neumark-Sztainer, 2005; Woolger & Power, 1993). As such, this study focused on examining maternal control, maternal support, mother-child communication, and family cohesion as familial factors influencing the physical activity of adolescent females.

Maternal Parenting: Control and Support

Parenting behavior has long been considered to be a determinant of adolescent health and well-being (Patterson & Stouthamer-Loeber, 1984). Maccoby and Martin (1983) characterized parenting behavior as the normal variations in parents' attempts to control and socialize their child. Darling and Steinberg (1993) have further defined parenting behavior as a "constellation of attitudes toward the child that are communicated to the child and create an emotional climate in which the parents' behavior is expressed" (p. 493).

Research has found that mothers are more influential than fathers in affecting adolescents' behavior, especially for daughters (Baumrind, 1991b; Cookston & Finlay, 2006). This finding has been attributed to the fact that mothers tend to be more involved in parenting than fathers (Craig 2006; Finley et al., 2008). For example, Craig (2006) found that mothers spent more time alone with children and had more overall responsibility for managing their care. Finley et al. (2008) found that mothers were more involved in several parenting domains such as physical and social development, caregiving, and advising. Cookston and Finlay (2006) found that mothers had higher levels of involvement than fathers during both childhood and adolescence. Furthermore,

daughters tended to report greater involvement with their mothers as compared to their fathers.

Two widely accepted dimensions of maternal parenting are maternal control and maternal support (Baumrind, 1991a; Maccoby & Martin, 1983). Maternal control, also described as maternal demandingness, refers to "the claims parents make on children to become integrated into the family whole, by their maturity demands, supervision, disciplinary efforts and willingness to confront the child who disobeys" (Baumrind, 1991a, p. 62). In contrast, maternal support, also referred to as maternal responsiveness, is defined as "the extent to which parents intentionally foster individuality, self-regulation, and self-assertion by being attuned, supportive, and acquiescent to children's special needs and demands" (Baumrind 1991a, p. 62).

Amato (1990) further characterized maternal control as the number of decisions and rules mothers make for their children, as well as the amount of supervision they exercise. In addition, he characterized maternal support as the mother's expressing interest in her child's activities and enthusiasm about the child's accomplishments, talking with children and spending time with them, providing help with problems and schoolwork, and showing love and affection.

Early research based on these two dimensions suggests that there are four types of parenting styles: permissive, authoritarian, authoritative, and uninvolved (Baumrind, 1991a; Maccoby & Martin, 1983). Permissive parents are characterized as being highly responsive or supportive while displaying low control or demandingness. These parents often fail to set firm limits and allow children to regulate their own behavior. Authoritarian parents provide little support or responsiveness but are highly demanding

and controlling. While they provide well-ordered and structured environments with clearly stated rules, authoritarian parents expect their rules to be obeyed without explanation. Authoritative parents are demanding and responsive. They are characterized as nurturing and providing support while setting firm limits for their child's behavior. Uninvolved parents are seen as being completely opposite of authoritative parents, exhibiting low support and control.

This typological classification of parenting, however, limits understanding of how each dimension uniquely contributes to adolescent physical activity behavior. Thus, there have been several studies that have examined the effects of maternal parenting behavior on adolescent social and psychological outcomes using the two independent dimensions of parenting—maternal control and maternal support. In general, these studies have found that high levels of maternal control and maternal support lead to better behavioral and psychological health among adolescents (Luthar, Cushing, Merikangas & Rounsaville, 1998; Suchman, Rounsaville, DeCoste & Luthar, 2007). In contrast, low levels of maternal control and maternal support have been found to promote anti-social behavior and negative psychological health outcomes among adolescents (Simons, Johnson & Conger, 1994).

For example, in one study by Suchman Rounsaville, DeCoste, and Luthar (2007) involving a diverse sample of mothers and their children ages eight through 16 years, the researchers found that higher levels of maternal control defined by setting limits without being overly intrusive were associated with fewer behavioral problems in school. In addition, higher levels of maternal support defined by affection and warmth were associated with fewer symptoms of anxiety, depression and social stress and higher levels

of self-esteem among children and adolescents. In another study of predominantly White seventh grade students, Simons, Johnson, and Conger (1994) found that low levels of maternal support (e.g., warmth and affection) and maternal control (e.g., monitoring and supervision) were associated with low self-esteem among adolescents.

Culturally, studies have consistently shown that African American mothers tend to exercise higher levels of control when compared to White mothers (e.g., Baumrind, 1991b; Dornbusch, Ritter, Leiderman, Roberts & Fraleigh, 1987). For example, Freeman and Newland (2002) found in an ethnically diverse sample of 9th, 10th, and 11th grade students that African Americans adolescents reported the highest levels of maternal control when compared to European American and Hispanic adolescents. The predominance of contextual factors such as economic stress and a harsh environment among African American families have been found to contribute to the adoption of stricter control behaviors among African American mothers (McLoyd, 1990).

The parenting literature suggests that very high levels of maternal control may contribute to lower adolescent autonomy and other negative behavioral outcomes (Lamborn, Mounts, Steinberg, & Dornbusch, 1991; Steinberg, Mounts, Lamborn & Dornbusch, 1991; Steinberg et al., 1994; Steinberg & Morris, 2001). However, some studies have found that higher levels of maternal control do not necessarily result in negative outcomes for African American children. For example, using an ethnically diverse sample of 14 to 18 year old adolescents, Steinberg et al. (1994) found that high levels of maternal control resulted in poorer academic competence among European American adolescents, but had no effect on academic competence for African American adolescents. In fact, some researchers have found that higher levels of control may be

associated with better outcomes for African American adolescents, particularly those living in high-risk neighborhoods (Baldwin, Baldwin & Cole, 1990; Lamborn, Dornbusch & Steinberg, 1996). Further, Cauce et al (1996) have shown that high maternal control by African American mothers is often appropriate given the conditions in which many African American youth are raised.

Research examining maternal support has found that African American mothers offer levels of support that are similar to those of White mothers (McLoyd & Smith, 2002; Smetana, Abernethy & Harris, 2000). Additionally, African American maternal support characterized by warmth and positive interactions has been positively associated with adolescents' increased levels of self-reliance and valuing of school and teacher support (Lamborn & Nguyen, 2004).

Maternal Parenting and Adolescent Physical Activity Outcomes

Few studies have examined the association between maternal parenting behaviors and physical activity in adolescents. Moreover, there appears to be no existing studies that have examined the independent effects of maternal parenting dimensions of control and support on adolescent physical activity behavior. Schmitz et al. (2002) found that adolescent girls who described their mothers as being authoritative (i.e., high in both control and support) had higher levels of physical activity than girls who described their mothers as being nonauthoritative (i.e., low in both control and support). Racial/ethnic differences were not analyzed in this study.

Other studies examined either relationships between parenting style and young children's outcomes (Arredondo et al., 2006) or relationships between parental/family variables and adolescent outcomes (Heitzler et al., 2006; Ornelas et al., 2007). For

example, Ornelas et al. (2007) likened parental/family variables that they examined (i.e., family cohesion, parental engagement, and mother-child communication) to authoritative parenting style (high control and support) and found that these variables were significantly associated with both male and female adolescents meeting recommended physical activity guidelines. However, neither the unique influences of maternal control and support nor racial/ethnic differences were examined. Arredondo et al. (2006) found that maternal parenting characterized by monitoring, use of reinforcement, appropriate limit setting and discipline among Latino families was associated with increased physical activity among children in kindergarten to second grade compared to children whose parents did not use this style of parenting.

Several studies that have used the two dimensions of maternal parenting (control and support) to examine their influences on child and adolescent outcomes have focused mainly on sexual activity and smoking behaviors (Buhi & Goodson, 2007; Cox, 2007; den Exter Blokland, Hale, Meeus & Engels, 2007; Longmore, Manning & Giordano, 2001). For example, in a nationally representative sample of adolescents ages 12 to 21 years, Cox (2007) found that maternal control and maternal support independently predicted adolescent abstinence from sex. Specifically, higher levels of maternal control and higher levels of maternal support predicted higher proportions of adolescents who were abstinent.

The vast majority of the literature investigating the effects of parenting on child and adolescent health outcomes have focused on drug and alcohol use, obesity, smoking, and sexual behavior using the four parenting styles—authoritative, authoritarian, permissive, and uninvolved (Baumrind, 1991a; Jackson et al., 1994; Jackson et al., 1998;

Miller et al., 1999; O'Byrne et al., 2002; Radziszewska et al., 1996; Rhee et al., 2006). For example, in a diverse sample of ninth grade students, Radziszewska et al. (1996) found that adolescents with authoritative parents were less likely than adolescents with permissive, uninvolved, and authoritarian parents to smoke. Rhee et al. (2006) employed a sample of predominantly White first grade students and found that children of authoritarian mothers had an increased risk of being overweight, compared with children of authoritative mothers. Further, children of permissive and uninvolved mothers were twice as likely to be overweight when compared with children of authoritative mothers.

Overall, research examining adolescent health outcomes suggests that high levels of maternal control and maternal support may be linked to better adolescent outcomes including increased physical activity. Moreover, both African American and White female adolescents may be more likely to participate in increased physical activity under higher levels of maternal control and maternal support.

Mother-Child Communication

Parents who provide an environment for their child that fosters parent-child communication may help their child to engage in more healthy behaviors (Friedman, 1989; Neumark-Sztainer, 2005). While the father-adolescent relationship plays an important role in preventing risky adolescent health behaviors and promoting positive health behaviors (Cookston & Finlay, 2006; Finley et al., 2008), research suggests that adolescents perceive their mothers as initiating more conversations on a host of issues and being more accepting of their opinions than their fathers (Noller & Callan, 1990). Further, Noller and Callan (1990) found that adolescent females reported talking more often with their mothers than their fathers.

To date, the majority of the research on parent-adolescent communication has focused on its influence in preventing or decreasing adolescent risk behaviors (Fasula & Miller, 2006; Guilamo-Ramos, Jaccard, Dittus & Bouris, 2006; Hutchinson, Jemmott, Jemmott, Braverman & Fong, 2003; Miller, Forehand & Kotchick, 1999). In addition, much of this research is based on the adolescents' perspective of communication. This is important because the adolescent's characterization of parent-child communication is more likely to be predictive of behavior than the parent's characterization of such communication (Guilamo-Ramos et al., 2006).

Hutchinson et al. (2003) found that mothers who communicated with their daughters about sex affected their daughters' sexual behaviors in positive ways. For example, higher levels of mother-daughter sexual risk communication were associated with fewer episodes of sexual intercourse and unprotected intercourse at a three month follow-up with African American female adolescents ages 12 to 19 years. Using a nationally representative sample of adolescents in grades seven through 12, Resnick et al. (1997) found that high levels of family communication protected adolescents against health compromising behaviors such as emotional distress, suicidal thoughts and behaviors, low age of sexual debut, violence, and use of cigarettes, alcohol, and marijuana. In a sample of African American and Hispanic adolescents ages 14 to 16, Miller et al. (1999) found that positive general communication between mothers and adolescents was associated with less frequent intercourse and fewer sexual partners. Moreover, higher levels of general mother-adolescent communication were consistently related to lower levels of adolescent sexual behavior than were mother-adolescent communications specifically about sex. As such, the researchers concluded that "general

communication may serve as a proxy of the overall quality of the parent-adolescent relationship” (p. 95).

Cultural influences also play a role in parent-child communication (Smetana et al., 2000). Traditional African American culture values both nonverbal and verbal communication (Kochman, 1981). As such, how a person communicates and the sincerity of that communication can be viewed as more important than what a person says. Smetana et al. (2000) also found support for the premise that family harmony, interconnectedness, genuineness, and affective tone were important elements of African American communication. Thus, sincere, harmonious parent-child communication may be an important predictor of healthy behaviors among African American youth. For example, in a sample of African American male and female adolescents aged 12 to 19 years, Bynum and Kotchick (2006) found that receptive, open mother-child communication was associated with higher self-esteem, fewer depressive symptoms, and less delinquent behavior of adolescents as compared to non-receptive, closed mother-child communication. Further, in examining mother-daughter communication about sexuality among low and middle-income African American mothers and their adolescent daughters ages 12 to 18 years, Pluhar and Kuriloff (2004) found that the sincerity of the communication and the body language used to discuss sex were more important than the content of communication influencing adolescent behavior.

Mother-Child Communication and Physical Activity

Currently, only one study has examined the influence of mother-child communication on the physical activity behavior of adolescents (Ornelas et al., 2007). Using a sample of African American, White, Hispanic, and Asian adolescents ages 12 to

21, Ornelas et al. (2007) found that mother-child communication was a significant predictor of adolescents meeting recommended physical activity guidelines. Specifically, higher levels of mother-child communication were associated with a higher percentage of adolescents engaging in five or more bouts of physical activity for five days a week or more. However, no racial/ethnic differences were investigated. Another study of White, African American and Hispanic adolescent girls ages 13-20 found that positive family communication about diet was associated with non-disordered eating behaviors (characterized by not engaging in fasting or binge eating) among adolescent girls (Mellin, Neumark-Sztainer, Patterson, & Sockalosky, 2004). Overall, the existing literature suggests that mother-child communication can significantly impact adolescent health behaviors including physical activity behaviors.

Family Cohesion

Adolescents who grow up in homes with a high level of family cohesion may be more likely to engage in healthy behaviors than their peers in less cohesive families. Family cohesion has been characterized as “the emotional bonding among family members and the feeling of closeness” (Johnson et al., 2001, p. 306). Such cohesion is often expressed by feelings of belonging and acceptance within the family system. In their work on adolescent and parent perceptions of family cohesion, Noller & Callan (1986) found that parents tend to judge the family as more cohesive than adolescents (Noller & Callan, 1986). However, adolescents still valued cohesion, indicating that a cohesive and supportive family environment was desirable, even though they were dissatisfied with their power and roles within the family system.

In examining family cohesion, Tolan (1988) found that high levels of family cohesion were associated with low levels of anti-social behavior among predominantly White adolescents age 16 to 18 years. Other studies of predominantly White young adolescents ages 11-15 years have found that adolescents' perceptions of low cohesion within their families were associated with heightened feelings of depression and reduced social acceptance (McKeown et al., 1997; Wentzel & Feldman, 1996). Research has also found in a sample of predominantly White adolescents ages 17 to 21 years, that girls face more negative psychosocial outcomes (e.g., depression and distress) than boys when there are disruptions in the closeness of the parent-adolescent relationship (Johnson et al. 2001). Chahal and Tung (2003) found that family cohesion was a significant predictor of the positive well-being of female adolescents aged 12 -14 years in India.

In examining cultural influences, research suggests that strong cultural values and beliefs about helping and giving support encourage cohesiveness in African American families (Williams & Dilworth-Anderson, 2002). One study found that African American adolescents reported more positive relationships with their mothers than White adolescents (Hall & Bracken, 1996). In addition, Watson and Protinsky (1988) found that family cohesion was positively associated with high self confidence among a sample of African American high school students.

Family Cohesion and Adolescent Health Outcomes

As with other parenting characteristics examined in this study, the body of literature addressing the influence of family cohesion on physical activity is limited. In general, family cohesion is a significant factor in adolescents' feeling of control over their own health (Zdanowicz, Pascal & Reynaert, 2004). Several studies have found

family cohesion to be positively associated with physical activity behaviors among adolescents (de Bourdeaudhuij & Van Oost, 1998; Moore & Harre, 2007; Ornelas et al., 2007). For example, de Bourdeaudhuij & Van Oost (1998) found that high levels of family cohesion in adolescents predicted a host of positive health behaviors such as no smoking, limited alcohol use, healthy food choice, more sleeping, and greater physical activity among a sample of Belgium adolescents ages 12 to 22.

Other studies that focused on substance use found that higher levels of family cohesion decreased or delayed use of alcohol, cigarettes, and marijuana in adolescents (Bray, Adams, Getz & Baer, 2001; Duncan, Tildesley, Duncan & Hops, 1995). In a diverse sample of young adolescents in grades six to eight, Bray et al. (2001) found that youth with higher levels of family cohesion had lower alcohol use when compared to adolescents with low levels of family cohesion. Likewise, Duncan et al. (1995) using a sample of predominantly White adolescents ages 11-18 years, found that increases in family cohesion were related to decreases in alcohol, cigarette and marijuana use among the adolescents.

In sum, the current very limited literature on family cohesion and adolescent outcomes suggests that high levels of family cohesion will be associated with higher levels of physical activity among adolescents. Further, African American adolescents may indicate higher perceived levels of family cohesion than White adolescents due to cultural values and beliefs. It is not known, however, whether higher levels of family cohesion will predict higher levels of physical activity among African American female adolescents. This exploratory study sought to fill the gap in the literature by examining the relationship between family cohesion and physical activity.

Community Level

For adolescents, developmental contexts that extend beyond the home and peer group, such as involvement in school, work, and religious institutions, become increasingly important. These institutions are often linked to family and friends who influence adolescents' performance in school, engagement in work, and participation in religious activities (Cairns, Cairns & Neckerman, 1989; Regnerus, 2003; Steinberg & Morris, 2001). Involvement in religious institutions and organizations, in particular, can serve as a vital foundation for an adolescent's developing sense of identity and behavioral outcomes. This section discusses religiosity and its potential influence on adolescent health outcomes.

Religiosity

As evident in today's society and throughout United States history, religious involvement and beliefs play a major role in the lives of Americans (Pargament, 1997). Religiosity has been characterized as the "formal, institutional, and outward expression of the sacred" (Cotton et al., 2006, p. 472). Further, it is often measured by variables such as importance of religion, belief in God, frequency of religious service attendance, frequency of prayer, and/or frequency of meditation (Cotton et al., 2006). For clarification, religiosity differs from spirituality in that spirituality is described as the internal, personal, and emotional expression of the sacred (Cotton et al., 2006; George, Larson, Koenig & McCullough, 2000; Koenig, McCullough & Larson, 2001). Spirituality is often measured by spiritual well-being, peace and comfort derived from faith, spiritual connectedness, and/or spiritual or religious coping (Cotton et al., 2006; Hill & Pargament, 2003).

Research has shown that adolescents find both religious involvement and spirituality to play an important role in their lives (Smith & Denton, 2005; Smith, Denton, Faris & Regnerus, 2002). For example, an estimated 95% of adolescents believe in God, 85% to 95% state that religion is important in their life, 93% believe God loves them, 67% believe in life after death, more than 50% attend religious services at least monthly, more than 50% participate in religious youth groups, and close to half frequently pray alone (Cotton et al., 2006). Gender differences have also been found in studying religiosity. Female adolescents are consistently more religious than male adolescents (Smith et al., 2002).

From a cultural perspective, religious and spiritual beliefs and practices play an important role in the African American community as many African Americans have been raised with and internalized a sense of spirituality (LittleJohn-Blake & Darling, 1993). Studies have also indicated that African Americans express higher levels of religiosity than Whites by participating more often in religious practices such as attendance at religious services and participation in religious study (Johnson, Elbert-Avila & Tulskey, 2005; Koenig, 1998; Levin, Taylor & Chatters, 1994). Among adolescents in 8th, 10th, and 12th grade, Johnston, O'Malley, and Bachman (1999) found that African American teens are more likely than White teens to attend church services regularly (40% vs. 29%) and considerably more likely to indicate that religion has high importance in their lives (55% vs. 24%).

Religiosity and Adolescent Health Outcomes

Religiosity has the potential to influence adolescents' health promoting and health compromising behaviors in a number of ways. For example, religion can provide youth

with a sense of social support, social control, and identity, influencing health related behaviors, which in turn affect adolescent health outcomes, and ultimately, adult morbidity and mortality (Wallace & Forman, 1998). As noted by Jarvis and Northcutt (1987), religiosity can also prescribe healthy behavior and proscribe unhealthy behavior:

“Religious prescription for healthy behavior might include encouragement to eat healthy, nutritious foods; the promotion of proper rest, exercise, and knowledge about bodily functions. On the other hand, proscriptions of unhealthy behaviors might include prohibitions against the use of tobacco, alcohol, and/or other harmful drugs, and the discouragement of immoderate activities such as promiscuous sex” (p. 813).

For example, several studies have found religiosity to be significantly associated with improved physical and mental health among adults (Hixson, Gruchow & Morgan, 1998; Mueller, Plevak & Rummans, 2001; Musick, House & Williams, 2004). Moreover, Schottenbauer, Spernak, and Hellstrom (2007) found that parents’ use of religious coping and family attendance at religious or spiritual programs was significantly associated with improved general and mental health, vocabulary, reading, math, and social skills among a sample of third grade students who formerly participated in Head Start. Parents’ use of religious coping and family attendance at religious programs predicted their children’s well-being above and beyond parenting styles.

Religiosity and spirituality have also been found to be protective factors for adolescents against a number of negative health outcomes such as sexual activity, substance use and abuse, and mental health problems (Amey, Albrecht & Miller, 1996; Bridges & Moore, 2002; Cochran, 1992; Donahue & Benson, 1995; Holder et al., 2000; Miller, Davies & Greenwald, 2000; Miller & Gur, 2002; Nonnemaker, McNeely & Blum, 2003; Pearce, Little & Perez, 2003; Pendleton, Cavalli, Pargament & Nasr, 2002; Regnerus, Smith & Fritsch, 2003; Rostosky, Wilcox, Wright & Randall, 2004; Steinman

& Zimmerman, 2004; Wallace, Brown, Bachman & LaVeist, 2003; Wallace & Forman, 1998; Wills, Yaeger & Sandy, 2003; Wright, Frost & Wisecarver, 1993). Overall, research indicates that higher levels of adolescent religiosity have been associated with lower levels of alcohol and drug use, suicidal thoughts or attempts, depression, violence, and sexual behavior among diverse samples of adolescents between the ages of 12 and 18 years.

In one study that examined the influence of religiosity on adolescent health risk behaviors, Nonnemaker et al. (2003) measured public religiosity by the frequency of attendance at religious services and the frequency of participation in religious youth group activities. Private religiosity was assessed by the frequency of prayer and importance of religion. The researchers found that higher levels of adolescent religiosity were significantly protective against cigarette, alcohol, and marijuana use in a nationally representative sample of 7th to 12th grade students. They also found that public and private religiosity were associated with a lower probability of having ever had sexual intercourse or engaging in violent behavior. High levels of public religiosity among adolescents were significantly associated with lower emotional distress, while private religiosity was significantly associated with a lower probability of having had suicidal thoughts.

Studies examining racial influences of religiosity on health outcomes have been inconsistent. For example, Ellison (1995) and Idler and Kasl (1997) found either no racial differences or stronger effects of religiosity on physical activity for White adults when compared to African American adults. In contrast, using a national sample of adults,

Ferraro and Koch (1994) found that the positive effects of more religious activity on health were strongest among African American respondents.

Few studies have examined the effects of religiosity on adolescent physical activity behaviors. One study using a nationally representative sample of high school seniors found that adolescents with high levels of religiosity, defined by greater attendance at religious services, and perceiving religion as more important in their lives, exercised more frequently than less religious or non-religious adolescents (Wallace & Forman, 1998). Race and ethnic differences were not examined in this study.

There is a clear need for additional research examining the relationship between religiosity and physical activity among adolescents. Current studies suggest that African American female adolescents have higher levels of religiosity than their White peers. Given the limited body of existing research, it was hypothesized that higher levels of religiosity would be associated with higher levels of physical activity among female adolescents.

Moderating Factor: Race

This study examined family and community influences on female adolescent physical activity. Moreover, research suggested that race might play a moderating role on the physical activity outcomes of adolescents (Steinberg et al., 1991). As such, the influence of race was examined within the set of predictor variables used in this investigation.

According to Thornton and White-Means (2000), race embodies “a sense of common origins and cultural or physical sameness” (p. 68). Further, “race is an approximation of an individual’s social position and acts as a proxy measure of

experiences that people are likely to encounter being a member of a group” (Thornton & White-Means, 2000, p. 69). In studying African American families, it is important to recognize the impact that culture has on family structure and processes because culture serves as a source of variation in the development of children and youth (McLoyd, 2004). Due to the unique historical past of many African American families, African Americans have adapted a culture that relies in part on spirituality, communalism (social interconnectedness), and family and fictive kin for social support (Boykin, Jagers, Ellison & Albury, 1997; McAdoo, 1998). In the United States, these collective values and cultural commonalities stand out because of the way in which they contrast with the individualistic values of European Americans (Julian, McKenry & McKelvey, 1994).

Racial Influences on Physical Activity

In general, African Americans have poorer physical activity outcomes than other racial ethnic groups (CDC, 2006; CDC, 2007). Furthermore, poor physical activity behavior has contributed to other poor health outcomes such as hypertension, obesity, and diabetes (Gordon-Larsen et al., 2002). As mentioned earlier, African American female adolescents have the worst physical activity outcomes among the adolescent population. In a nationally representative sample of over 4,000 youth ages eight to 16, Andersen et al. (1998) found that 31% of African American girls report two or fewer bouts of vigorous activity per week compared to 23% of White girls. In another representative study of White, African American, and Hispanic students in grades nine through 12, Heath et al. (1994) found that vigorous physical activity levels decreased significantly by grade for girls in all three race/ethnicity categories, but the largest proportional drop, 21.6% in ninth grade to 9.1% by 12th grade, occurred among African American girls.

As adolescents transition into adulthood they take their habits with them. In fact, research has found that an individual's past history of physical activity is an important correlate of current activity (Dishman, Sallis & Orenstein, 1985). This finding may help to explain why African American women have the lowest prevalence of regular physical activity (36%) compared to all other adults in the general population (CDC, 2007).

The data on physical activity behavior among African Americans, however, does not match attitudes about physical activity. Studies indicate that African American adults and youth alike believe physical activity to have beneficial outcomes and want social support for physical activity (Henderson & Ainsworth, 2003; Kriska & Rexroad, 1998; Nichols-English et al., 2006).

Because African American female adolescents have the worst physical activity behavior outcomes compared to girls from other cultural backgrounds, they stand to gain the most from physical activity prevention efforts. An important step in creating culturally appropriate interventions is identifying and understanding the family and community factors that may influence physical activity behavior in African American female adolescents.

Control Variables

Age and Adolescent Physical Activity Outcomes

Research has consistently shown that physical activity decreases as adolescents grow older (Allison & Adalf, 1997; Allison et al., 1999; Anderssen et al., 2005; Heath et al., 1994; Lemmon et al., 2007; McMurray et al., 2003). However, age has a greater effect on female than male adolescent physical activity. Butcher, Sallis, Mayer, and Woodruff (2008) found in a national sample of adolescents age 14 to 17 years that age

was a significant correlate of physical activity prevalence for females, but not males. Further, as female adolescents progressed from 9th to 12th grade their levels of physical activity significantly declined by approximately 78%. Research examining data from the National Longitudinal Study of Adolescent Health has also consistently found that younger adolescent females are more likely to engage in physical activity more times per week when compared to older adolescent females (Gordon-Larsen et al., 2000; Richmond, Hayward, Gahagan, Field & Heisler, 2006). For the current study, age was used as a control variable due to the plethora of studies that have found a significant relationship between age and adolescent physical activity and because age was not a variable of interest for this study.

Socioeconomic Status and Adolescent Physical Activity Outcomes

Parental socioeconomic status (SES) has also been found to be associated with a host of health and socio-emotional outcomes for children throughout their development (Bradley & Corwyn, 2002). The majority of studies examining adolescent physical activity have used parental education, employment status, and family income as measures of SES. However, research examining each of these variables separately has been inconsistent in finding associations with adolescent physical activity behavior (Ferreira et al., 2006).

In examining effects of maternal education on adolescent physical activity, several studies found a positive association between maternal education and adolescent physical activity (Gordon-Larsen et al., 2000; Ornelas et al., 2007; Schmitz et al., 2002). For example, in a nationally representative sample of adolescents, Gordon-Larsen et al. (2000) found that higher levels of maternal education were associated with higher levels

of moderate to vigorous physical activity among male and female adolescents, regardless of race/ethnicity.

However, one study found no significant association between maternal education and physical activity among a sample of urban adolescent females aged 12 to 21 years (Saxena, Borzekowski & Rickert, 2002). This finding was probably influenced by the small sample size (N=305) of the study in comparison to national studies or larger studies that have found a positive association. The educational level of fathers has not been found to be associated with adolescent physical activity in a sample of nine to 15 year old Finland boys and girls (Yang, Telama & Laakso, 1996).

Similar to the factor of education, there is also conflicting research on the effects of employment status on adolescent physical activity (Aarnio, Winter, Kujala & Kaprio, 2002; Lasheras, Aznar, Merino & Lopez, 2001; Schmitz et al., 2002). For example, Schmitz et al. (2002) found in a diverse sample of U.S. seventh grade students that boys with at least one working parent had higher levels of physical activity. There was no association between parental occupational status and physical activity for girls. In another study with a sample of Spanish youth ages six to 15 years, children were more physically active when the head of the household was employed (Lasheras et al., 2001).

In a study of Finnish adolescent twins, the mother's occupational status was found to be associated with regular physical activity for males, but not females (Aarnio et al., 2002). The father's occupational status had no association with male or female adolescent physical activity. Furthermore, several studies have found no association between mother's or father's occupational status and adolescent physical activity (Karvonen & Rimpela, 1997; Vilhjalmsson & Thorlindsson, 1998; Yang et al., 1996). In general, the

research suggests that employment status of the mother or father is not associated with female adolescent physical activity, but may have an influence on male physical activity behavior.

Some studies using national samples of adolescents have found that income was positively associated with adolescent physical activity (Gordon-Larsen et al., 2000; Lee & Cubbin, 2002; Lowry, Kann, Collins & Kolbe, 1996). For example, one study utilizing data from the National Longitudinal Study of Adolescent Health found that adolescents from middle-income households with an income between \$26,200 and \$50,000 and from high-income households with an income equal to or greater than \$50,000 were more likely to have high levels of moderate to vigorous physical activity than those from low-income households with income of less than \$26,200 (Gordon-Larsen et al., 2000). Another study using a national sample of youth aged 12 to 21 years also found that adolescents from high-income homes with an income equal to or greater than \$35,000 participated in more physical activity than adolescents from low-income homes with an income of less than \$35,000 (Lee & Cubbin, 2002). In contrast, several studies have found no association between family income and adolescent physical activity behavior (Higgins, Gaul, Gibbons & Van Gyn, 2003; Lasheras et al., 2001; Sweeney, Glaser & Tedeschi, 2007).

In all, research examining the influences of socioeconomic status on adolescent physical activity suggests that parent education, maternal employment status, and household income may influence adolescent physical activity outcomes. As such, these variables were used as controls for this study because they were not variables of interest.

Family Structure and Adolescent Physical Activity Outcomes

Other research has found positive or negative associations between family structure and physical activity behavior. For example, in a national sample of students in grades one through 12, Sallis, Taylor, Dowda, Freedson, and Pate (2002) found that male students in a single-parent household were more likely to participate in exercise than male students in a two-parent household. There was no association found between family structure and physical activity for female students. Lindquist et al. (1999) found in a sample of African American and White children ages six to 13 years of age that children with single parents reported less exercise received in school physical education classes and more days per week of other exercise than those in two-parent families. The researchers suggested that this conflict may have been due to lack of parental supervision which was likely to increase play outside of the home.

In another study of Greek students ages 11 to 16 years, students who reported growing up with one or no parent were less likely to participate in exercise than students who lived in a two-parent household (Theodorakis, Papaioannou & Karastogianidou, 2004). However, numerous other studies have found no significant association between family structure and adolescent physical activity (Gillander & Hammarstrom, 2002; Hoefler, McKenzie, Sallis, Marshall & Conway, 2001; Karvonen & Rimpela, 1997; Sallis et al., 1999; Wagner et al., 2004). While the research examining the influence of family structure on adolescent physical activity behavior is inconsistent, studies suggest that family structure may be associated with adolescent physical activity. As such, family structure was utilized as a control variable since it was not a variable of interest for this study.

Research Definitions

This study examined the relationship between selected family factors, a community factor, and adolescent physical activity among African American and White female adolescents. Following are definitions of the variables that were examined in this investigation.

Independent Variables

Maternal Control

The degree to which the adolescent described her mother as monitoring and setting limits for her behavior.

Maternal Support

The degree to which the adolescent perceived her mother as providing warmth, love, and attention to the adolescent's needs.

Mother-Child Communication

The degree to which the adolescent discussed with her mother general issues important to the adolescent.

Family Cohesion

The degree to which the adolescent perceived emotional bonding and closeness among family members.

Religiosity

The adolescent's frequency of attending religious services and religious youth activities.

Moderator Variable

Race

Race of the female adolescent.

Control Variables

Adolescent Age

Age of the female adolescent in years.

Parent Education

Highest level of education attained by either parent, categorized by four groups: no high school degree, high school or GED, some college, and college degree or beyond.

Maternal Employment Status

The current working status of the mother, categorized by three groups: full-time, part-time, and unemployed/retired.

Household Income

The total household income reported by the parent of the adolescent, categorized by three groups: low-income (less than \$26,199), middle-income (\$26,200 - \$49,999), and high-income (\$50,000 and above).

Family Structure

Single-parent or two-parent household as reported by the adolescent.

Dependent Variable

Physical Activity

The total weekly bouts of moderate to vigorous physical activity (MVPA) measured at wave I as reported by the adolescent.

Summary of Research Questions and Hypotheses

Six research questions and 16 specific hypotheses were proposed for this study and summarized below:

1. Is maternal control associated with moderate to vigorous physical activity [MVPA] among African American and White female adolescents?

Hypothesis 1a: Increased levels of maternal control will be associated with more MVPA among all female adolescents.

Hypothesis 1b: Increased levels of maternal control will be associated with more MVPA for both African American and White female adolescent subsamples.

2. Is maternal support associated with MVPA among African American and White female adolescents?

Hypothesis 2a: Increased levels of maternal support will be associated with more MVPA among all female adolescents.

Hypothesis 2b: Increased levels of maternal support will be associated with more MVPA for both African American and White female adolescent subsamples.

3. Is communication among African American and White female adolescents and their mothers associated with MVPA?

Hypothesis 3a: Increased levels of mother-child communication will be associated with more MVPA among all female adolescents.

Hypothesis 3b: Increased levels of mother-child communication will be associated with more MVPA for both African American and White female adolescent subsamples.

4. Is family cohesion in families of African American and White female adolescents associated with MVPA?

Hypothesis 4a: Increased levels of family cohesion will be associated with more MVPA among all female adolescents.

Hypothesis 4b: Increased levels of family cohesion will be associated with more MVPA for both African American and White female adolescent subsamples.

5. Does African American and White female adolescents' involvement in religious activities predict MVPA?

Hypothesis 5a: Increased levels of adolescent religiosity will be associated with more MVPA among all female adolescents.

Hypothesis 5b: Increased levels of adolescent religiosity will be associated with more MVPA for both African American and White female adolescent subsamples.

6. Does race influence the strength of the relationship between maternal control, maternal support, mother-child communication, family cohesion, religiosity, and female adolescents' physical activity behavior?

Hypothesis 6: Race will moderate the predictive relationship of maternal control, maternal support, mother-child communication, family cohesion, and religiosity influences on adolescent physical activity behavior.

Hypothesis 6a: The relationship between maternal control and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.

Hypothesis 6b: The relationship between maternal support and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.

Hypothesis 6c: The relationship between mother-child communication and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.

Hypothesis 6d: The relationship between family cohesion and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.

Hypothesis 6e: The relationship between religiosity and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.

CHAPTER III: METHODS

Data

This study used secondary data from wave I of the National Longitudinal Study of Adolescent Health (Add Health). The Add Health study is funded by the National Institute of Child Health and Human Development through the Carolina Population Center, University of North Carolina at Chapel Hill, and receives cooperative funding from 17 other federal agencies. Add Health is considered the most comprehensive and largest survey of adolescents ever conducted in the U.S.

As a nationally representative study of adolescent students in grades seven to 12 in the United States, Add Health began collecting data in 1994-1996. Add Health data are based on a stratified, random sample of high schools in the United States (Harris et al., 2006). In order to retain numbers of participants in each grade over time in the study, each high school was matched with a 7th/8th grade “feeder” school that was also recruited for the study. Schools were stratified into clusters by region, urbanicity, school size, school type (private, public, parochial), and racial mix to ensure diversity in the sample. Over 70% of the randomly selected schools agreed to participate in the study. The individual response rate within the clustered school samples was 78%.

Data collection for wave I occurred in two phases: the in-school questionnaire completed by students in school, and the in-home survey completed by students and one parent in the home. The Add Health study preferentially chose mothers to participate in parent interviews because of previously documented evidence that mothers are more familiar than fathers with the social and health issues of their children. The in-school surveys were completed by over 90,000 youth from approximately 130 schools in 80

different communities across the country in 1994-1995. School administrators were also asked to complete a survey about the school climate, policies, and student body at that time.

The second phase of wave I, completed in 1995, consisted of in-depth interviews lasting one to two hours with the student (student survey) and a parent (parent survey) in the student's home. This in-home sample consisted of a core sample of about 12,000 nationally representative students and additional special samples of groups such as twins and disabled youth to ensure large enough sample sizes for subgroup analyses. One year later, in 1996, the in-home student, parent, and school administrator surveys were repeated, and these data constitute wave II. The in-school survey was not repeated in wave II. Response rates for wave I and II in-home interviews were 79% and 88%, respectively. Wave III Add Health data were released in 2005, and wave IV and V are under development.

Wave I of the in-home student survey was completed by adolescents and the parent survey was completed by a parent or guardian, usually the mother. Add Health data are available in both a public use version and a restricted version. The data for this study was drawn from the former.

Sample

A subsample of Add Health consisting of only non-Hispanic African American and non-Hispanic White female adolescents at wave I was analyzed to respond to the research questions of this study ($N = 2,428$). The mean age of the female adolescents is 16 years. Due to purposive oversampling of certain groups in the research design, normalized weights were used for all samples to allow for generalization to the U.S.

population of students in grades seven through 12. Pregnant females were excluded from the analyses as well as disabled adolescents who used a walking aid device (e.g., cane, crutches, or wheelchair).

Measures

The student in-home survey and the parent survey source question items that were utilized for this study were developed and tested by the Add Health research team at University of North Carolina at Chapel Hill during the survey development phase of the study. The variables of interest that were constructed and recoded for use in this study include: predictor variables (maternal control, maternal support, mother-child communication, family cohesion, religiosity), control variables (adolescent age, parent education, maternal employment status, household income, family structure), moderator variable (race), and outcome variable (moderate to vigorous physical activity). All survey items used for this study are summarized in Appendix A. These variables and constructs were operationalized using items from the Add Health data as described below.

Demographic Variables

Demographic variables, used as controls, includes adolescent's age, parent education, maternal employment status, household income, and family structure as a proxy for socioeconomic status. Unfortunately, region and urbanicity variables, appearing on the school administrator survey, were not available in the public use version of Add Health.

Adolescent Age

The age of the adolescent at interview was calculated by subtracting the birth year and month from the year and month of the interview (converting difference in years to months first, subtracting the -/+ difference in months, and converting back to years). The final calculated age was rounded to tenths.

Parent education

The education level of parents was the highest level of education achieved by either mother or father. Data were taken first from the parent survey and secondly from identical question items found on the student in-home student survey to replace missing data from the parent survey. Responses were coded into four groups representing highest level of parental education: no high school degree, high school or GED, some college, and college degree or beyond.

Maternal Employment Status

Maternal employment status was taken from the parent survey. The mother indicated whether she was currently working full-time, part-time, or unemployed/retired.

Household Income

Household income was taken from the parent survey. Parents indicated the total income for the household in 1994 before taxes. A categorical variable was created for low (\$0-\$26,199), middle (\$26,200-\$49,999), and high-income (\$50,000 and above) households.

Family Structure

Family structure was constructed using the adolescent's report on current household members. A dichotomous variable was created for single-parent (lives with

one parent) and two-parent households (lives with two parents including biological, adoptive, or step parent).

Predictor Variables

The socio-cultural variables that were used as predictor variables include maternal control, maternal support, mother-child communication, family cohesion, and religiosity. All predictor variables were taken from wave I data.

Maternal Control

For maternal control, adolescents were asked if their parents let them make their own decisions about such issues as “the time you must be home on weekend nights,” “the people you hang around with,” and “what you wear.” The seven items for this construct were reversed coded and summed so that a low score reflected low maternal control and high score reflected high maternal control. Scores on the maternal control scale ranged from 0=low to 7=high. Cronbach’s alpha for this measure was .61.

Maternal Support

For maternal support, adolescents responded to five items indexing the level of maternal warmth and caring. Sample items included, “How close do you feel to your mother,” “How much do you think your mother cares about you?,” “Most of the time your mother is warm and loving toward you,” “You are satisfied with the way your mother and you communicate with each other,” and “Overall, you are satisfied with your relationship with your mother.” Responses to these items were summed to create a support scale for each adolescent’s mother. Scores for the maternal support scale ranged from 5=low to 25=high. Thus, a high score reflected high maternal support and low score reflected low maternal support. Cronbach’s alpha for the maternal support scale was .86.

Mother-Child Communication

Mother-child communication was calculated as the sum of four types of communication that the adolescent had with her primary female caregiver in the last four weeks, including talking with her about dating, a personal problem, school work, and other things related to school. Scores for this scale ranged from 0= low to 4= high. Cronbach's alpha for the measure was .55.

Family Cohesion

Family cohesion was measured by summing responses to adolescent reports for three items addressing how much people in their family understand the adolescent, how much the adolescent and her family have fun together, and how much the family pays attention to the adolescent. Scores on each item ranged from 1 = not at all to 5 = very much, with total scores ranging from three to 15. Cronbach's alpha for the family cohesion scale was .80.

Religiosity

For each adolescent at wave I, a religiosity index was calculated based on the responses to two items. Specifically, religiosity was defined as attendance at religious services and religious youth group activities. The items are, "In the past 12 months, how often did you attend religious services?" and "In the past 12 months, how often did you attend special activities organized by churches, synagogues and other places of worship such as youth groups, bible classes, or choir?" The scale for this variable was reverse coded so that low scores indicated low religiosity and high scores indicated high religiosity. The two items were answered using a four-point Likert response scale ranging

from 0 = never to 3= once a week or more, with total scale responses ranging from zero to six. Cronbach's alpha for the two item religiosity scale was .71.

Moderator Variable

Race

This study only examined a subset of data for African American and White female adolescents. Respondents for Add Health were permitted to mark more than one race/ethnic identification on the survey. To construct the race variable needed for this study, first adolescents who indicated that they were of Hispanic origin were filtered out from the dataset. Then adolescents who marked only one race identification for Asian, American Indian, and Other were filtered out and removed from the dataset. The final race variable was constructed by forcing a single race designation based on the following order: African American and White. A dichotomous variable was created where 0 indicated a White female adolescent and 1 indicated an African American female adolescent. Race was treated as a background variable for logistical regression analyses and was also used to examine the effects of the predictor variables on the outcome variable and to examine interaction effects.

Outcome Variable

Physical Activity

The primary outcome of interest is total weekly bouts of moderate to vigorous physical activity [MVPA], measured at wave I. This outcome was derived using a standard seven-day physical activity recall scale administered to adolescents. Questions were worded, "During the past week, how many times did you...," followed by a list of activities, allowing calculation of the number of physical activity bouts per week. MVPA

activities included skating, cycling, exercise and active sports, and had an estimated energy cost of five to eight METs (metabolic equivalent values; 1 MET = resting metabolic rate, or 3.5 ml O₂ body weight/minute). An indicator variable was created where one indicated that they met the 1995 national recommendations for physical activity of at least 30 minutes of MVPA for five or more weekly bouts and 0 indicates that they did not meet the 1995 national recommendation. This comparison was more appropriate than comparison to the 2005 recommendations by the U.S. Departments of Agriculture and Health and Human Services of 60 minutes or more of MVPA for five or more weekly bouts since data for this study were collected during the period of the 1995 recommendations.

Data Screening Procedures

Standard data screening and variable preparation procedures used by Tabachnick and Fidell (2001) were followed prior to analysis. Missing data were inspected for the percentage missing; they were then replaced with identical information from other survey items, substituted with median data, deleted casewise or deleted listwise prior to analysis. Multicollinearity of predictor variables was assessed by examining tolerance and variance inflation factor (VIF) values. Reliability analysis was performed on each composite variable to obtain a Cronbach's alpha for all scales. The processes for preparing variables for this analysis consisted of the following:

- Examined the variable distribution for outliers and normality,
- Checked items for directionality and reverse coded items as needed,
- Recoded and constructed scale or summed variables,

- Obtained Cronbach's alpha correlations on composite variables (e.g., maternal control, maternal support, mother-child communication, family cohesion, religiosity) to determine internal consistency,
- Made decisions about cut points for dichotomous categories as needed, and
- Addressed missing data issues with appropriate procedures, as described in chapter four.

Data Analysis for Complex Survey Design

All data screening and variable preparation were performed using Add Health survey weights in SPSS version 16.0. The prepared data set was then transferred to STATA(SE) version 10.0 with Stat Transfer to perform all collinearity and multivariate analyses. By entering the cluster variable provided by the Add Health research team, STATA is able to account for the complex survey design of Add Health and to estimate more conservative standard errors accordingly. All data utilized for this study was collected from the adolescent or their parent and as such represents an individual level of analysis to test the association between the predictor variables and outcome variable.

Multivariate analyses consisted of direct or simultaneous logistic regression due to the dichotomous nature of the dependent variable and an analysis of interaction (moderator) effects. First, models were estimated for each predictor variable individually in order to observe the effects of each. Then models were estimated with all predictor variables entered together. A third estimation was done for African American and White female adolescents separately. Finally, an analysis of interaction for race and each of the predictor variables was conducted. Control variables were entered into each of the logistic regression models. Analytic strategies for testing specific hypotheses are

summarized in Table 1, followed by detailed descriptions. Odds ratios are reported for this analysis. An odds ratio greater than 1.0 indicates that the outcome is more likely in the presence of the predictor variable than in the absence of the predictor variable. An odds ratio less than 1.0 indicates an outcome is less likely in the presence of the predictor variable than in the absence of the predictor variable.

Table 1

Summary of Hypotheses and Analytic Strategies

Hypotheses	Analytic Strategy
<p>1a) Increased levels of maternal control will be associated with more moderate to vigorous physical activity [MVPA] among all female adolescents.</p> <p>1b) Increased levels of maternal control will be associated with more MVPA for both African American and White female adolescent subsamples.</p>	<p>1) Logistic regression predicting MVPA at wave I from maternal control at wave I, controlling for background factors.</p>
<p>2a) Increased levels of maternal support will be associated with more MVPA among all female adolescents.</p> <p>2b) Increased levels of maternal support will be associated with more MVPA for both African American and White female adolescent subsamples.</p>	<p>2) Logistic regression predicting MVPA at wave I from maternal support at wave I, controlling for background factors.</p>
<p>3a) Increased levels of mother-child communication will be associated with more MVPA among all female adolescents.</p> <p>3b) Increased levels of mother-child communication will be associated with more MVPA for both African American and White female adolescent subsamples.</p>	<p>2) Logistic regression predicting MVPA at wave I from mother-child communication at wave I, controlling for background factors.</p>
<p>4a) Increased levels of family cohesion will be associated with more MVPA among all female adolescents.</p> <p>4b) Increased levels of family cohesion will be associated with more MVPA for both African American and White female adolescent subsamples.</p>	<p>4) Logistic regression predicting MVPA at wave I from family cohesion at wave I, controlling for background factors.</p>
<p>5a) Increased levels of adolescent religiosity will be associated with more MVPA among all female adolescents.</p> <p>5b) Increased levels of adolescent religiosity will be associated with more MVPA for both African American and White female adolescent subsamples.</p>	<p>5) Logistic regression predicting MVPA at wave I from religiosity at wave I, controlling for background factors.</p>
<p>6) Race will moderate the predictive relationship of maternal control, maternal support, mother-child communication, family cohesion, and religiosity influences on adolescent physical activity behavior.</p> <p>6a) The relationship between maternal control and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.</p>	<p>6) Logistic regression predicting MVPA at wave I from the interaction of race and each predictor variable (race x maternal control; race x maternal support; race x mother-child communication; race x family cohesion; and race x religiosity), controlling for background factors.</p>

Hypotheses	Analytic Strategy
6b) The relationship between maternal support and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	
6c) The relationship between mother-child communication and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	
6d) The relationship between family cohesion and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	
6e) The relationship between religiosity and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	

Hypotheses 1 through 5: Predicting moderate to vigorous physical activity from maternal control, maternal support, mother-child communication, family cohesion, and religiosity.

Hypotheses one through five were assessed using logistic regressions to predict the relationship between maternal control, maternal support, mother-child communication, family cohesion, and religiosity variables and physical activity behavior of African American and White female adolescents. This model included the control variables of adolescent age, parent education, maternal employment status, household income, and family structure.

Hypothesis 6: Race and moderating effects

Logistic regression was used for this model to examine race as a moderator of the relationship between maternal control, maternal support, mother-child communication, family cohesion, religiosity and moderate to vigorous physical activity [MVPA] by adding the following interaction terms to the respective models tested for hypothesis one through five: race x maternal control; race x maternal support; race x mother-child

communication; race x family cohesion; and race x religiosity. The reference group was African American female adolescents. Race, as a moderator variable, was expected to affect the strength of the correlation between the predictor variables and outcome variable (Baron & Kenny, 1986). Standard procedures were followed in each model: the outcome variable (MVPA) was regressed first on the controls, followed by the respective predictor variables (maternal control, maternal support, mother-child communication, family cohesion, or religiosity), the moderator variable (race), and finally each interaction (predictor variable x race). It was expected that race would strengthen the relationship between family and community factors and physical activity behavior for African American female adolescents, but not for White female adolescents.

The conceptual diagram in Figure 2 summarizes the relationships that are examined in this study. The numbers represent the hypotheses relevant to each relationship and correspond to the summary of analytic strategies outlined in Table 1.

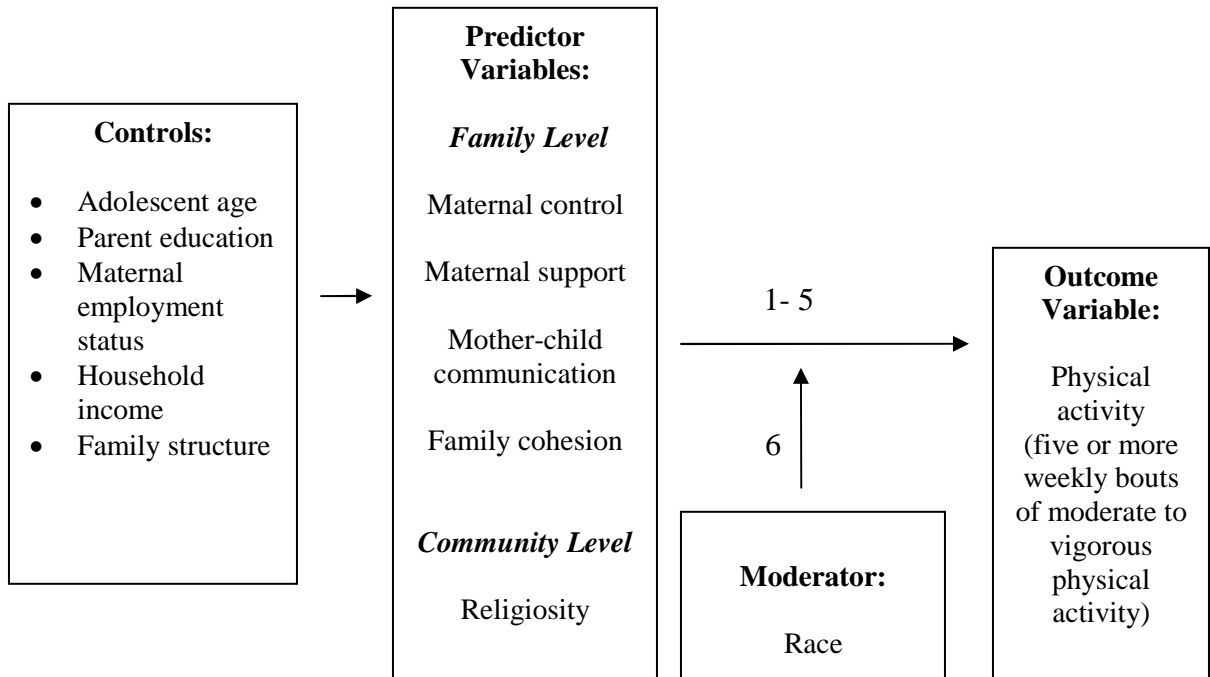


Figure 2. Conceptual diagram of proposed prediction of physical activity.

CHAPTER IV: RESULTS

This chapter begins by presenting descriptive statistics for the sample and all study variables. Included is a summary of the characteristics of female adolescents who engaged in five or more bouts of physical activity per week, both as a total group and by race. Bivariate relationships between all study variables are also shown.

The chapter then presents results of direct logistic regression analyses to answer the six research questions for this study. Data were analyzed using STATA(SE) 10.0. Each proposed hypothesis was evaluated, and a summary of all results is found at the end of this chapter. Together the six research questions aimed to explore the degree to which socio-cultural factors at the family (i.e., maternal control, maternal support, mother-child communication, family cohesion) and community (i.e., religiosity) levels may serve a protective role in promoting the behavior of increased physical activity among a sample of African American and White female adolescents. This study also explored the influence of race/ethnicity on the relationships of these socio-cultural factors to physical activity behavior in this sample of adolescents.

Demographic Characteristics of the Sample

Univariate descriptive statistics such as means, frequencies, standard deviations, distribution attributes, and missing values for each variable and the composite variables were obtained using SPSS statistical package 16.0. Variables assessed included control, predictor, and outcome variables.

Table 2 describes the demographic variables for the entire sample and by race. The sample consisted of 736 African American and 1,692 White female adolescents,

Table 2

Descriptive Statistics of Sample, Total and by Race

Variable	Total (<i>N</i> = 2428)		African American (<i>n</i> = 736)		White (<i>n</i> = 1692)	
	<i>M</i>	<i>N</i> (%) ^a	<i>M</i>	Frequency (%) ^a	<i>M</i>	Frequency (%) ^a
Age	16	2428	16	736 (30.3)	16	1692 (69.7)
Parent education		2331		700 ^{***}		1631
No high school degree		237 (10.2)		102 (14.6)		135 (8.2)
High school or GED		998 (42.8)		255 (36.4)		743 (45.6)
Some college		425 (18.2)		125 (17.9)		300 (18.4)
College degree or beyond		671 (28.8)		218 (31.1)		453 (27.8)
Maternal employment status		2106		608 ^{***}		1498
Full-time		1238 (58.8)		412 (67.8)		826 (55.1)
Part-time		324 (15.4)		56 (9.2)		268 (17.9)
Unemployed/ Retired		544 (25.8)		140 (23.0)		404 (27.0)

Variable	Total (<i>N</i> = 2428)		African American (<i>n</i> = 736)		White (<i>n</i> = 1692)	
	<i>M</i>	<i>N</i> (%) ^a	<i>M</i>	Frequency (%) ^a	<i>M</i>	Frequency (%) ^a
Household income (\$)	47,832	2428	33,951	736 ^{***}	53,870	1692
Low-income (\$0-\$26,199)		552 (22.7)		232 (31.5)		320 (18.9)
Middle-income (\$26,200- \$49,999)		1099 (45.3)		360 (48.9)		739 (43.7)
High-income (\$50,000 and above)		777 (32.0)		144 (19.6)		633 (37.4)
Family structure		2262		668 ^{***}		1594
Single-parent household		598 (26.4)		296 (44.3)		302 (18.9)
Two-parent household		1664 (73.6)		372 (55.7)		1292 (81.1)

Note. All values are weighted to provide national estimates among adolescent girls.

^aPercentages exclude missing data.

^{***}Difference between African American and White females significant at $p < .001$.

respectively. The ages of the female adolescents ranged from 12 to 21 years with an average age of 16 years. While the majority of adolescents had a least one parent that graduated from high school (90%), many of the female adolescents had at least one parent who had a college degree or beyond (29%). In examining the employment status

of the mothers of female adolescents, 59% had a full-time job, 15% had a part-time job, 26% were unemployed/retired. Approximately 23% of the female adolescents lived in a household with an income less than \$26,199, 45% lived in a household with an income between \$26,200 and \$49,999, and 32% lived in a household with an income of \$50,000 or more. In exploring the family structure of the sample, approximately 74% of female adolescents lived in two-parent households and 26% lived in single-parent households.

When examining the sample by race, chi-square analysis found that characteristics for African American and White female adolescents differed significantly in terms of parent education, maternal employment status, household income, and family structure, $\chi^2(3, N = 2331) = 30.62, p = .00$; $\chi^2(2, N = 2106) = 35.51, p = .00$; $\chi^2(2, N = 2428) = 90.02, p = .00$; $\chi^2(1, N = 2262) = 155.70, p = .00$, respectively. For example, 85% of African American and 92% of White female adolescents had at least one parent who graduated from high school or had a GED. Both African American and White female adolescents had a high proportion of at least one parent obtaining a college degree or beyond, 31% and 28%, respectively. For maternal employment status, approximately 68% of African American female adolescents and 55% of White female adolescents had mothers who worked full-time. In addition, approximately 23% of African American girls and 27% of White girls had a mother who was unemployed/retired.

While the majority of African American and White female adolescents lived in middle-income households, there were a higher proportion of African American female adolescents in low-income households (32%) in comparison to White female adolescents (19%). In examining family structure, approximately 56% of African American female adolescents resided in a two-parent household compared to 81% of White female

adolescents. Only 19% of White female adolescents resided in a single-parent household in comparison to 44% of African American female adolescents.

Predictor Variables

Table 3 presents the descriptive statistics for the predictor variables in the study. Maternal control had a score range of zero to seven with a mean of 1.81. This mean score indicates that parents enabled their adolescents to make decisions about a majority of the aspects of their lives (e.g. friends, television, bed time hours). The mean score for maternal control was significantly higher for African American female adolescents ($M = 2.05$) in comparison to White female adolescents ($M = 1.71$), $t(1,250) = -4.89$, $p = .00$ (two-tailed), indicating that African American mothers exhibited more control than White mothers. The score range for maternal support was five to 25 with a mean score of 22, indicating that mothers provided their daughters a high level of support. When examining this variable by race, African American female and White female adolescents had the same mean score of 22 so there was no significant difference between the groups.

Mother-child communication had a score range of zero to four with a mean of 2.28, indicating that the average adolescent female had discussed slightly more than half of the scale items (e.g., personal problems, school work) with her mother during the last month. African American female adolescents had a slightly lower mean score of 2.22 for mother-child communication when compared to the mean score of 2.30 for White female adolescents. However, the mean difference for mother-child communication among African American and White female adolescents was not significant.

For the variable of family cohesion, scores ranged from three to 15 with an average score of 11.30. This score indicated that the average adolescent in the study felt

Table 3

Descriptive Statistics for Predictor Variables

Variables	<i>M</i>	<i>SD</i>	Range	Frequency	<i>N</i>	Missing (%)	α
Maternal control	1.81	1.49	0-7		2379	49 2%	.61
African American	2.05***	1.59	0-7	720		16	
White	1.71	1.44	0-7	1659		33	
Maternal support	22.00	3.41	5-25		2323	105 4%	.86
African American	22.02	3.47	7-25	707		29	
White	22.00	3.38	6-25	1616		76	
Mother-child communication	2.28	1.28	0-4		2325	103 4%	.55
African American	2.22	1.28	0-4	707		29	
White	2.30	1.28	0-4	1618		74	
Family cohesion	11.30	2.48	3-15		2422	6 <1%	.80
African American	11.38	2.59	3-15	734		2	
White	11.27	2.44	3-15	1688		4	
Religiosity	3.43	2.01	0-6		2428	0	.71
African American	4.00***	1.79	0-6	736			
White	3.19	2.06	0-6	1692			

Note. All values are weighted to provide national estimates among adolescent girls.
 ***Difference between African American and White females significant at $p < .001$.

there was considerable closeness in her family. Among African American female adolescents, the mean family cohesion score was 11.38 while White female adolescents had a mean family cohesion score of 11.27. This difference in mean scores for family cohesion was not significant. The mean score for religiosity was 3.43 with a score range of 0 to 6. Thus, the average participant had participated in a religious service or religious youth activity approaching the level of once a month or more, but less than once a week. African American female adolescents reported a significantly higher mean of 4.00 (less than once a week, but more than once a month) when compared to the mean of 3.19 for White female adolescents, $t(1591) = -9.71, p = .00$.

Outcome Variable

Table 4 presents by race the characteristics of female adolescents in the study sample who engaged in five or more bouts of physical activity per week. There were 884 female adolescents who engaged in five or more bouts of physical activity per week representing approximately 36% of the study sample. Chi-square analysis found that African American and White female adolescents in this subsample did not differ significantly in terms of physical activity behavior. Approximately 37% of the African American female adolescents in the sample and 36% of the White female adolescents in the sample met the 1995 recommended levels of physical activity.

With respect to education, findings revealed that the percentage of female adolescents who met the recommended five or more bouts of physical activity per week increased with parent's level of education. Specifically, 30% of adolescents whose parent(s) had no high school degree, 35% of those with a high school degree or GED,

Table 4

Descriptive Statistics of Female Adolescents Achieving Recommended Levels of Physical Activity, Total and by Race

Variable	Total (<i>N</i> = 884)		African American (<i>n</i> = 272)		White (<i>n</i> = 612)	
	<i>M</i>	<i>N</i> (%) ^a	<i>M</i>	Frequency (%) ^{a,b}	<i>M</i>	Frequency (%) ^{a,b}
Age	16	884	16	272 (37.0)	16	612 (36.2)
Parent education		848		256		592
No high school degree		72 (30.4)		33 (32.4)		39 (28.9)
High school or GED		347 (34.8)		84 (32.9)		263 (35.4)
Some college		161 (37.9)		49 (39.2)		112 (37.3)
College degree or beyond		268 (39.9)		90 (41.3)		178 (39.3)
Maternal employment status		779		225		554
Full-time		445 (35.9)		148 (35.9)		297 (36.0)
Part-time		127 (39.2)		22 (39.3)		105 (39.2)
Unemployed/ Retired		207 (38.1)		55 (39.3)		152 (37.6)

Variable	Total (<i>N</i> = 884)		African American (<i>n</i> = 272)		White (<i>n</i> = 612)	
	<i>M</i>	<i>N</i> (%) ^a	<i>M</i>	Frequency (%) ^{a,b}	<i>M</i>	Frequency (%) ^{a,b}
Household income (\$)	49,129	884	35,654	272	55,118	612
Low-income (\$0-\$26,199)		189 (34.2)		76 (32.8)		113 (35.3)
Middle-income (\$26,200- \$49,999)		396 (36.0)		139 (38.6)		257 (34.8)
High-income (\$50,000 and above)		299 (38.5)		57 (39.6)		242 (38.2)
Family structure		837		253		584
Single-parent household		213 (35.6)		109 (36.8)		104 (34.4)
Two-parent household		624 (37.5)		144 (38.7)		480 (37.2)

Note. All values are weighted to provide national estimates among adolescent girls.

^a Percentages exclude missing data.

^b Percentages calculated by dividing the number of females who met the recommended level of physical activity by the total number of girls (Table 2) in each subcategory.

38% of those with some college, and 40% of those with a college degree or higher met the recommended level of physical activity.

For the variable maternal employment status, 36% of the female adolescents who had a mother who worked full-time, 39% of those whose mother worked part-time, and

38% of those whose mother was unemployed/retired engaged in the recommended five or more bouts of physical activity per week. With respect to income, findings revealed that the percentage of female adolescents who engaged in five or bouts of physical activity per week increased with household income. Specifically, 34% of female adolescents who lived in low-income households, 36% of those in middle-income households, and 39% of those who lived in high-income households met the recommended levels of physical activity. For the variable family structure, approximately 36% of female adolescents who lived in single-parent households and 38% of those who lived in two-parent households met the recommended level of physical activity.

In examining the characteristics of the subsample by race, loglinear analysis found that African American and White female adolescents were not significantly different from each other in terms of parent education, maternal employment status, household income, and family structure. For example, findings revealed that the percentage of female adolescents who met the recommended level of physical activity per week increased with parent's level of education for both African American and White female adolescents. For African American female adolescents, 32% whose parent(s) had no high school degree, 33% of those with a high school degree or GED, 39% of those with some college, and 41% of those with a college degree or higher engaged in five or more bouts of physical activity per week. For White female adolescents, 29% whose parent(s) had no high school degree, 35% of those with a high school degree or GED, 37% of those with some college, and 39% of those with a college degree or higher met the recommended levels of physical activity.

With respect to maternal employment status, among African American female adolescents, 36% of those who had a mother who worked full-time, 39% of those whose mother worked part-time, 39% of those whose mother was unemployed/retired engaged in the recommended five or more bouts of physical activity per week. For White female adolescents, 36% of those who had a mother who worked full-time, 39% of those whose mother worked part-time, 38% of those whose mother was unemployed/retired met the recommended level of physical activity.

For the variable household income, findings revealed that for African American female adolescents the percentage of those who engaged in five or bouts of physical activity per week increased slightly with household income. Specifically, 33% of those who lived in a low-income household, 39% of those who lived in a middle-income household, and 40% of those who lived in a high-income household met the recommended level of physical activity. For White female adolescents, 35% of those who lived in a low-income household, 35% of those who lived in a middle-income household, and 38% of those who lived in a high-income household engaged in five or more bouts of physical activity per week.

With respect to family structure, the percentage of African American and White female adolescents who met the recommended level of physical activity was higher among those living in a two-parent household. Specifically, 37% of African American female adolescents who lived in single-parent households and 39% of those who lived in two-parent households engaged in the recommended level of physical activity. For White female adolescents, 34% of those who lived in a single-parent household and 37% of

those who lived in a two-parent household engaged in the recommended five or more bouts of physical activity per week.

Missing Data

Missing values were assessed for each variable and ranged from 0 to 322, or less than 1% to 13%. Missing data for less than 10% of cases is considered acceptable. Two methods were used to recover missing data for control variables in this study: median substitution and triangulation. Median substitution uses the median as a substitute for missing values for a particular variable and is more appropriate than mean substitution when data are not normally distributed. Due to the initial large percentage of missing values (23%) for household income variable, median substitution was employed. This method is similar to that used in other studies utilizing Add Health data (e.g. Blum et al., 2000).

Triangulation refers to capturing missing data from a different item or survey to recover comparable information. This method was used on the parent education variable. The parent education variable from the parent survey was missing 312 cases. To remedy this problem, triangulation was used with two questions on the student in-school survey which asked adolescents about their parents' education. This approach is similar to that used in other studies utilizing Add Health data (e.g., Gordon-Larsen et al., 2000). Adolescents responded to a question about how far their biological/step/adoptive mother and biological/step/adoptive father had gone in school, and the response set was identical to the response set the parents used on the parent survey. These questions were coded so that the highest educational achievement of the two (mother or father) was obtained. These data were then used to replace missing data from the parent survey on matched

cases. This reduced the total cases with missing data on parent education to within an acceptable range (4%). There were no identical survey items to allow for triangulation of the control variable maternal employment status. However, since maternal employment status was not a variable of interest in predicting the outcome variable, cases with missing values (322) were retained to prevent further loss of the study sample. For the predictor variable, *religiosity*, cases with missing values were deleted prior to analysis due to the large percentage of missing cases (13%). Following these procedures, remaining missing data were dropped via listwise deletion.

Assessment of Bivariate Relationships among Variables

Table 5 presents a correlation matrix depicting the interrelationships among all the independent, control, moderator and dependent variables in this study. Maternal control was significantly positively correlated with the independent variables of family cohesion ($r = .07, p \leq .01$) and religiosity ($r = .17, p \leq .01$) and significantly negatively correlated with mother-child communication ($r = -.10, p \leq .01$). In addition, maternal control was significantly positively associated with race ($r = .11, p \leq .01$) and moderate to vigorous physical activity ($r = .09, p \leq .01$). Adolescents whose mother exercised increased levels of control over their behavior (e.g. friends, television, bedtime) were more likely to be African American; have high levels of family cohesion and religiosity; have less positive mother-child communication; and engage in five or more bouts of physical activity per week.

Table 5

Correlation Matrix of Study Variables

Variable	1	2	3	4	5	6	7	8	9	10	11
Independent variables											
1. Maternal control	—										
2. Maternal support	.04	—									
3. Mother-child communication	-.10**	.22**	—								
4. Family cohesion	.07**	.65**	.15**	—							
5. Religiosity	.17**	.10**	.01	.17**	—						
Control variables											
6. Adolescent age	-.37**	-.13**	.15**	-.11**	-.17**	—					
7. Parent education	-.06*	.03	.07**	.07**	.11**	-.02	—				
8. Maternal employment status	-.07**	-.03	.04	-.02	.01	.07**	.20**	—			
9. Household income	-.08**	.03	.05*	.05*	.01	-.00	.33**	.12**	—		
10. Family structure	.00	.06**	-.04	.07**	.06*	-.03	.07**	-.07**	.42**	—	
Moderator variable											
11. Race ^a	.11**	.01	-.01	.01	.17**	.01	-.04	.10**	-.21**	-.28**	—
Dependent variable											
12. Moderate to vigorous physical activity	.09**	.02	.01	.02	.07**	-.10**	.06*	-.02	.04	.03	.00

^aRace: 0 = White, 1 = African American

* $p \leq .05$, ** $p \leq .01$

Maternal control was also significantly negatively associated with the control variables of adolescent age ($r = -.37, p \leq .01$), parent education ($r = -.06, p \leq .05$), maternal employment status ($r = -.07, p \leq .01$), and household income ($r = -.08, p \leq .01$). Adolescents whose mothers exercised increased levels of control over their behavior were more likely to be younger in age; have a parent(s) with less education; have a mother who worked less than full-time; and reside in a low-income household.

Maternal support was significantly positively correlated with the independent variables mother-child communication ($r = .22, p \leq .01$), family cohesion ($r = .65, p \leq .01$), and religiosity ($r = .10, p \leq .01$). Adolescents whose mother displayed increased levels of support were more likely to have high levels of positive mother-child communication, family cohesion, and religiosity. Maternal support was not significantly associated with moderate to vigorous physical activity. For the control variables, maternal support was significantly negatively correlated with adolescent age ($r = -.13, p \leq .01$) and significantly positively correlated with family structure ($r = .06, p \leq .01$). Adolescents whose mother displayed increased levels of support were more likely to be young and reside in a two-parent household.

Mother-child communication was also significantly positively correlated with the independent variable family cohesion ($r = .15, p \leq .01$) and the control variables adolescent age ($r = .15, p \leq .01$), parent education ($r = .07, p \leq .01$), and household income ($r = .05, p \leq .05$). Adolescents who reported increased levels of positive mother-child communication were also more likely to have high levels of family cohesion; be older; have a parent(s) with high levels of education; and live in a two-parent household.

There was no significant association between mother-child communication and moderate to vigorous physical activity.

In addition to family cohesion being associated with maternal control, maternal support, and mother-child communication, it was also significantly positively associated with the independent variable religiosity ($r = .17, p \leq .01$), the control variables parent education ($r = .07, p \leq .01$), household income ($r = .05, p \leq .05$), and family structure ($r = .07, p \leq .01$), and significantly negatively associated with adolescent age ($r = -.11, p \leq .01$). Adolescents who indicated increased levels of family cohesion were more likely to be young; have high levels of religiosity; have a parent(s) with a high level of education; have a higher level of household income; and reside in a two-parent household.

For the fifth independent variable, religiosity, findings revealed that it was significantly positively correlated to race ($r = .17, p \leq .01$) and moderate to vigorous physical activity ($r = .07, p \leq .01$) in addition the independent variables maternal control, maternal support, and family cohesion previously presented. Adolescents who reported an increased level of religiosity were more likely to be African American and to engage in five or more bouts of physical activity per week. Religiosity was also significantly negatively correlated with adolescent age ($r = -.17, p \leq .01$) and positively correlated with parent education ($r = .11, p \leq .01$) and family structure ($r = .06, p \leq .05$). Adolescents who exercised increased levels of religiosity were more likely to be younger; have a parent(s) with high levels of education; and reside in a two-parent household.

Collinearity statistics were also performed to assess the relationship between the independent variables. All predictor variables had acceptable tolerance values and were retained in the analyses (Table 6).

Table 6

Collinearity Statistics for Predictor Variables^{a,b,c}

Variable	Tolerance	VIF
Maternal control	.964	1.04
Maternal support	.583	1.71
Mother-child communication	.933	1.07
Family cohesion	.588	1.70
Religiosity	.947	1.06

^a Dependent variable: Five or more bouts of physical activity per week.

^b Tolerance values less than .10 indicate high correlation with other variables, suggesting multicollinearity.

^c VIF (Variance inflation factor) is the inverse of Tolerance. VIF values above 10 indicate multicollinearity.

Predicting MVPA from Maternal Control (Questions 1)

Logit models were used in order to test the following hypotheses: a) increased levels of maternal control will be associated with more MVPA among all female adolescents, and b) increased levels of maternal control will be associated with more MVPA for both African American and White female adolescent subsamples. First a model was estimated for maternal control independently from all other predictor variables (Table 7). Next a model was estimated with all the predictor variables entered together (Table 7). Then fully adjusted models were estimated, separately for African American and White female adolescents (Table 8). Control variables were entered in all models.

When maternal control was entered independently into the logistic regression model, it was found to be significantly associated with MVPA. As such, for every unit increase in maternal control, there was an 11% increased likelihood of adolescents engaging in five or more bouts of MVPA per week ($OR = 1.11, p \leq .01$). When all predictor variables were entered into the model simultaneously, maternal control remained significantly associated with female adolescent physical activity behavior.

In examining the fully adjusted regression by race, maternal control remained significant for White female adolescents only. As such, for every unit increase in maternal control, there was a 12% increased likelihood of White female adolescents meeting the recommended guidelines for physical activity ($OR = 1.12, p \leq .05$).

Table 7

Partially and Fully Adjusted Logits for Maternal Control on Moderate to Vigorous Physical Activity^a

Variable	OR	95% CI	p
Maternal Control ^b	1.11	(1.03-1.20)	.008
Maternal Control ^c	1.10	(1.02-1.19)	.013

^a All models are adjusted for adolescent's age, race, parent education, maternal employment status, household income, and family structure.

^b Partially adjusted model.

^c Fully adjusted model.

Table 8

Fully Adjusted Logits for Maternal Control on Moderate to Vigorous Physical Activity, by Race^a

Variable	<u>African American</u>		<u>White</u>	
	OR	95% CI	OR	95% CI
Maternal Control	1.04	(.89-1.22)	1.12*	(1.02-1.22)

^a All models are adjusted for adolescent's age, parent education, maternal employment status, household income, and family structure.

* $p \leq .05$.

Predicting MVPA from Maternal Support (Questions 2)

Logit models were used in order to test the following hypotheses: a) increased levels of maternal support will be associated with more MVPA among all female adolescents, and b) increased levels of maternal support will be associated with more MVPA for both African American and White female adolescent subsamples. First a model was estimated for maternal support independently from all other predictor variables (Table 9). Next a model was estimated with all the predictor variables entered together (Table 9). Then fully adjusted models were estimated, separately for African American and White female adolescents (Table 10). Control variables were entered in all models.

In both the partially and fully adjusted models that included all female adolescents, maternal support was not significantly associated with MVPA. Further, there was no significant association between maternal support and MVPA when examining African American and White female adolescents separately.

Table 9

Partially and Fully Adjusted Logits for Maternal Support on Moderate to Vigorous Physical Activity^a

Variable	OR	95% CI	p
Maternal Support ^b	1.00	(.97-1.03)	.828
Maternal Support ^c	1.01	(.98-1.05)	.494

^a All models are adjusted for adolescent's age, race, parent education, maternal employment status, household income, and family structure.

^b Partially adjusted model.

^c Fully adjusted model.

Table 10

Fully Adjusted Logits for Maternal Support on Moderate to Vigorous Physical Activity, by Race^a

Variable	<u>African American</u>		<u>White</u>	
	OR	95% CI	OR	95% CI
Maternal Support	.96	(.90-1.02)	1.03	(.98-1.07)

^a All models are adjusted for adolescent's age, parent education, maternal employment status, household income, and family structure.

Predicting MVPA from Mother-Child Communication (Question 3)

Logit models were used in order to test the following hypotheses: a) increased levels of mother-child communication will be associated with more MVPA among all female adolescents, and b) increased levels of mother-child communication will be associated with more MVPA for both African American and White female adolescent subsamples. First a model was estimated for mother-child communication independently from all other predictor variables (Table 11). Next a model was estimated with all the predictor variables entered together (Table 11). Then fully adjusted models were estimated, separately for African American and White female adolescents (Table 12). Control variables were entered in all models.

In both the partially and fully adjusted models that included all female adolescents, mother-child communication was not significantly associated with MVPA. However, in the model that examined the influence of this variable by race, mother-child communication was significant for African American female adolescents only. As such, every unit increase in mother-child communication lead to a 33% increased likelihood of African American female adolescents engaging in five or more bouts of physical activity per week ($OR = 1.33, p \leq .01$). There was no significant association between mother child-communication and MVPA for White female adolescents.

Table 11

Partially and Fully Adjusted Logits for Mother-Child Communication on Moderate to Vigorous Physical Activity^a

Variable	OR	95% CI	p
Mother-child communication ^b	.99	(.90-1.08)	.746
Mother-child communication ^c	1.00	(.92-1.09)	.967

^a All models are adjusted for adolescent's age, race, parent education, maternal employment status, household income, and family structure.

^b Partially adjusted model.

^c Fully adjusted model.

Table 12

Fully Adjusted Logits for Mother-Child Communication on Moderate to Vigorous Physical Activity, by Race^a

Variable	<u>African American</u>		<u>White</u>	
	OR	95% CI	OR	95% CI
Mother-child communication	1.33**	(1.10-1.60)	.95	(.86-1.05)

^a All models are adjusted for adolescent's age, parent education, maternal employment status, household income, and family structure.

** $p \leq .01$.

Predicting MVPA from Family Cohesion (Question 4)

Logit models were used in order to test the following hypotheses: a) increased levels of family cohesion will be associated with more MVPA among all female adolescents, and b) increased levels of family cohesion will be associated with more MVPA for both African American and White female adolescent subsamples. First a model was estimated for family cohesion independently from all other predictor variables (Table 13). Next a model was estimated with all the predictor variables entered together (Table 13). Then fully adjusted models were estimated, separately for African American and White female adolescents (Table 14). Control variables were entered in all models.

Results show that family cohesion was not significantly associated with MVPA in any of the models. Further, there was no significant association between family cohesion and MVPA when examining African American and White female adolescents separately.

Table 13

Partially and Fully Adjusted Logits for Family Cohesion on Moderate to Vigorous Physical Activity^a

Variable	OR	95% CI	p
Family cohesion ^b	.98	(.93-1.03)	.434
Family cohesion ^c	.96	(.91-1.02)	.211

^a All models are adjusted for adolescent's age, race, parent education, maternal employment status, household income, and family structure.

^b Partially adjusted model.

^c Fully adjusted model.

Table 14

Fully Adjusted Logits for Family Cohesion on Moderate to Vigorous Physical Activity, by Race^a

Variable	<u>African American</u>		<u>White</u>	
	OR	95% CI	OR	95% CI
Family cohesion	.98	(.87-1.10)	.96	(.90-1.03)

^a All models are adjusted for adolescent's age, parent education, maternal employment status, household income, and family structure.

Predicting MVPA from Adolescent Religiosity (Question 5)

Logit models were used in order to test the following hypotheses: a) increased levels of religiosity will be associated with more MVPA among all female adolescents, and b) increased levels of religiosity will be associated with more MVPA for both African American and White female adolescent subsamples. First a model was estimated for religiosity independently from all other predictor variables (Table 15). Next a model was estimated with all the predictor variables entered together (Table 15). Then fully adjusted models were estimated, separately for African American and White female adolescents (Table 16). Control variables were entered in all models.

In both the partially and fully adjusted models that included all female adolescents, religiosity was not significantly associated with MVPA. However, when examining the influence of religiosity by race, religiosity as measured by adolescents' participation in religious services and youth religious activities was found to be a significant predictor among African American females only. As such, for every unit increase in religiosity, there was a 28% increased likelihood of African American female adolescents engaging in five or more bouts of physical activity per week ($OR = 1.28, p \leq .001$).

Table 15

Partially and Fully Adjusted Logits for Religiosity on Moderate to Vigorous Physical Activity^a

Variable	OR	95% CI	p
Religiosity ^b	1.05	(.99-1.11)	.076
Religiosity ^c	1.04	(.98-1.10)	.197

^a All models are adjusted for adolescent's age, race, parent education, maternal employment status, household income, and family structure.

^b Partially adjusted model.

^c Fully adjusted model.

Table 16

Fully Adjusted Logits for Religiosity on Moderate to Vigorous Physical Activity, by Race^a

Variable	<u>African American</u>		<u>White</u>	
	OR	95% CI	OR	95% CI
Religiosity	1.28***	(1.10-1.48)	1.01	(.95-1.08)

^a All models are adjusted for adolescent's age, parent education, maternal employment status, household income, and family structure.

*** $p \leq .001$.

Predicting MVPA from Interaction Effects of Race (Question 6)

Logit models were used in order to test the following hypotheses: a) the relationship between maternal control and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents, b) the relationship between maternal support and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents, c) the relationship between mother-child communication and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents, d) The relationship between family cohesion and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents, and e) The relationship between religiosity and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents. A fully adjusted logistic regression model that included all control variables, predictor variables, and interaction terms of race x each predictor variable was conducted.

Table 17 presents a summary of results of the interaction terms used to assess the moderating effect of race. Race significantly strengthens the relationship between mother-child communication and female adolescents' moderate to vigorous physical activity and between religiosity and female adolescents' moderate to vigorous physical activity, with findings revealing a stronger relationship for African American female adolescents than for White female adolescents (see Table 17). This confirms the results found for hypotheses 3b and 5b. The odds ratio relating mother-child communication and moderate to vigorous physical activity for African American and White female subsamples can be found in Table 12. The odds ratio relating religiosity and moderate to

vigorous physical activity for African American and White female subsamples can be found in Table 16.

Table 17

Moderating Effect of Race with Predictor Variables on Moderate to Vigorous Physical Activity^a

Variable ^b	OR	95% CI	p
Maternal control x race	.93	(.79-1.10)	.403
Maternal support x race	.94	(.87-1.01)	.110
Mother-child communication x race	1.37	(1.10-1.71)	.005
Family cohesion x race	1.01	(.88-1.16)	.909
Religiosity x race	1.25	(1.06-1.47)	.007

^a All models are adjusted for adolescent's age, race, parent education, maternal employment status, household income, and family structure.

^b African American is the reference category for race (i.e., 1 = African American, 0 = White).

Summary of Results

The following table provides a summary of the results for this study.

Table 18

Summary of Results

Hypothesis	Results
1) Is maternal control associated with moderate to vigorous physical activity [MVPA] among African American and White female adolescents?	
a) Increased levels of maternal control will be associated with more MVPA among all female adolescents.	Supported. Every unit increase in maternal control was significantly associated with a 10% increased likelihood of MVPA among all female adolescents.
b) Increased levels of maternal control will be associated with more MVPA for both African American and White female adolescent subsamples.	Partially supported. Every unit increase in maternal control was significantly associated with a 12% increased likelihood of MVPA for White female adolescents only.
2) Is maternal support associated with MVPA among African American and White female adolescents?	
a) Increased levels of maternal support will be associated with more MVPA among all female adolescents.	Not supported. Maternal support was not significantly associated with MVPA among all female adolescents.
b) Increased levels of maternal support will be associated with more MVPA for both African American and White female adolescent subsamples.	Not supported. Maternal support was not significantly associated with MVPA for African American or White female adolescents.
3) Is communication among African American and White female adolescents and their mothers associated with MVPA?	
a) Increased levels of mother-child communication will be associated with more MVPA among all female adolescents.	Not supported. Mother child communication was not significantly associated with MVPA among all female adolescents.

Hypothesis	Results
b) Increased levels of mother-child communication will be associated with more MVPA for both African American and White female adolescent subsamples.	Partially Supported. Every unit increase in mother-child communication was significantly associated with a 33% increased likelihood of MVPA for African American female adolescents only.
4) Is family cohesion in families of African American and White female adolescents associated with MVPA?	
a) Increased levels of family cohesion will be associated with more MVPA among all female adolescents.	Not supported. Family cohesion was not significantly associated with MVPA among all female adolescents.
b) Increased levels of family cohesion will be associated with more MVPA for both African American and White female adolescent subsamples.	Not supported. Family cohesion was not significantly associated with MVPA for African American or White female adolescents.
5) Does African American and White female adolescents' involvement in religious activities predict MVPA?	
a) Increased levels of adolescent religiosity will be associated with more MVPA among all female adolescents.	Not supported. Religiosity was not significantly associated with MVPA among all female adolescents.
b) Increased levels of adolescent religiosity will be associated with more MVPA for both African American and White female adolescent subsamples.	Partially supported. Among African American female adolescents only, every unit increase in religiosity was significantly associated with a 28% increased likelihood of MVPA.
6) Does race influence the strength of the relationship between maternal control, maternal support, mother-child communication, family cohesion, religiosity, and female adolescents' physical activity behavior?	
Race will moderate the predictive relationship of maternal control, maternal support, mother-child communication, family cohesion, and religiosity influences on adolescent physical activity behavior.	Partially Supported. Race was only a significant moderator of the predictive relationship between mother-child communication and adolescent physical activity and between religiosity and adolescent physical activity.

Hypothesis	Results
a) The relationship between maternal control and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	Not supported. There was no significant interaction between race and maternal control on adolescent physical activity behavior.
b) The relationship between maternal support and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	Not supported. There was no significant interaction between race and maternal support on adolescent physical activity behavior.
c) The relationship between mother-child communication and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	Supported. The relationship between mother-child communication and physical activity behavior was stronger for African American female adolescents than for White female adolescents.
d) The relationship between family cohesion and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	Not supported. No significant interaction was found.
e) The relationship between religiosity and physical activity behavior will be stronger for African American female adolescents compared to White female adolescents.	Supported. The relationship between religiosity and physical activity behavior was stronger for African American female adolescents than for White female adolescents.

CHAPTER V: DISCUSSION

The current study utilized the ecological model to examine predictors of moderate to vigorous physical activity in African American and White female adolescents. This study extends existing literature examining the impact of family and community influences on adolescent physical activity behavior in a number of important ways.

First, this research study focused exclusively on female adolescents, and specifically on African American and White female adolescents. Female adolescents are less likely to achieve recommended levels of physical activity than male adolescents. Further, previous research indicated that African American female adolescents are at greater risk for low physical activity than any other adolescent population group (CDC, 2006). Second, this study expanded previous research that assessed the influence of family and community factors on female adolescent physical activity by investigating five potential protective factors: maternal control, maternal support, mother-child communication, family cohesion, and religiosity. There are no existing studies that have used the two independent dimensions of maternal parenting—maternal control and maternal support—to examine the impact of maternal parenting behavior on adolescent physical activity. Furthermore, few studies have examined the influence of mother-child communication, family cohesion, and religiosity on adolescent physical activity outcomes, particularly among female adolescents.

Finally, unlike other studies that focus on adolescent physical activity, this study also examined the impact of race by 1) conducting separate analyses for African American and White female adolescents, and 2) investigating the interaction of race with the five potential protective factors in predicting physical activity behavior among female

adolescents. To date, there are no studies that have examined racial influences with this group of potential protective factors to determine the influence of race on adolescent physical activity, particularly for African American female adolescents.

The current study examined five ecological factors that might enhance a female adolescent's participation in moderate to vigorous physical activity. The first four potential protective factors, all family level variables, were maternal control, maternal support, mother-child communication, and family cohesion. Maternal control examined the degree to which female adolescents described their mothers as monitoring and setting limits for their behavior. Maternal support examined the degree to which adolescent girls perceived their mothers as expressing warmth, love, and attention to the adolescent's needs. Mother-child communication examined the degree to which female adolescents discussed with their mother general issues important to the adolescent. Family cohesion assessed the degree to which adolescent girls' perceived emotional bonding and closeness with their family members.

The fifth potential protective factor was religiosity, a community level variable, which examined the frequency of female adolescents' attendance at religious services and youth religious activities. Religiosity has historically played an important role in the African American community and has been a means of support for coping with life stressors and maintaining a healthy lifestyle (Bopp et al., 2007). Finally, this study examined the influence of these potential protective variables within cultural norms by using "race" as a proxy for culture. African American families have a unique historical past that has led to developing a culture that relies heavily on family and the community (including the Black church), and that stands in contrast to individualistic values of

European Americans (e.g., Julian et al., 1994). As such, cultural influences among African Americans may serve as a protective factor capable of enhancing healthy individual behaviors, such as engaging in moderate to vigorous physical activity.

Characteristics of Adolescents

While the major goal of this study was to examine predictors of African American and White female adolescents' physical activity behavior, it is also important to consider the characteristics of the adolescents who participated in this study. The mean age of the female adolescents was 16 years with ages ranging from 12 to 21 years. Similar to other studies and research examining physical activity among adolescents (Gordon Larsen et al., 1999; Ornelas et al., 2007), this study found that only slightly more than one third of female adolescents (36%) met the 1995 recommended level of physical activity by achieving five or more bouts of moderate to vigorous physical activity of at least 30 minutes per week. Moreover, it should be noted that the 2005 recommendation calls for at least five or more weekly physical activity bouts of 60 minutes or more—double the activity time required in 1995. While this study focused exclusively on the physical activity behavior of female adolescents, previous research has also shown that female adolescents are less likely to participate in moderate to vigorous physical activity when compared to male adolescents (CDC, 2006).

Among female adolescents who did meet the recommended guidelines for physical activity, this study found that characteristics for African American and White female adolescent subsamples were not significantly different between the two groups. For example, very similar percentages of African American and White female adolescents met the 1995 physical activity goal. Specifically, 37% of African American

and 36% of White female adolescents reported engaging in five or more bouts of physical activity per week. These results contrast those of another study using nationally representative data that found African American female adolescents were less likely to achieve three or more bouts of physical activity per week when compared to White female adolescents (Andersen et al., 1998). The discrepancy in findings may be due, in part, to difference in the age groups in the two samples (8-16 in the Andersen study versus 12-21 in the current study) and the definitions of low physical activity (two or fewer bouts in the Andersen study versus four or fewer bouts in the current study). Evidence suggests that females become less physically active with age (e.g., Gordon-Larsen et al., 2000; Richmond et al., 2006) and different racial/ethnic groups may grow closer together in terms of their physical activity levels as females' transition to young adulthood.

Current findings also revealed that the percentage of female adolescents who met the recommended level of physical activity per week increased with parent's level of education for both African American and White female adolescents. For African American female adolescents, the percentage of girls who engaged in five or more bouts of physical activity per week increased from 32% for those whose parent(s) had no high school degree to 41% for those who had at least one parent with a college degree. For White female adolescents, the percentage of those who met the recommended physical activity level increases from 29% for those whose parent(s) had no high school degree to 39% for those who had at least one parent with a college degree. This finding is consistent with results of a previous study of a nationally representative sample of adolescent females and males (Ornelas et al., 2007). The latter study found that 62% of

adolescents (representing all cultural backgrounds) who had a least one parent with a college degree engaged in five or more bouts of physical activity per week compared to 54% who parents had no high school degree.

With respect to maternal employment status, both African American and White female adolescents who met the recommended guidelines for physical activity had similar percentages of mothers who worked full-time, part-time, or were unemployed/retired. For example, 36% of African American and 36% of White female adolescents who had a mother who worked full-time engaged in five or more bouts of physical activity per week. To date, there are no comparable studies that have specifically investigated differences in maternal employment status by race when examining female adolescent physical activity behavior.

For the demographic variable household income, findings revealed that the greatest percentage of African American (40%) and White female adolescents (38%) who met the recommended guidelines of physical activity had high family incomes of \$50,000 or more. Two previous studies using national datasets have also found that adolescents from middle and higher income families engaged in more physical activity than those from lower income families earning less than \$26,000 (Gordon-Larsen et al., 2000) and less than \$35,000 (Lee & Cubbin, 2002).

With respect to family structure, the greatest percentage of African American (39%) and White (37%) female adolescents who engaged in five or more bouts of physical activity lived in a two-parent household when compared to those in a single-parent household. This finding is consistent with research conducted by Ornelas et al. (2007) which found that 55% of female adolescents who lived in a single-mother

household and 59% of those who lived in a two-parent household engaged in five or more bouts of physical activity per week.

Predictors of Adolescent Physical Activity Behavior

A major goal of this study was to employ an ecological framework to examine the extent to which selected family and community level variables predicted African American and White female adolescents' physical activity behavior. Ecological theory recognizes the important role that families and religious institutions play in the development of healthy lifestyle behaviors in children and adolescents (Bogenschneider, 1996). Specifically, this study sought to examine the role of four family level variables including maternal control, maternal support, mother-child communication, and family cohesion, and the community level variable of religiosity in predicting female adolescents' moderate to vigorous physical activity.

Maternal Parenting

It was hypothesized that two dimensions of maternal parenting—maternal control and maternal support—would be associated with African American and White female adolescents' moderate to vigorous physical activity. As hypothesized, maternal control was significantly associated with an increased likelihood of female adolescents engaging in moderate to vigorous physical activity. Adolescents whose mothers exhibited greater control over their lives, participating in decisions about issues such as weekend curfews, friends, wardrobe, television viewing, bedtime, and eating habits, were 10% more likely to engage in five or more bouts of physical activity per week. Thus, this study demonstrates a link between positive parenting characterized by monitoring and setting

appropriate limits and the positive adolescent health behavior of increased physical activity.

Contrary to another hypothesis, increased levels of maternal support were not found to be significantly associated with African American and White female adolescents' moderate to vigorous physical activity. Adolescents whose mothers exhibited increased levels of support by expressing warmth, love, and attention to adolescent needs were not more likely to participate in moderate to vigorous physical activity when compared to adolescents whose mothers exhibited lower levels of support. However, it should be noted that the majority of female adolescents in this study rated their mothers as high on support. Thus, the limited variability in adolescent responses on the maternal support scale may have contributed to the nonsignificant relationship between maternal support and adolescent physical activity behavior.

To date, there are no published studies examining the relationship between maternal parenting and adolescent physical activity behavior using the independent dimensions of maternal control and maternal support. However, in one study comparing authoritative and nonauthoritative styles of parenting which combined the control and support dimensions of parenting, Schmitz et al. (2002) found that girls who described their mothers as being high in control and support (i.e. authoritative) had higher levels of physical activity than girls who described their mother as being low in control and support (i.e., nonauthoritative). One can speculate that mothers who set limits and monitor their adolescent daughter's behavior may also be giving their daughters guidance about the positive health benefits of physical activity. However, mothers' provision of

unconditional love, warmth, and attention to their daughters may not be related to their provision of constructive advice about health behavior.

When examining the effects of maternal control on physical activity by race, White female adolescents who described their mothers as employing increased levels of control were 12% more likely to engage in five or more bouts of moderate to vigorous physical activity than those whose mothers exhibited less control. Other studies have also found that higher levels of maternal control are associated with better behavioral and psychological health among adolescents (Luthar, Cushing, Merikangas & Rounsaville, 1998; Suchman, Rounsaville, DeCoste & Luthar, 2007) and better physical activity outcomes among children (Arredondo et al., 2006). For example, Arredondo et al. (2006) found that high maternal control characterized by monitoring, use of reinforcement, appropriate limit setting and discipline among Latino families was associated with increased physical activity among children from kindergarten to second grade when compared to children whose mothers showed low maternal control. Based on the findings of this study, maternal control that is not overly intrusive and harsh may also contribute to better physical activity outcomes for adolescents, particularly White female adolescents. Adolescents may perceive that their parents have their best interests in mind when setting limits and monitoring their behavior.

No significant associations were found between maternal control and physical activity behavior among African American female adolescents. Overall, African American female adolescents reported that their mothers exhibited significantly higher maternal control than White female adolescents. This higher level of maternal control and the lesser variability in African American mothers' use of this parenting behavior may

have contributed, in part, to the nonsignificant association of this factor with moderate to vigorous physical activity among African American female adolescents.

When examining the effects of maternal support on physical activity by race, there was no significant association for either African American or White female adolescents subsamples. Both African American and White female adolescents reported that their mothers were highly supportive, and thus there was relatively little variability in female adolescents' perceptions of maternal support. Again, this response pattern may have contributed to the nonsignificant results for maternal support.

Taken together, the current results indicate that at least one dimension of maternal parenting may play an important role in predicting female adolescent physical activity behavior. In particular, maternal control over adolescent behavior may have a significant influence on female adolescent physical activity, and particularly on the subpopulation of White female adolescents.

Mother-Child Communication

Mother-child communication was a third factor hypothesized to influence African American and White female adolescent physical activity behavior. However, mother-child communication was not found to be a significant predictor of moderate to vigorous physical activity when all female adolescents were included in the analysis. This finding contradicts results of a similar study using a nationally representative sample of adolescents. Ornelas et al. (2007) found that mother-child communication was a significant predictor of a female adolescent achieving five or more bouts of moderate to vigorous physical activity. This discrepancy in findings may be due, in part, to the fact that Ornelas and her colleagues had a larger sample of female adolescents that included

all racial and ethnic backgrounds. The current study employed a smaller sample and focused exclusively on African American and White adolescent girls and their mothers.

When examining African American and White female adolescents separately, mother-child communication was found to be a significant predictor of African American female adolescents engaging in five or more bouts of physical activity. African American female adolescents who reported increased levels of mother-daughter communication were 33% more likely to meet the recommended physical activity level. This was not the case for White female adolescents. The differential finding for African American and White adolescent females may be partially attributed to unique cultural influences that affect the way African Americans communicate both verbally and nonverbally.

Previous research found that verbal and nonverbal communication was more interconnected, intense, and intimate among African Americans than among White Americans (Giordano et al., 1993; Smetana et al., 2000). Moreover, given the higher percentage of African American than White female adolescents living in a female headed, single-parent households, communication between the mother and daughter may have been particularly important or salient in many African American daughter's lives. This situation would enable African American mothers to have a greater influence than White mothers on adolescent daughters' behaviors, such as physical activity.

Family Cohesion

Another hypothesis of this study was that family cohesion would be associated with moderate to vigorous physical activity among African American and White female adolescents. However, family cohesion was not found to be a significant predictor of physical activity behavior in the total sample or in subpopulations of African American

and White female adolescents. The current finding is inconsistent with several previous studies examining the influence of family cohesion on adolescent physical activity behavior (de Bourdeaudhuij & Van Oost, 1998; Moore & Harre, 2007; Ornelas et al., 2007). For example, in a national sample of diverse female adolescents ages 12–21, Ornelas et al. (2007) found a significant positive relationship between family cohesion and both male and female adolescents independently engaging in five or more bouts of moderate to vigorous physical activity. The differential outcomes of the current study and the study by Ornelas and colleagues may be influenced by the current study's smaller sample size and its focus on only African American and White female adolescents.

Religiosity

This study also hypothesized that religiosity would be associated with moderate to vigorous physical activity among African American and White female adolescents. Religiosity was not found to be a significant predictor of moderate to vigorous physical activity when all female adolescents were included in the analysis. This contradicts a previous study of a nationally representative sample of high school male and female seniors which found that adolescents for whom religion is very important and who attend church weekly are significantly more likely than their less religious peers to exercise regularly (Wallace & Forman, 1998). The inconsistency in findings may be due to a number of differences in the samples of the latter study and the current investigation. Specifically, the current study was smaller, limited to African American and White female adolescents, and included adolescents from a much wider age range (12-21 years) than the study of high school seniors. Moreover, the current study's measure of religiosity focused only on attendance at church and religious youth group activities,

whereas the Wallace and Forman study also asked adolescents about the importance of religion in their lives.

In separate analyses for African American and White female adolescents, religiosity was found to be significantly associated with African American adolescents achieving five or more bouts of physical activity, but not for White female adolescents. While no previous studies have examined racial differences in the influence of religiosity on adolescent physical activity behaviors, this outcome does lend support to research finding that religiosity plays an important role in the lives of African Americans (McAdoo, 1998). Notably, African Americans tend to have higher levels of religiosity when compared to White Americans (Johnston et al., 1999). It appears likely that African American adolescents who regularly attend church and youth religious activities are exposed to multiple messages promoting healthy behaviors, including the importance of regular physical exercise. African American female adolescents who hear these messages at religious activities may be motivated to engage in regular physical activity. Studies involving adults have also found that the effects of religious activity on health were strongest among African American as compared to White adults (Ferraro & Koch, 1994). The researchers suggested that this finding may be due, in part, to African Americans' greater reliance on religious functions as a coping mechanism when facing health problems.

Moderator Effect of Race on Physical Activity Behavior

Finally, it was hypothesized that race would influence the strength of the relationship between maternal control, maternal support, mother-child communication, family cohesion, religiosity, and female adolescents' physical activity behavior. The

findings suggest that being an African American female adolescent significantly strengthens the association between mother-child communication and engaging in five or more bouts of physical activity. To date, there are no published studies examining this moderating relationship. However, current findings lend support to research examining mother-daughter communication among African Americans and its importance in influencing adolescent risk behaviors (e.g., Pluhar & Kuriloff, 2004).

The role of mother-daughter communication in the lives of African American and White female adolescents was investigated in a qualitative study by Penington (2004). Findings revealed that African American mothers and daughters had stronger mother-child communication behaviors and were more comfortable with higher levels of relational connection than European American mother-daughter dyads. In addition, “African American mothers more often than European American mothers co-constructed the role of ‘best friends’ with their daughters and had a heightened degree of connection in the area of conversational openness” (Penington, 2004, p. 13). In still another study examining the effects of mother-child communication on adolescent outcomes, Smetana et al. (2000) found that higher levels of mother-adolescent communication in a sample of middle-class African American families predicted lower levels of adolescent behavior problems. Thus, it is not surprising that in the current study, the relationship between mother-child communication and adolescent physical activity was stronger for African American female adolescents as compared to White female adolescents.

In this study, race was also found to moderate the relationship between religiosity and moderate to vigorous physical activity. Thus, suggesting that being an African American female adolescent significantly strengthens the association between religiosity

and engaging in five or more bouts of physical activity. Again, there are no published studies examining this relationship among adolescents. However, studies do indicate that African Americans have high levels of religiosity, are likely to attend church, use religion as a coping strategy, and believe that religion or prayer contributes to their physical health (Resnicow, Jackson, Wang, Dudley & Baranowski, 2002; Streaty-Wimberly, 2001). As such, religiosity may be more salient in the lives of African American female adolescents than White female adolescents and be more likely to play an important role in encouraging healthy behaviors, including physical activity.

Race was not found to moderate the relationship between maternal control, maternal support, or family cohesion and adolescent physical activity. These findings are likely influenced by the insignificant associations between maternal support and physical activity, and family cohesion and physical activity in the total sample, as well as the insignificant association between maternal control and physical activity in the African American female adolescent subsample. There are no existing comparable studies that have examined the role of race in moderating the influence of these variables on female adolescents' physical activity.

Summary

This study provides support for an ecological approach to identifying and understanding protective factors for female adolescent physical activity. On a family level, findings expanded the ecological theory by demonstrating the impact of maternal parenting behavior and mother-child communication on female adolescents' moderate to vigorous physical activity. Specifically, maternal control and mother-daughter

communication served as protective factors in encouraging African American or White female adolescents to engage in five or more bouts of physical activity.

On the family level, findings revealed that maternal control was associated with increased likelihood of female adolescents engaging in five or more bouts of physical activity among the total sample and subsample of White adolescents. In this study, White female adolescents whose mothers engaged in more monitoring and control of their daughter's behavior were more likely to engage in five or more bouts of physical activity each week than White female adolescents with mothers who exercised lower monitoring and control. Such findings indicate that with the family system, maternal parenting behavior may have a direct influence in shaping female adolescent health behavior, particularly among White adolescents.

Findings also revealed that among African Americans, mother-daughter communication was associated with female adolescents' greater likelihood of meeting the national recommendations for physical activity. At the family level, the salience of long traditions of intimate and intense verbal and nonverbal communication in African American families (Giordano et al., 1993; Smetana et al., 2000) and the more recent trend of growing numbers of female-headed African American families (McAdoo, 1998) suggest that mothers may have an important influence in daughters' health behaviors including their physical activity.

On a community level, this study expanded the ecological theory by validating the importance of religious institutions in influencing African American female adolescent health behaviors, particularly physical activity. The ecological theory would assert that in offering spiritual, emotional, and social support through its services and activities, the

Black church can 1) directly influence the physical activity behaviors of African American female adolescents who attend services and activities on a regular basis and 2) indirectly influence African American female adolescent physical activity behavior through the microsystem of the family-child relationship. Thus, the Black church may also encourage parental healthy behaviors, which can, in turn, influence female adolescent physical activity behavior. Findings revealed that among African Americans, increased levels of female adolescent religiosity were associated with female adolescents' greater likelihood of meeting the national recommendations for physical activity.

On a societal level, this study expanded the ecological theory by documenting the impact of culture (using race as a proxy) on moderate to vigorous physical activity of female adolescents. Findings revealed that race was a significant moderator in predicting adolescent physical activity behavior from mother-child communication and religiosity. Current findings lend support to the integrative theorists' emphasis on the need to consider race and racial/cultural norms and traditions in studying influences on adolescent behavior. The ecological theory would contend that the cultural values found within the African American community infiltrated the microsystem of the mother-child relationship in African American families, thus influencing the way they communicate with their daughters on a range of health issues including physical activity. It also asserts that these same cultural values may influence the interactions that African Americans have with religious institutions in their community, which, in turn, contribute to positive health behaviors such as physical activity.

Limitations

The current findings expand the literature on protective factors for African American and White female adolescent physical activity behavior, and cover new ground by examining racial influences associated with these protective factors. However, there are several limitations of this study which should be noted. First, it is important to recognize that this is a cross-sectional study, so care must be taken not to infer a causal direction in the detected relationships. A longitudinal study would be necessary in order to be able to answer questions of causation.

One limitation of this study, which is common in using existing datasets, is the measurement of key concepts. It should also be noted that some scales had only moderate internal consistency including the measures of mother-child communication and maternal control.

A potential threat to internal validity should also be noted. Interviews were conducted in a face-to-face format, raising questions about whether or not participants would respond differently if they were given anonymous, written questionnaires. However, to minimize each participant's likelihood of giving socially desirable responses, the Add Health interviewers used two approaches. For less sensitive topics, the interviewer read the questions aloud and entered the respondent's answers. For more sensitive topics, the respondent listened through earphones to pre-recorded questions and entered the answers directly. In addition to maintaining data security and protecting confidentiality, this two-pronged approach minimized the potential for interviewer or parental influence.

Another limitation of this study is that it focused only on African American and White female adolescents and did not include female adolescents of other racial/ethnic backgrounds. As such, findings can only be generalized to African American or White adolescents.

Finally, it should also be noted that given the time period during which data were collected (1994-1995), an older recommendation for physical activity was used. The use of the 1995 recommendations is likely to overestimate the number of adolescents meeting current physical activity recommendations. The 1995 dietary guidelines for Americans recommended that adolescents engage in at least 30 minutes of moderate to vigorous physical activity for five or more days of the week. The 2005 dietary guidelines for Americans recommend that adolescents engage in at least 60 minutes of moderate to vigorous physical activity for five or more days of the week.

Programmatic and Policy Implications

In spite of the current study's limitations, the results have implications for parents, health educators, program developers, policy makers, and practitioners seeking to increase physical activity among female adolescents, particularly African American and White female adolescents. Overall, the study suggests that mothers can play an important role in enhancing female adolescents' participation in moderate to vigorous physical activity.

Current findings suggest that maternal control and mother-child communication may be important in increasing physical activity behaviors among female adolescents. Mothers who provide control in their parenting through activities such as monitoring and setting limits for their adolescent daughters' behavior may positively influence female

adolescents' participation in moderate to vigorous physical activity. Increased levels of maternal control appears especially likely to influence White female adolescents' physical activity behavior. In addition, African American mothers who communicate often with their daughters about school, social life, and personal problems may positively influence their daughter's participation in moderate to vigorous physical activity. These findings highlight the importance of including parents, particularly mothers, in programs and policies aimed at increasing physical activity among female adolescents.

Most current policies designed to increase physical activity among youth and adolescents are focused on four areas: after-school programs, community-based youth sports and recreation programs, school physical education programs, and facilities and environmental design, such as recreation facilities and bike paths (National Coalition for Promoting Physical Activity, n.d.). While these interventions are needed, they do not target the parental involvement that is addressed in this study. In order to truly incorporate parental involvement, physical activity programs and policies must be created utilizing a family impact analysis that puts families first. Further, policies designed to increase physical activity among youth and adolescents should consider research identifying the contributions of parents and family members in their development, implementation, and evaluation. These interventions should educate parents about how to communicate effectively with their child about general life issues and about physical activity specifically. Moreover, they should stress the potential benefits of setting limits and monitoring youth behavior including adolescents' involvement in physical activity.

Although there are currently some evidence-based programs, predominantly based in schools, that incorporate family involvement such as Coordinated Approach to

Child Health (CATCH) and EAT WELL and *KEEP MOVING*, they are primarily targeted towards youth in grades three through five. The CATCH program was funded by the National Institutes of Health (NIH) and EAT WELL and *KEEP MOVING* was funded, in part, by the Department of Education. Funded, in part, by NIH and CDC, *Planet Health*, an integrated, interdisciplinary middle school curriculum designed to increase physical activity (among other behaviors) for 6th and 7th grade students, has minimal parent involvement. Current findings suggest that schools can do more to encourage and increase female adolescent physical activity behavior, in part, by creating gender-focused physical activity programs that invite the participation of the mother. These programs should provide school credit or other incentives to encourage involvement of both the adolescent and her mother. Such programs may foster a stronger bond between the mother and her adolescent daughter and contribute to adolescent females' greater participation in moderate to vigorous physical activities over time.

This study also suggests that culture or race is an important factor to consider when designing interventions that will encourage female adolescents to participate in moderate to vigorous physical activity. Among African Americans female adolescents only, increased levels of mother-child communication and religious attendance were found to predict increased engagement in five or more bouts of physical activity per week. Policies and programs can address reported findings of a growing disparity in physical activity between African American female adolescents and their peers from other cultural groups by targeting mothers and other family members, and by designing culturally appropriate interventions that build on the strong family and religious/spiritual bonds typical in African American families (McAdoo, 1998).

Policies and programs targeting adolescent physical activity, particularly for African American female adolescents, should also reach out to religious institutions in the African American community. The Black church is a major institution within the African American community and families depend on the church for support. Churches have historically provided services and assistance with food, shelter, clothing, and childcare. They have also supported health education and disease prevention programs addressing teen pregnancy, diabetes, and cancer (Baker, 1999; Rubin, Billingsley & Caldwell, 1994).

More recently, some churches have begun to offer exercise programs for their members. Studies have found that these programs can be effective in increasing physical activity behaviors, particularly among adults (Resnicow et al., 2002). This study suggests that Black churches should expand the target audience of their exercise programs to female adolescents, especially because this provides an opportunity for families to participate in physical activity together. Exercise programs should also be gender-specific to encourage African American female adolescents to increase their levels of moderate to physical activity. In particular, church-based programs for girls might incorporate dance, softball, and/or soccer. Health educators and practitioners working in religious settings should offer physical education interventions beginning in childhood and continuing through adolescence and adulthood in order to prevent the poor health outcomes associated with low physical activity.

Policy initiatives seeking to increase physical activity among African American adolescent females should target the Black Church and provide funding for churches to train their own members to lead exercise physical activity programs. Research has found

that such efforts to empower and train church leaders and local community members show promise in encouraging increased physical activity behavior among African Americans (Bopp et al., 2007).

Directions for Future Research

The current findings suggest that increased levels of maternal control may influence African American and White female adolescent physical activity behavior (with the greatest influence on White families), and that increased levels of positive mother-child communication and religiosity can encourage physical activity among African American adolescent girls. Further research is needed to explore how family and community variables are related to physical activity behavior among other racial/ethnic groups such as Hispanics, Asians, Native Americans and multi-racial adolescents. Research should also explore how the factors targeted in this study are predictive of adolescent male physical activity behavior and the physical activity behavior of both boys and girls at various age levels (e.g., preschool, elementary, middle, and high school).

While this study found relationships between mothers' behaviors and their adolescent daughters' physical activity behavior, the role of fathers also needs to be explored. Future studies should investigate potential protective factors such as paternal parenting and father-child communication to examine their influence on female adolescent physical activity behavior. Research should also explore the role of other family and community level variables, such as familial social support (e.g. extended kin, siblings), familial communication, and involvement in non-religious youth clubs.

This study suggests that religiosity, as defined by youth involvement in religious services and religious youth activities, predicts engagement in moderate to vigorous

activity for African American female adolescents. However, it is possible that an unknown third factor may be influencing this predictive relationship. For example, do social networks within the church lead African American female adolescents to participate more in activities outside of their religious institution? Future research should examine mechanisms within church attendance (e.g. peer social networks) and outside of church attendance that may lead to more physical activity behavior among female adolescents, particularly African American female adolescents. Future research should also explore how spirituality, which focuses on internal, personal, and emotional expression of the sacred, is related to the physical activity of African American adolescents and youth from other cultural groups.

Also, the current findings for this study were based on an individual level of analysis utilizing variables that were based on responses from either the adolescent or their parent. Future studies should also consider exploring data that are based on family level variables (e.g. research that includes the entire family unit) and community level variables (e.g. research that includes community organizations).

Finally, future research should examine the longitudinal effects of family and community influences such as religiosity on female and male adolescent physical activity behavior throughout adolescence and as adolescents' transition into adulthood. This type of longitudinal research could address and expand the chronosystem component of ecological theory, and provide important insights about how specific factors may lead to sustained moderate to vigorous physical activity.

Conclusion

The major purpose of this study was to examine the influence of maternal control, maternal support, mother-child communication, family cohesion, and religiosity on the health-promoting behavior of increased physical activity among a sample of African American and White female adolescents. Overall, findings support and expand an ecological view of family and community level contributions to female adolescent physical activity, indicating that maternal control, mother-child communication and religiosity may contribute to increases in female adolescents' engagement in five or more bouts of moderate to vigorous physical activity per week. The study also highlights the importance of considering the cultural variable of race since increased levels of maternal control were more strongly associated with daughters' physical activity in White female adolescents and increased levels of mother-child communication and religiosity were associated with increased physical activity behavior among African American female adolescents.

Current findings underscore the need for health educators, program developers, policy makers, and practitioners to tackle reported disparities in the physical activity rates of African American females by developing interventions that emphasize the protective value of maternal-child communication and female participation in religious activities. Interventions that emphasize the strengths and cultural traditions of African American families may be most effective in encouraging increased physical activity among African American female adolescents.

APPENDIX A

Survey Items Used from National Longitudinal Study of Adolescent Health

Variable	Survey Item Operationalization	Survey Source ^a
Biological sex	Are you a male or female?	Student-home, wave I
Race/ethnicity	Are you of Hispanic origin? Check your race/ethnicity 0 = White 1 = African American	Student-home, wave I
Date of birth	What is your birth date [month and year]?	Student-home, wave I
Date interview	Mark month, year of survey	Student-home, wave I
Adolescent age	Calculated from above	Constructed, from wave I
Parent education	How far did you go in school? How far did your mother go in school? How far did your father go in school? ...8th grade or less ...some high school ...high school graduate ...GED ...some college ...vocational training after high school ...college graduate	Parent, wave I Student- school, wave I
Maternal employment status	Are you employed full time? Are you unemployed right now, but looking for a job? 1= Unemployed/retired 2= Part-time 3= Full-time	Parent, wave I
Household income	About how much total income, before taxes, did your family receive in 1994? ...range \$0 to \$999 thousand	Parent, wave I

Variable	Survey Item Operationalization	Survey Source ^a
Family structure	Household roster What is [Name]'s relationship to you? 0 = Single-parent household (lives with one parent) 1 = Two-parent household (lives with two parents including biological, adoptive, or step parent)	Student-home, wave I
Maternal control	Summed score (0 = Low control to 7 = High control) on the following items: 1. Do your parents let you make your own decisions about the time you must be home on weekend nights? (0 = Yes; 1 = No) 2. Do your parents let you make your own decisions about the people you hang around with? (0 = Yes; 1 = No) 3. Do your parents let you make your own decisions about what you wear? (0 = Yes; 1 = No) 4. Do your parents let you make your own decisions about how much television you watch? (0 = Yes; 1 = No) 5. Do your parents let you make your own decisions about which television programs you watch? (0 = Yes; 1 = No) 6. Do your parents let you make your own decisions about what time you go to bed on week nights? (0 = Yes; 1 = No) 7. Do your parents let you make your own decisions about what you eat? (0 = Yes; 1 = No)	Student-home, wave I

Variable	Survey Item Operationalization	Survey Source ^a
Maternal support	<p>Summed score (5 – 25) on the following items:</p> <ol style="list-style-type: none"> 1. How close do you feel to your [mother/adoptive mother/stepmother/foster mother/etc.]? (1= Not at all; 2=Very little; 3=Somewhat; 4=Quite a bit; 5=Very much) 2. How much do you think she cares about you? (1= Not at all; 2=Very little; 3=Somewhat; 4=Quite a bit; 5=Very much) 3. Most of the time, your mother is warm and loving toward you. (1=Strongly Disagree; 2=Disagree; 3=Neither agree or disagree; 4=Agree; 5=Strongly agree) 4. You are satisfied with the way your mother and you communicate with each other. (1=Strongly Disagree; 2=Disagree; 3=Neither agree or disagree; 4=Agree; 5=Strongly agree) 5. Overall, you are satisfied with your relationship with your mother. (1=Strongly Disagree; 2=Disagree; 3=Neither agree or disagree; 4=Agree; 5=Strongly agree) 	Student-home, wave I
Mother-child communication	<p>Summed score (0-4) on the following items: Which of the things listed on this card have you done with your [mother, adoptive mother, stepmother, foster mother/etc.] in the past 4 weeks? (0=No; 1= Yes)</p> <ul style="list-style-type: none"> ...talked about someone you're dating, or a party you went to ...had a talk about a personal problem you were having ...talked about your school work or grades ...talked about other things you're doing in school 	Student-home, wave I
Family cohesion	<p>Summed score (3-15) on the following items:</p> <ol style="list-style-type: none"> 1. How much do you feel that people in your family understand you? (1-5) 2. How much do you feel that you and your family have fun together? (1-5) 3. How much do you feel that your family pays attention to you? (1-5) <p>1 = Not at all 2 = Very little 3 = Somewhat 4 = Quite a bit 5 = Very much</p>	Student-home, wave I

Variable	Survey Item Operationalization	Survey Source ^a
Religiosity	<p>Summed score (0 – 6) on the following items:</p> <ol style="list-style-type: none"> 1. In the past 12 months, how often did you attend religious services? 2. Many churches, synagogues, and other places of worship have special activities for teenagers—such as youth groups, Bible classes, or choir. In the past 12 months, how often did you attend such youth activities? <p>0 = never 1 = less than once a month 2 = once a month or more, but less than once a week 3 = once a week or more</p>	Student-home, wave I
Moderate to vigorous physical activity	<p>During the past week, how many times did you...</p> <ul style="list-style-type: none"> ▪ go roller-blading, roller-skating, skateboarding, or bicycling? ▪ play an active sport, such as baseball, softball, basketball, soccer, swimming, or football? ▪ exercise, such as jogging, walking, doing karate, jumping rope, doing gymnastics or dancing? <p>0 = not at all 1 = 1 to 2 times 2 = 3 to 4 times 3 = 5 times or more</p>	Student-home, wave I

^a Student = in-home or school student survey; Parent=parent survey.

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