

THE INFLUENCE OF FRIENDS ON PHYSICAL ACTIVITY AND SEDENTARY
BEHAVIOR IN ADOLESCENTS: A MIXED METHODS ANALYSIS

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Abstract

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PURPOSE: 1) Determine the association between adolescent moderate-to-vigorous physical activity (MVPA) and screen time with their nominated friends' behaviors and 2) explore potential social influences of friends on MVPA and screen time **METHODS:** Participants consisted of 152 adolescents (mean age: 14.5 years, 53% female, 50% high school, 80% Caucasian). MVPA was measured with an Actigraph GT3X+ accelerometer. Demographic and psychological variables were assessed via questionnaires. Participants nominated up to 5 friends who completed MVPA and screen time questionnaires. A subset of adolescents (n=108) participated in focus groups that examined friends' influence on activity behavior. Multiple regression analysis examined the association of demographic, psychological, and nominated friend variables with participants' MVPA, sedentary behavior (SB), and screen time. NVivo 10.0 was used to analyze qualitative data. **RESULTS:** Greater levels of friends' MVPA was associated with greater levels of MVPA in both middle school ($p=.02$) and high school females ($p=.03$). Greater levels of friends' screen time was associated with greater levels of screen time in middle school males ($p=.03$). Focus group data indicated that friends positively influenced participants' MVPA through engaging in activity with participants, verbal encouragement, and modeling of MVPA. All participants preferred to be active with friends rather than alone, however, females preferred activity with a close friend while males preferred to be active with a group. Enjoyment of MVPA was the most cited reason for engaging in MVPA with friends. The majority of participants reported friends not having an influence on screen time.

CONCLUSIONS: Friends influence MVPA in youth, while having limited influence on SB and

screen time. Interventions to increase MVPA in youth could be designed to include friends to increase enjoyment of MVPA.

DEDICATION

This work is dedicated to my husband, Dave, and my parents, Isaac and Sheila, who encouraged and believed in me all of these years. I will forever be grateful for your support.

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CHAPTER 1: INTRODUCTION

It is well established that engaging in physical activity (PA) in adolescence is associated with numerous physiological and psychological benefits such as decreased risk of type 2 diabetes, obesity, depression, and increased levels of self-esteem and positive mood (15, 22, 85, 96, 98). In contrast, sedentary behavior (SB), including screen time (television viewing, computer work, video game playing), in adolescents is positively associated with obesity, depression, and other cardiovascular health risks (71). Despite the benefits of PA, most children and adolescents do not engage in the recommended 60 minutes of PA per day (104), and are reporting increasing levels of SB as they transition from childhood into adolescence (71, 94).

Numerous studies have examined correlates of physical activity in adolescents (8, 18, 63, 67, 96, 99). Several demographic factors such as being male, Caucasian, and increased socio-economic status (SES) are correlated with increased PA behavior (96). Results from these studies have identified several psychosocial variables such as physical activity enjoyment (8), physical activity self-efficacy (18), and perceived benefits and barriers to PA (63) to be associated with PA behavior. Social support for PA has also been correlated with physical activity behavior (25). However, these psychosocial variables explain only a modest amount of the variance associated with PA behavior (in general, only 14.2 – 22.8% of variance (86)).

Although much is known about the correlates of PA for adolescents, correlates of SB and screen time have not been as extensively studied, though several socio-demographic variables have been identified. Studies have reported that being male, non-white, from a lower SES family, and psychological variables such as low screen time self-efficacy and enjoyment of SB are associated with increased screen time (11, 12, 67, 111).

In adolescents, friend interactions influence a variety of outcomes including cognitive, psychosocial, and emotional development and behavior (2, 7, 89). Friends influence adolescent behaviors such as tobacco use (69), drug and alcohol use (6), and dietary patterns (110). However, little is known about the role of friends on PA and screen time in adolescents. Knowledge of social factors associated with adolescent PA and screen time is important, as adolescents become more autonomous from their parents and rely more heavily on behavioral cues from friends. In addition, PA significantly declines and screen time significantly increases during adolescence, and only a small portion of PA behavior can be explained by psychosocial factors (86). Although friend social support for PA has been observed in previous studies, there is limited research on the influence of friends on adolescent PA and screen time (47-48, 93). In addition, research conducted with adolescents may reflect adult investigators' perspectives on childhood, which may bias data interpretation. When the purpose of research is to understand the participants' perspectives, procedures must be used to reduce this potential bias (45). Research methods that encourage active participation by adolescents can facilitate adults' understanding of their behavior and decision-making (45). Horner (45) suggests that focus groups are a useful format for encouraging middle school

children's active participation in the research process. However, to our knowledge, only one study used focus groups to examine social influences of PA in 10 – 11 year old children, finding that friendship groups are key influences on the location and type of PA in which children engage (47).

In the current study, we collected the following data: qualitative data on friends' influence of PA and screen time in a focus group format, psychosocial outcomes that are related to PA and screen time behaviors, objective measure of PA using accelerometers, an established questionnaire to assess screen time, and nominated friends' self-reported PA and screen time. Our study was the first, to our knowledge, that utilized both a quantitative and qualitative approach to examine the effect of friend networks on both PA and screen time in a sample of middle and high school students. It was hypothesized that adolescent MVPA and screen time would be associated with nominated friends' MVPA and screen time, and that this association would be moderated by demographic variables and mediated by psychological factors. It was also hypothesized that the strength of these associations would differ according to gender and school level. In addition, the results from the focus groups may enable us to better guide future quantitative research and develop more effective intervention strategies.

CHAPTER 2: REVIEW OF THE LITERATURE

I. ADOLESCENT PHYSICAL ACTIVITY

Maintaining a physically active lifestyle can result in aerobic fitness benefits during adolescence that may reduce adverse health effects, such as hypertension, osteoporosis, and the incidence of chronic diseases, including coronary heart disease, later in life (12, 15, 36, 61, 85). In addition, engaging in weight-bearing exercises and resistance training may be effective in promoting good skeletal health for adolescents (84). Furthermore, PA may enhance mental health, and improve both self-esteem and self-identity among adolescents (9, 12, 36, 63).

Unfortunately, even with all the known benefits of engaging in PA, only 8% of adolescents (12 – 19 years) meet the current recommendation of 60 minutes or more of moderate to vigorous physical activity (MVPA) on most days of the week (104).

Furthermore, PA tends to decline in adolescence with one study showing that MVPA declines in adolescence by 23% in males and 46% in females (11). Another study that examined 2312 adolescents from 9 to 15 years of age found that MVPA decreased from childhood to adolescence (-1 to -2.5 min/day per year of follow-up, $p=0.01$) (57).

Particular emphasis should be placed on encouraging MVPA behavior in adolescents because evidence suggests that PA behaviors learned and maintained during adolescents may predict adult PA (73). Due the combination of declining adolescent PA levels,

increased adolescent obesity and type 2 diabetes levels (15), it is critical to explore and better understand the factors associated with MVPA in adolescents.

A. CORRELATES OF PA FROM A SOCIAL-ECOLOGIC MODEL PERSPECTIVE

Several studies have examined the correlates of PA among adolescents, and have concluded that PA behavior and the factors influencing it are very complex, with no one factor able to explain either PA levels among adolescents or the decline in PA as children age (26). Therefore, studies have utilized a social ecological model approach to examine PA behavior in adolescents. Social ecological models (13, 29, 97-98) attempt to define the complexity of behavioral choices and typically include psychological, behavior, social, home, school, and neighborhood environmental factors (26, 42).

1. Individual-level correlates

The first level of the social-ecologic model include the individual-level variables: genetic factors, physiological characteristics (gender, age, race), and psychological characteristics (self-efficacy, enjoyment). For individual-level correlates, evidence indicates that males and younger adolescents engage in more PA than females or older adolescents (92). Psychological factors have also found to be significantly correlated with PA behavior, with PA self-efficacy emerging as one of the strongest factors associated with PA behavior in adolescents (18). Craggs et al. (18) published a review examining correlates associated with PA change in adolescents, finding that self-efficacy for PA was positively associated with PA across all reviewed studies. Other psychological variables such as PA enjoyment and barriers to PA are also associated with

PA behavior in adolescents (8, 63, 96). Barr-Anderson et al. (8) examined 2971 adolescent girls participating in the Trial of Activity for Adolescent Girls, finding that self-efficacy for PA ($p < 0.001$), and PA enjoyment ($p = 0.004$) were associated with greater participation in structured PA and higher overall PA. Another study by Neumark-Sztainer et al. (63) examined psychological factors associated with PA behavior in 201 high school girls, finding that barriers to PA such as time constraint was the most significant correlate of PA behavior ($p < .001$), though self-efficacy for PA was also significant ($p < .01$). While it appears that individual-level correlates explain a significant amount of variance in PA behavior, there is still a large portion of variance unexplained (11).

2. Social-level correlates

The next level in the social-ecologic model, the social-level correlates, include the relationships, culture, and society with whom an individual interacts (98). For adolescents, this would include the family, peers, friends, and community norms (42). Social support for PA has been of great interest in adolescent studies, and the majority of studies have found a positive association between adolescent PA and family and friend support for PA (25), though not all studies have found these associations (9). Beets et al. (9) examined the role of social support for MVPA in 259 high school girls, and observed that friend social support, but not family support, was significantly associated with adolescent PA. Furthermore, there is evidence that as children age, friends' support may be a stronger correlate of PA than family support (25-26). However, this area is limited because most of the studies that have measured social support for PA in adolescents rely

on adolescents' own perception of support and typically include only a few questions asking about friends' encouragement of PA (47).

3. Physical Environment

The physical environment of the social-ecological model for adolescents includes the natural environment (weather) and the built environment (parks, playgrounds, fitness facilities) (12, 98). The physical environment takes into account the contextual features of neighborhoods and schools when examining adolescent PA (37). Evidence indicates that socioeconomic and built environment conditions are associated with adolescent PA (12).

The presence of parks and having PA facilities close to home are associated with increased PA behavior in adolescents (17, 24). Grow et al. (38) examined active transport to recreation sites in 124 adolescents, finding that active transport was positively associated ($p < .05$) with higher perceived traffic safety, better pedestrian infrastructure, and negatively associated with crime threat. A study by Rodriguez et al. (79) examined the associations of the built environment with PA in 293 adolescent females, finding that PA behavior was increased in areas with parks, schools, and high population density, while lower PA behavior was associated with more roads and food outlets. However, the majority of studies examining environmental factors have found that these factors only explain a small amount of the variance in PA, and that the individual and social level correlates are more strongly associated with PA in adolescents (12).

II. ADOLESCENT SEDENTARY BEHAVIOR

Sedentary behavior refers to activities that require minimal body movement, and result in levels of energy expenditure similar to resting level (1.0 to 1.5 metabolic equivalents (METs)) (72). Sedentary behavior (SB) includes sitting for a wide range of purposes (work, driving) and screen-based activities (screen time) such as television watching, computer usage, and playing video games (111).

In the past, SB had been largely ignored due to the importance placed on PA behavior. However, there is now sufficient evidence suggesting that SB and PA are two independent variables, and now sedentary behaviors are conceptualized as being behaviorally distinct from the absence of PA (61, 106). In addition, there is evidence that high levels of PA may not protect individuals from cardiovascular risk factors if they also have high levels of SB, in particular screen time (15-16). Studies have found evidence of the negative physiological and psychological effects of SB and screen time in adolescents (102). For example, a review by Costigan et al. (16) found a significant positive association between screen time and sleep problems, musculoskeletal pain, and depression, and a negative association between screen time and fitness, social support, and psychological well-being in adolescent studies. Interestingly, there is often little association between SB and PA (4). Therefore, it is possible for an individual to accumulate larger amounts of both PA and SB in a single day (72).

Screen time, defined as sedentary behavior that includes television watching, playing electronic games, and sitting at the computer, is one of the most prevalent forms of sedentary behavior (93). In fact, television viewing makes up approximately 50% of

total time spent in SB (27, 41). Results from the Third National Health and Nutrition Examination Survey report that 26% of U.S. children watch 4 or more hours of television per day and 67% watch at least 2 hours per day (4). Evidence suggests that screen time may have greater adverse health risks than other forms of SB (16, 29). For example, a study by Chaput et al. (15) examined the association between both PA and screen time with cardiometabolic risk factors in a sample of 536 adolescents, and found that screen time was positively associated with diastolic blood pressure, but after adjustment for PA, the association was no longer statistically significant. In contrast, when the investigators singled out screen time, it was positively associated with waist circumference and negatively associated with HDL cholesterol, independent of PA (15). In agreement, Andersen et al. (4) examined the association of both PA and television watching with level of BMI and body fatness in 4063 adolescents, finding that greater levels of screen time were more associated with greater BMI and body fat than PA levels. However, the majority of studies suggest that it is necessary to focus both on increasing PA levels, and decreasing screen time in order to optimize health and well-being in adolescents (12, 15, 29).

Unfortunately, while evidence indicates that PA levels decline during adolescence (73), at the same time, results from studies suggest that SB, and in particular, screen time increase during adolescence (57-58). Two longitudinal studies that utilized accelerometers to measure SB, found that there was a significant increase in sedentary time in adolescents from 9 to 15 years in age (57), and in adolescents from 12 to 16 years of age (58). Ortega et al. (71) examined SB, using accelerometers, in 2312 participants,

and found that SB increased from childhood to adolescence (+15 and +20 minutes per day, for males and females respectively, $p < 0.001$).

A. CORRELATES OF SB (SOCIAL-ECOLOGIC MODEL)

Studies have explored various factors associated with SB, and similar to the review on PA, we will use the social-ecologic model approach to address correlates of SB, and in particular, screen time. There was a previous assumption that the same variables that were associated with PA behavior, however, findings suggest that adolescent sedentary behavior has correlates that are distinct from correlates found for PA (31, 72, 106).

1. **Individual-level correlates**

Similar to PA, results indicate that age plays a factor in amount of SB, with adolescents engaging in more SB than younger children (5, 11, 57, 62). Brodersen et al. (11) examined physiological and psychological correlates of screen time in 11 to 12 year old males and females, finding that age ($p = .035$) and being from an ethnic minority ($p = .007$), and poor self-rated health ($p = .002$) are all positively associated with screen time. Males reported significantly higher amounts of screen time than females (13.60 hr/wk vs. 13 hr/wk, $p = 0.25$) (11). Other studies, however, found no significant differences between males and females with regard to SB (27, 92, 94). These findings are in contrast to PA studies, which have reported females to have significantly lower PA levels than males (62, 71).

Several studies have reported that significant psychosocial correlates of SB are similar to PA (12, 65-67). For example, increased self-efficacy and classroom behavior

are important for increased PA behavior, and decreased SB behavior (5, 12). In agreement, Norman et al. (67) found PA self-efficacy to be inversely associated with screen time behavior, and low screen time self-efficacy to be positively associated with screen time behavior. Interestingly, while PA enjoyment is significantly associated with PA behavior, at the same time, enjoyment of screen time is also found to be a strong correlate of screen time behavior (65).

2. Social-level correlates

Overall, studies examining social economic status (SES) in parents have found that increased SES is associated with lower levels of SB (11-12, 67, 92), regardless of how SES is measured. For example, Bronderson et al. (12) defined SES as neighborhood quality, Singh et al. (92) defined it as household income, and Norman et al. (67) defined it as parental education. All of these studies found that higher SES levels were associated with lower levels of SB and screen time (12, 67, 92).

While it is difficult to measure social support for SB, studies have found that parental involvement in PA is significantly associated with decreased SB and screen time (54, 106). Leatherdale et al. (54) found that adolescent self-reported parental encouragement and support for PA is associated with lower levels of screen time behavior in high school adolescents.

3. Physical environment correlates

Studies investigating the physical environment have concluded that there is no significant evidence that environmental neighborhood factors such as safety from crime or lower traffic is associated with time spent in SB (27, 54, 67). These results support that

PA is shaped more by the physical environment than SB is (12, 54, 67). However, one study found that having more affluent schools in the neighborhood was associated with decreased screen time ($p=.048$), while this association was not significant for PA levels ($p=.155$) (12). In addition, one cross-sectional study by Norman et al. (67) did find that the self-reported number of hills in a neighborhood was positively associated with sedentary behavior in a sample of 568 adolescent females. Similar to previous studies, Norman et al. (67) did not find other neighborhood factors significant, such as crime rate or traffic, in either males or females. This supports the findings that physical environment plays more of a role in PA behavior than SB behavior.

III. SOCIAL INFLUENCES ON PA AND SB

From the social-ecological models of PA and SB, it is apparent that both behaviors are complex, and while there are several correlates that are predictive of PA and SB, there is still quite a bit of variance unexplained (12). Studies that have used a social-ecological approach have only been able to explain approximately 5.5-25% of the variance in PA, and 9.2-22% of the variance in SB and screen time (12, 67, 74). Therefore, it is necessary to further explore, in greater detail, areas that have shown to be correlated with PA and SB.

Studies examining the correlates of PA and SB have noted that social support is significantly associated with adolescent PA and SB, however, these studies have noted that there needs to be greater examination and understanding of the social influences on adolescents (25, 47). It is also of importance to note that results indicate that the strength of parental support and PA tends to weaken as children transition into adolescence and

friend support may become more significant (9, 12, 34). This may be due, in part, to adolescents becoming more autonomous from their parents, and relying more heavily on behavioral cues from friends (34). Research on the social influences of PA and SB in adolescents is limited. While there is evidence that social support for PA is associated with increased PA behavior in adolescents, there have been few studies that have examined other types of social influences.

The following studies that will be discussed will focus on “friends” rather than “peers” in the context that “friends” are defined as a person with whom one has a bond of mutual affection, while a “peer” can be defined as an individual who is equal to another with respect to certain characteristics such as skills, educational level, age, background, and social status (20, 25, 89). Although some studies have used these terms interchangeably, the majority of previous research has operationalized these two terms in different ways (89). The purpose of the current proposed study is to examine friends’ influence only, and therefore, will not examine literature that focuses on peers.

A. SOCIAL INFLUENCES OF FRIENDS ON PA

Until recently, research has only focused on limited areas of social support. For example, the majority of studies measure friend social support by having participants fill out a questionnaire asking about how often they feel their friends support them in their efforts to be active (47). However, there are a number of factors within friend domains that may be related to PA behaviors among adolescents (20, 25, 89). These factors include direct support (friends partaking in PA with adolescent), emotional and

motivation support (providing encouragement for PA), and observational support (modeling of PA) (20, 25, 89, 95).

Several studies have investigated whether the number of friends an adolescent has may be associated with PA behavior. Jago et al. (50) examined whether the number of friends in an adolescent's social circle is related to adolescent PA in a sample of 10-11 year old boys and girls transitioning from primary to middle school. Participants were assessed in the final year of primary school, and then a year later in the first year of secondary school. The results of this study found that an increase in the number of friends during this transition period was associated with both increased after-school ($p=0.043$) and weekend PA ($p=0.036$) (50).

Adolescents who report greater presence of friends in their lives also report engaging in more PA (88). A number of studies have found that adolescents are more active when in the presence of friends (50, 88). Adolescents who report spending more time alone, tend to also report the least amount of PA (88). In a study by Salvy et al. (88), researchers examined whether variability in 20 adolescents' PA intensity could be explained by presence of friends using an experience sampling methodology. For seven consecutive days, adolescents carried pagers and described their activities and the social context. The findings from this study indicate that adolescents engage in more intense PA when in the company of friends (2.5 METs vs. 1.2 METs, $p<.001$) than when they are alone. In addition, the presence of family members did not significantly predict participation in PA ($p=.42$) (88).

While it appears that having a greater number of friends is associated with PA behavior, it is not clear whether the friends themselves are influencing the individual to be active (25, 50). There is evidence that friends may have a direct impact on adolescents' attitudes and beliefs about PA (7). For example, adolescents' perception of peer norms has been found to predict their attitudes towards PA, and influence their intentions to engage in PA (34). This evidence suggests that adolescents are more likely to either choose friends who have similar PA behavior or alter their PA behavior to emulate their friends (20). A longitudinal study by De la Haye (20) examined whether participation in PA was relevant to the formation of adolescent friendships and whether adolescents were influenced by their friends' PA behavior in a sample of 378 eighth grade students. Participants listed the names of friends in their grade level at school, and both the participants' PA and their nominated friends' PA was measured over the school year. The results from this study indicated that participation in PA was found to play a significant role in friendship selection, with participants preferring friends whose PA levels were similar to their own. In addition, friends appeared to influence participants' PA over the school year, as evidenced by PA becoming more similar among friends (20).

The majority of studies have not measured friends' PA directly, and are based on adolescents' self-report of their friends, however, a few studies have attempted to measure friends' PA directly (2, 20, 93). Sirard et al. (93) examined the association between an adolescent's PA and his/her nominated friends' PA in a sample of 2126 adolescents from 20 middle schools and high schools. Results from this study indicated that PA behavior in adolescents was associated with PA of nominated friends (93). A study by Ali et al. (2) also examined PA and sport participation in a sample of 3898

adolescents and their nominated school friends. The results from this study showed that, on average, a 10 percentage point increase in the proportion of friends who engage in PA is associated with a 0.79 percentage point ($p=0.025$) greater likelihood that the participant exercises. In addition, the effect of a 10 percentage point increase in the proportion of friends who participate in sports is associated with a 1.84 percentage points ($p<0.001$) greater likelihood that the participant engages in sports (2).

Even though a few studies have directly examined nominated friends' PA, one limitation is that adolescents are limited to choosing friends who are from their school and are already participants in the studies (46). Friends from community contexts or sports teams may be able to be important influences for adolescent PA behavior (47-48). While there have been no studies, to our knowledge, that have examined neighborhood or community friends' influence on PA, there have been several studies that have examined adolescent sports team networks (51, 95, 100-101).

Sports activity is an important source of MVPA for adolescents (50, 94, 99-100). It also can have beneficial psychological effects such as positive mood, and lower levels of unhealthy behaviors (95). Unfortunately, similar to other PA behaviors, sports activity starts to decrease in adolescence (51, 100). However, it appears that sports participation is influenced by friend networks (51). Keresztes et al. (51) examined the role of social influences in sports activity in 548 adolescents, finding that a greater number of adolescents reported that friends were a greater source of social influence on sports activity, as compared to parents (61.7% vs. 37%).

Gender differences in friend influences of PA

Although there has been limited research in this area, studies have found that gender differences may exist in the association of adolescent and friend PA (42-43, 75). In the previously mentioned study by Sirard et al. (93), gender stratified analyses were conducted and indicated that PA for female adolescents was associated with both male and female friends' PA ($p<.05$), while male adolescents' PA was associated with only their female friends' PA ($p<.03$) (93). The results from this study suggest that friends may have a greater influence on PA in females as compared to males (93). This finding is supported by Jago et al. (50) who found that an increase in friend support for PA ($p=.02$) and number of friends ($p=.006$) were both associated with an increase in females' PA, while these results were not significant in males. Examination of the coefficients indicated that each additional friend was associated with 3.7 more minutes of PA on weekdays, and 9.8 minutes of PA during the weekend for females, while for males, each additional friend was associated with 1.8 more minutes of PA on weekdays and 6.0 more minutes of PA on weekends (50). The findings that suggest friend influence for PA may be more significant in females than males are supported by a study by Keresztes et al. (51) who examined social influences on adolescents' sports activity. When the analysis was stratified by gender, friends' participation in sports was significantly associated with sports activity for females, but was not significant for males (50).

B. SOCIAL INFLUENCES OF FRIENDS ON SB

There is also interest in examining the influence of friends on SB, in particular, screen time since this variable has been most closely associated with cardiovascular risk

as compared to other forms of SB (15, 29, 41, 61, 93). Several of the studies that have examined friend influence on adolescent PA, have also looked at screen time in their analyses (15-16, 39, 60, 93). For example, Sirard et al. (93) examined the amount of time adolescents spent watching television, at the computer, and playing video games, and compared it to their nominated friends screen time habits. This study found significant associations between adolescents' screen time and that of their nominated friends ($p \leq .03$) (93). In contrast, the study by Ali et al. (2), who also examined whether friendship networks influenced screen time in 3898 adolescents, found that there was no significant correlation between adolescents and their nominated friends' screen time.

While the previous studies examined the influence of friends' screen time on adolescents' screen time behavior, a cross-sectional study by Leatherdale et al. (53) examined the effect of friends' PA behaviors on screen time in a large sample of 25,916 high school students. This study found that having three or more active friends was associated with lower levels of screen time, which was defined as less than 2 hours of screen time per day ($p < .05$) (53).

Gender differences in friend influences on screen time

There have been only a limited number of studies that have examined friend influences on screen time according to gender, however, those studies suggest that gender differences may exist (51, 93). The previous study by Leatherdale et al. (51) did examine gender differences in friend PA on screen time, finding that having 3 or more active friends appeared to be a greater predictor of having lower levels of screen time per day in females ($p < .001$) than in males ($p < .05$), though both were significant predictors. Sirard et

al. (93) found that female adolescents' screen time was associated with both their nominated male and female friends' screen time ($p < 0.03$), but male adolescents' screen time was only associated with their female friends' screen time ($p = 0.04$). Though additional research is warranted, it may be possible that friend influences are not only stronger for girls for PA behavior, but also for SB and screen time as well.

IV. QUALITATIVE STUDIES EXAMINING PA IN ADOLESCENTS

It is apparent that more information is needed to understand the role of friendship networks on PA and SB behavior (47). One approach to better understand these roles is through qualitative analysis (44-45). Horner concluded that by utilizing qualitative methods, researchers can gain more insight into the thoughts, behaviors, and attitudes of adolescents (45).

This qualitative approach to adolescent PA has been examined in several studies (47-48, 101). However, no studies to our knowledge, have examined SB or screen time using a qualitative method. In addition, there has only been one study, to our knowledge, that has examined friendship groups and PA specifically in adolescents through a qualitative analysis (48). Jago et al. (48) conducted seventeen focus groups in a sample of 110, 10-11 year old participants. This study focused on the nature of the adolescent's friendship groups, the associations between PA and social group status, and how friendship groups affect the initiation and maintenance of PA. Participants reported that friends provided support to initiate PA by participating in the activity together, modeling of being active, and by providing verbal support to engage in PA. Enjoyment was the most important factor in maintaining activity participation with participating in PA with

friends a key factor influencing enjoyment. Results also suggest that friendship groups are important influences on the location and type of PA in which adolescents engage. Friendship groups were not uniform and that the more friendship groups adolescents formed, the more likely they were to engage in different physical activities. Interestingly, Jago et al. (48) found that adolescents reported belonging to three different friendship groups: school friends, neighborhood friends, and friends who participate in organized activities, such as sports. Gender differences were also examined in this study. In males, PA competency was associated with a positive social status regardless of what friendship group they belonged to. In females, there was no clear direction between PA competency and friendship groups. It appeared that attitudes toward PA were either positive or negative depending on the perception of the friendship group. While SB behavior was not directly examined, there were data from adolescents suggesting that engaging in PA with friends was more preferable to watching television alone (48).

V. SUMMARY OF LITERATURE

From the existing literature, it is apparent that: 1) engaging in PA is beneficial for physiological and psychological health in adolescents, 2) high levels of SB, particularly screen time, are associated with adverse health effects, independent of PA levels, 3) several individual, social, and environmental correlates are associated with PA and SB, however, there is still a large portion of unexplained variance, 4) friends significantly influence PA and SB levels though the information is limited.

The results from the literature suggest that the presence of friends as well as the number of friends are both associated with increased PA levels and decreased screen time

levels. More time spent alone is correlated with increased levels of screen time, and adolescents appear to prefer to engage in more active pursuits when out with friends. While most studies had adolescents report the PA and screen time of themselves and their friends, a few studies actually examined nominated friends' PA and SB using accelerometers. These studies did find significant correlations between PA and SB levels of the adolescents and their nominated friends.

As evidenced in the literature, there may be significant differences in how friends influence adolescent PA and SB, screen time in particular, according to gender. It appears that females may be more influenced by friends' PA and screen time behavior, though this has not been extensively studied (47). Though no studies, to our knowledge, have directly examined age differences, it is also possible that there may be significant differences in friends' influence on PA, SB, and screen time according to whether adolescents are in high school or middle school. The reasoning is that there are significant declines in PA and increases in screen time throughout adolescence, and friends start to become more important to adolescents (11-12, 20).

Qualitative studies are a good approach to closely examine themes related to friends' influence on PA and screen time, however, only one study, to our knowledge, has examined friends' influence on PA in a qualitative manner (48). This study provided insight into friends' influence on PA by identifying three main friendship groups (school, neighborhood, organized activities), finding that psychological variables such as PA enjoyment played a role in the relationship between friends' influence and adolescent PA, and suggesting of possible gender differences in this association.

CHAPTER 3: METHODS

Participants

Adolescents (N=152) in both middle (grades 6-8) and high schools (grades 9-12), living in the Albemarle County area, were recruited to participate in this study. To obtain a sample that was less prone to bias, 300 students were randomly selected from a school or class roster, and asked to participate in this study. Participants were matched by school level and sex to ensure an equal number of males and females from both middle and high schools. This study obtained approval from both the University of Virginia Institutional Review Board, and the Albemarle County Public Schools Review Board. Written consent/assent was obtained from all participants and a parent/guardian.

Measures

Focus groups

Students from each grade were selected to participate in focus groups, consisting of 4 – 12 participants of the same gender (47). Each focus group lasted approximately 45 – 60 minutes and was conducted by a trained moderator. All focus groups took place during the school day, and were typically held in a private conference room or classroom to ensure privacy. All focus groups were audio recorded using an Olympus VN-7200 digital recorder and an assistant moderator took notes on participants and any salient

events. All participants were offered refreshments, and each group began with the moderator posing an “icebreaker” question to help participants feel relaxed talking to the group. The focus groups had a semi-structured design with follow-up process on key topics of interest. Questions were based on PA and SB, friendship groups, and the influence of friends on PA and SB. The conversations from these sessions were audio recorded, transcribed by two researchers, and coded based on the content response.

Demographic Characteristics

Participants completed a short questionnaire containing questions about the following demographic characteristics: age, grade level, race/ethnicity, parent education, and self-reported height and weight so that body mass index (BMI; kg/m^2) could be calculated. BMI was then converted into a BMI z-score and BMI percentile based on age and gender was calculated.

Physical Activity/Sedentary Behavior measures

The ActiGraph GT3X+ device was used to assess PA and SB (ActiGraph, LLC, Pensacola, FL). The ActiGraph has the ability to detect normal human motion while filtering out high-frequency vibrations that would artificially increase movement data, and has been validated for use in children and adolescents in laboratory and field studies (76). Movement is captured in 3 axes and expressed at a rate of counts per minute (CPM). Participants were instructed to wear the accelerometers for 7 days except during sleep, swimming, or bathing. Times of > 60 minutes of accelerometer CPM values = 0 were considered times when the device was not worn (104), and were excluded from the analysis. Values less than 100 CPM were classified as SB, 101 – 2996 CPM was

classified as light activity, and values ≥ 2296 CPM was classified as moderate-to-vigorous physical activity (MVPA) (32, 103). Participants were included in this analysis if they provided at least 3 days of at least 600 minutes of data per day (55, 106).

Godin-Shephard PA recall

The Godin-Shephard (G-S) PA recall asked participants to record the number of hours in a typical week that they engaged in strenuous (“heart beats rapidly”), moderate (“not exhausting”), and mild exercise (“little effort”). The G-S recall has been previously validated in adolescent and adult populations using various criterion measures, such as the Caltrac accelerometer ($r=0.32$ to 0.45) (56), aerobic fitness ($r=0.38 - 0.56$) (68), and other PA questionnaires ($r=0.36$ to 0.61) (46). Response options are “none”, “ <0.5 hours/week”, “ $0.5-2$ hours/week”, “ $2.5-4$ hours/week”, “ $4.5-6$ hours/week”, and “ $6+$ hours/week”, and were coded as 0, 0.25, 1.25, 3.25, 5.25, and 6.75 hours/week, respectively. The sum of the responses for both strenuous and moderate PA were calculated to determine hours spent in moderate to vigorous PA (MVPA) per week.

Screen Time

Participants responded to a previously validated questionnaire (105) that asks “In your free time on an average weekday (Monday-Friday), how many hours do you spend doing the following activities?” These activities included watching television/DVDs/videos, using a computer, and videogames (Xbox/Play-Station/other electronic games). Participants were asked to rate the amount of time engaged in these activities on an average weekend day. The seven response options ranged from “0 hours” to “5+ hours”. Test-retest reliabilities for both weekday and weekend items are $r=0.63$ and 0.64 for television viewing, $r=0.76$ and 0.77 for computer use, and $r=0.72$ and 0.84

for electronic games. The weighted mean was calculated based on responses to these six questions to obtain the weekly hours spent on screen time (105).

Psychosocial measures

Self-efficacy for PA was measured using a previously validated modified version of the original scale (59). This scale consisted of questions that measure children's confidence in their ability to overcome barriers and engage in PA. The questionnaire starts "I can be physically active during my free time on most days..." followed by the statements "no matter how busy my day is", "even if it is very hot or cold outside", and "even if I have to stay home". Response options for this 5-point scale range from 1 ("Disagree a lot") to 5 ("Agree a lot"). Internal consistency for this scale in a school-based sample of 100 adolescents was $\alpha=0.76$.

Self-efficacy for SB was measured using a 7-item sedentary behaviors self-efficacy scale that assess adolescents' confidence to reduce the amount of time that they spend being sedentary (e.g., plan ahead of time what TV shows you will watch during the week) (66). The 5-point Likert scale contains responses that range from 1 (I'm sure I can't) to 5 (I'm sure I can). A higher score indicated that the participant was more confident that they could refrain from sedentary behaviors. Test-retest reliability for this scale was .81 and internal consistency was $\alpha=.81$ (65-66).

PA enjoyment was measured using a validated modified version of the original scale (58) that asks three questions that started "When I am active..." followed by the items "I feel bored", "I dislike it", and "It frustrates me". The 5-point scale contains responses that range from 1 ("Agree a lot") to 5 ("Disagree a lot"), with a higher score indicative of more enjoyment related to PA.

Enjoyment of SB was measured using a validated scale (65, 86) that consisted of 10 items that started “I enjoy doing the following activities...” followed by SB items such as “computer use”, “television viewing”, and “sitting and socializing”. The 5-point scale contains responses that range from 1 (“Strongly disagree”) to 5 (Strongly agree”) (65, 86).

Perceived barriers to PA were measured with 4 items adapted from a validated modified version of the original scale (30) which asked “How often do these things keep you from being physically active?” Items included “The weather is bad”, “I don’t have time to do physical activity”, “It would take time away from my school work”, and “I’m embarrassed about how I look when I’m active”. The 5-point scale ranges from 1 (“very often”) to 5 (“never”), with a higher score indicative of fewer barriers. Internal consistency for this scale was $\alpha=0.49$.

Nominated Friends

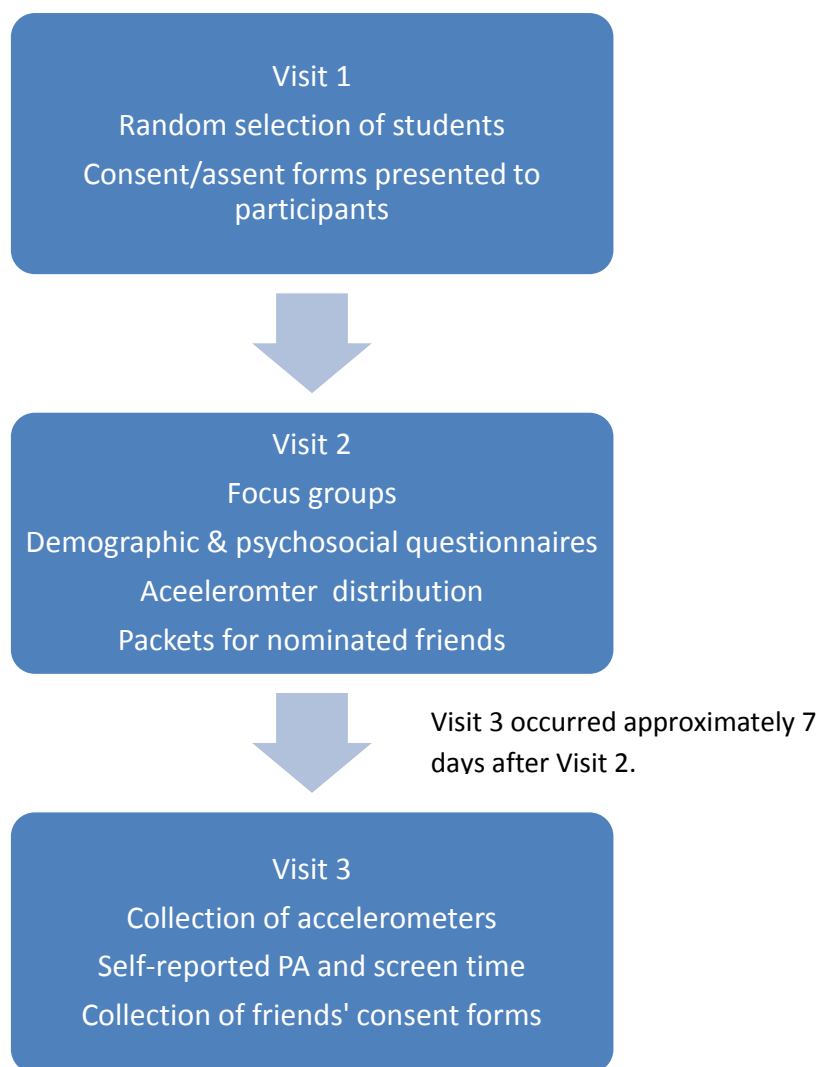
In order to compare adolescents’ PA and screen time with their friends’ PA and screen time, we asked participants to choose up to 5 friends to participate in this study (53). These friends did not have to be in the same grade or attend the same school. Participants were given an envelope containing a consent/assent form for the nominated friend and parent/guardian, a PA (G-S Recall) questionnaire, and the screen time questionnaire.

Procedures

For the initial visit, two researchers traveled to the selected schools and randomly selected students from the designated grade levels to participate in the study. If the students agreed to participate, they were presented with the consent/assent forms that

they signed and took home to their parent/guardian to sign. For the second visit, we returned to the schools for collection of the consent forms and to conduct the focus groups. The focus groups lasted approximately 45 – 60 minutes and consisted of semi-structured questions pertaining to friends, peers, and activities with friends. At the end of the focus groups, participants filled out several demographic and psychological questionnaires previously described, and received an accelerometer that they were to wear for 7 days. In addition, participants nominated up to 5 of their closest friends. A week later, we returned to the schools to collect the accelerometers, distributed questionnaires inquiring about past week MVPA and screen time, and collected any consent/assent forms and questionnaires from the nominated friends. The following figure on the next page (Figure 1) illustrates the flow of the testing procedures.

Figure 1: Flow chart of procedures



Statistical Analysis

Quantitative Analysis

Power Analysis:

G-power software (v.3.1.2), with power = 0.80 and $\alpha = .05$, was used to determine the required sample size. Based on the effect sizes (Cohen's $d = .23$) reported by Jago et al.(49) when stratifying by gender, stratifying by school level and gender required a sample size of approximately 200 participants (50 in each group).

A 2 x 2 between subjects ANOVA was conducted to examine differences in gender, school level, and the interaction effect of gender and school level on both self-reported and objectively measured MVPA and SB. Tukey HSD post hoc tests were conducted to determine the differences in the gender and school level interaction effect.

A hierarchical regression model was used to examine the association between self-reported nominated friends MVPA and screen time and both self-reported and objectively measured adolescent MVPA and SB. Nominated friends' MVPA and screen time were averaged across all nominated friends. The baseline regression model consisted of the standard demographic variables. The second model consisted of the psychosocial variables for PA and SB. The final model consisted of the demographic variables, psychosocial variables, and the nominated friends' MVPA and screen time variables. Analyses were conducted first on the overall sample, then stratified by gender and school level, and then finally stratified by gender and school level interaction. All quantitative analyses were performed using SAS statistical software, version 9.3, with a significance level set a priori at $\alpha < .05$.

Qualitative Analysis

All focus groups were audio recorded and transcribed verbatim. Consistent with content analysis (75), transcripts were read line by line and marked with independent codes that described the content response. Two trained researchers coded the transcriptions from the focus groups independently, met to refine code definitions, and any inconsistencies were addressed. Cohen's K statistic was calculated to assess inter-rater reliability. Codes were then entered as free nodes (labels that describe themes) into a created database with NVivo qualitative analysis software, version 10.0. Matrices of codes were developed and resulted in the development of hierarchical codes (categories that describe a broader group of themes). Text retrievals were then performed on the hierarchical codes and content was interpreted and summarized into tables.

CHAPTER 4: RESULTS

Participants

There were 179 participants recruited for the present study. Four were excluded for insufficient physical activity data, 21 were excluded for missing nominated friends' data, and 3 were excluded for missing multiple variables. The included sample was comprised of 152 participants (53% female, 80% Caucasian, 50% middle school, mean age 14.5 ± 1.75 yrs.). Independent samples t-test indicated that there were no significant differences in demographic data among the excluded and included participants. Table 1 displays descriptive statistics for middle and high school males and females.

QUANTITATIVE RESULTS

Objective MVPA

Descriptive Results

Objective MVPA descriptive statistics are presented in Table 2. Accelerometer data indicated that the overall sample, on average, engaged in 46.87 ± 21.03 minutes of MVPA per day. ANOVA and post hoc tests revealed the following: 1) males ($M = 53.29 \pm 21.39$) had significantly higher levels of MVPA minutes ($p=.0003$) than females ($M = 41.08 \pm 19.04$); 2) no significant differences were found between middle school ($M=48.3 \pm 20.83$) and high school students ($M=45.43 \pm 21.27$); 3) high school females had significantly lower levels of objective MVPA ($M=37.65 \pm 18.36$) than either high school boys ($M=54.56 \pm 21.04$) or middle school boys ($M=52.1 \pm 21.93$).

Regression Results for Overall Sample

For objective MVPA, regression analysis revealed that the total model (demographic variables + psychosocial variables + nominated friends' variables) was significantly associated with objective MVPA ($p < .0001$, $r^2 = .29$). Complete results of the regression model are displayed in Table 3. Males ($\beta = 7.86$, $p = .02$), minority status ($\beta = 9.72$, $p = .01$), greater PA self-efficacy ($\beta = 1.45$, $p = .01$), greater SB self-efficacy ($\beta = .87$, $p = .006$), greater number of friends ($\beta = .17$, $p = .04$), and nominated friends' MVPA ($\beta = 3.26$, $p = .0003$) were associated with higher levels of objective MVPA.

Regression Results by Gender

For males, the overall regression model (demographic variables + psychosocial variables + nominated friends' variables) was significantly associated with objective MVPA ($p = .006$, $r^2 = .24$). Within males, minority status ($\beta = 18.37$, $p = .009$), and greater SB self-efficacy ($\beta = 1.06$, $p = .04$) were significantly associated with objective MVPA. For females, the overall regression model was significantly associated with objective MVPA ($p = .0004$, $r^2 = .3$). Within females, less SB enjoyment ($\beta = -.27$, $p = .05$) and nominated friends' MVPA ($\beta = 4.45$, $p = .0004$) were significantly associated with objective MVPA (Table 4).

Regression Results by School Level

For middle school, the overall regression model was significantly associated with objective MVPA ($p = .0005$, $r^2 = .31$). Within middle school, males ($\beta = 10.7$, $p = .02$), minority status ($\beta = 12.52$, $p = .01$), and friends' MVPA ($\beta = 4.32$, $p = .0005$) were significantly associated with objective MVPA. For high school, the overall regression model was significantly associated with objective MVPA ($p = .0003$, $r^2 = .32$). Within high

school, greater PA self-efficacy ($\beta=1.83$, $p=.05$), and greater SB self-efficacy ($\beta=1.76$, $p=.0008$), and nominated friends' MVPA ($\beta=3.18$, $p=.05$) were associated with objective MVPA (Table 5).

Regression Results for Gender and School Level Interaction

For middle school males, the overall regression model was not significantly associated with objective MVPA ($p=.1$, $r^2=.21$). For middle school males, only being from a minority group ($\beta=26.57$, $p=.009$) was associated with increased objective MVPA. For middle school females, the overall regression model was significantly associated with objective MVPA ($p=.02$, $r^2=.35$). For middle school females, only nominated friends' MVPA ($\beta=5.14$, $p=.004$) was significantly associated with objective MVPA. For high school males, the overall regression model was significantly associated with objective MVPA ($p=.0015$, $r^2=.48$). For high school males, only SB self-efficacy ($\beta=3.73$, $p=.0002$) was significantly associated with objective MVPA. For high school females, the overall regression model was significantly associated with objective MVPA ($p=.03$, $r^2=.29$). For high school girls, only nominated friends' MVPA ($\beta=4.09$, $p=.03$) was significantly associated with objective MVPA (Table 6).

Subjective MVPA

Descriptive Results

Subjective MVPA descriptive results are presented in Table 7. The overall sample reportedly engaged in 8.25 ± 2.05 hours of MVPA per week. No significant differences were revealed when the sample was analyzed according to gender, school level, and the interaction between gender and school level. Subjective MVPA had a significant, but low correlation with objective MVPA ($r=.31$, $p<.0001$), and was

significantly greater than objective MVPA for the overall sample, gender, school level, and the interaction between gender and school level ($p < .0001$).

Regression Results for Overall Sample

For subjective MVPA, regression analysis revealed that the total model was significantly associated with subjective MVPA ($p < .0001$, $r^2 = .32$). Complete results of the regression model are displayed in Table 8. Greater PA self-efficacy ($\beta = .28$, $p < .0001$) and nominated friends' MVPA ($\beta = .37$, $p < .0001$) were associated with subjective MVPA.

Regression Results by Gender

For males, the overall regression model was significantly associated with subjective MVPA ($p < .001$, $r^2 = .54$). For males, minorities ($\beta = 1.14$, $p = .03$), greater PA self-efficacy ($\beta = .32$, $p < .0001$), and nominated friends' MVPA ($\beta = .62$, $p < .0001$) were significantly associated with subjective MVPA. For females, the overall regression model was significantly associated with subjective MVPA ($p = .04$, $r^2 = .15$). For females, only greater PA self-efficacy ($\beta = .32$, $p = .0006$) was significantly associated with subjective MVPA (Table 9).

Regression Results by School Level

For middle school, the overall regression model was significantly associated with subjective MVPA ($p = .0009$, $r^2 = .29$). For middle school, greater PA self-efficacy ($\beta = .27$, $p = .002$) and nominated friends' MVPA ($\beta = .27$, $p = .001$) were significantly associated with subjective MVPA. For high school, the overall regression model was significantly associated with subjective MVPA ($p < .0001$, $r^2 = .42$). For high school, being younger in age ($\beta = -.85$, $p = .002$), greater PA self-efficacy ($\beta = .32$, $p = .0002$), and nominated friends' MVPA ($\beta = .57$, $p = .0001$) were associated with subjective MVPA (Table 10).

Regression Results for Gender and School Level Interaction

For middle school males, the overall regression model was significantly associated with subjective MVPA ($p < .0001$, $r^2 = .65$). For middle school males, minority status ($\beta = .67$, $p = .04$), greater PA self-efficacy ($\beta = .21$, $p = .05$), greater SB self-efficacy ($\beta = .15$, $p = .01$), and nominated friends' MVPA ($\beta = .57$, $p = .0004$) were associated with subjective MVPA. For middle school females, the overall regression model was not significantly associated with subjective MVPA ($p = .59$, $r^2 = .04$). For middle school females, none of the demographic, psychosocial, or nominated friends variables were associated with subjective MVPA. For high school males, the overall regression model was significantly associated with subjective MVPA ($p = .0015$, $r^2 = .58$). For high school males, greater PA self-efficacy ($\beta = .54$, $p = .001$) and nominated friends' MVPA ($\beta = .53$, $p = .03$) were both significantly associated with subjective MVPA. For high school females, the overall regression model was not significantly associated with subjective MVPA ($p = .07$, $r^2 = .22$). For high school females, nominated friends' MVPA ($\beta = .54$, $p = .02$) was significantly associated with subjective MVPA (Table 11).

Objective Sedentary time

Descriptive Results

Descriptive results are presented in Table 12. ANOVA and post hoc tests revealed that high school students ($M = 549.8 \pm 82.25$) had significantly greater levels of sedentary minutes per day ($p = .05$) than middle school students ($M = 522.8 \pm 89.68$). No significant differences existed between males and females or among the gender by school level interaction.

Regression Results for Overall Sample

For objective sedentary time, regression analysis revealed that the total model was not significantly associated with objective sedentary time ($p=.24$, $r^2=.12$). Only greater PA barriers ($\beta=5.33$, $p=.05$) was significantly associated with objective sedentary time (Table 13).

Regression Results by Gender

For males, the overall regression model was not significantly associated with objective sedentary time ($p=.3$, $r^2=.04$). No significant associations existed among any of the demographic, psychosocial, and nominated friends variables with objective sedentary time. For females, the overall regression model was not significantly associated with objective sedentary time ($p=.22$, $r^2=.05$). For females, both greater PA barriers ($\beta=10.05$, $p=.02$) and greater SB enjoyment ($\beta=1.63$, $p=.02$) were significantly associated with objective sedentary time (Table 14).

Regression Results by School Level

For middle school, the overall regression model was not significantly associated with objective sedentary time ($p=.13$, $r^2=.09$). No significant associations existed among any of the demographic, psychosocial, and nominated friends variables with objective sedentary time. For high school, the overall regression model was not significantly associated with objective sedentary time ($p=.12$, $r^2=.1$). For high school, a higher BMI percentile ($\beta=72.5$, $p=.03$) and greater PA barriers ($\beta=9.06$, $p=.04$) were associated with objective sedentary time (Table 15).

Regression Results for Gender and School Level Interaction

For middle school males, the overall regression model was not significantly associated with objective sedentary time ($p=.87$, $r^2=.03$). None of the demographic, psychosocial, or nominated friends variables were associated with objective sedentary time. For middle school females, the overall regression model was not significantly associated with objective sedentary time ($p=.17$, $r^2=.26$). None of the demographic, psychosocial, or nominated friends variables were associated with objective sedentary time. For high school males, the overall regression model was significantly associated with objective sedentary time ($p=.0012$, $r^2=.46$). For high school males, Caucasians ($\beta=-51.06$, $p=.006$), decreased PA self-efficacy ($\beta=14.29$, $p=.02$), less enjoyment of PA ($\beta=14.56$, $p=.009$), increased SB enjoyment ($\beta=4.13$, $p=.03$), and decreased amount of friends ($\beta=-8.47$, $p=.004$) were associated with objective sedentary time. For high school females, the overall regression model was not significantly associated with objective sedentary time ($p=.35$, $r^2=.06$). For high school females, only a greater BMI percentile ($\beta=116.81$, $p=.05$) was associated with objective sedentary time (Table 16).

Reported Screen Time

Descriptive Results

Descriptive statistics for reported hours of screen time per week are presented in Table 17. Overall, the sample reported engaging in 10.09 ± 6.3 hours of screen time per week. ANOVA and post hoc testing revealed that males ($M = 11.76 \pm 6.52$) had significantly greater levels of reported screen time per week ($p=.002$) than females ($M = 8.58 \pm 5.72$). No significant differences existed between middle and high school students. The gender by school level interaction analysis indicated that middle school girls ($M =$

7.14 \pm 4.56) had significantly less hours of reported weekly screen time ($p=.003$) than either middle school boys ($M = 12.04 \pm 7.28$) or high school boys ($M=11.47 \pm 5.69$).

Regression Results for Overall Sample

For subjective screen time, regression analysis revealed that the total model was significantly associated with total hours of reported screen time per week ($p<.001$, $r^2=.25$). Males ($\beta=2.64$, $p=.009$), decreased SB self-efficacy ($\beta=-.2$, $p=.05$), greater SB enjoyment ($\beta=.09$, $p=.04$), and greater number of friends ($\beta=.05$, $p=.05$) (Table 18).

Regression Results by Gender

For males, the overall regression model was significantly associated with total hours of reported screen time per week ($p<.0001$, $r^2=.37$). For males, less parent education ($\beta = -1.21$, $p=.04$), less SB self-efficacy ($\beta = -.45$, $p=.003$), and greater number of friends ($\beta=.07$, $p=.02$) were significantly associated with total hours of reported screen time. For females, the overall regression model was significantly associated with total hours of reported screen time per week ($p=.004$, $r^2=.23$). For females, greater PA barriers ($\beta=.54$, $p=.03$), less enjoyment of PA ($\beta=.5$, $p=.04$), and greater SB enjoyment ($\beta=.11$, $p=.01$) were significantly associated with reported screen time per week (Table 19).

Regression Results by School Level

For middle school, the overall regression model was significantly associated with total hours of reported screen time per week ($p=.0004$, $r^2=.32$). For middle school, both males ($\beta=3.42$, $p=.02$) and less PA enjoyment ($\beta=.61$, $p=.03$) were associated with total hours of reported screen time per week. For high school, the overall regression model was significantly associated with total hours of reported screen time per week ($p=.0006$, $r^2=.3$). For high school, less parent education ($\beta=-1.86$, $p=.008$), greater PA barriers

($\beta=.59$, $p=.04$), greater SB enjoyment ($\beta=.36$, $p=.01$), and less nominated friends' MVPA ($\beta=-1.03$, $p=.03$) were associated with total hours of reported screen time per week (Table 21).

Regression Results for Gender and School Level Interaction

For middle school males, the overall regression model was significantly associated with total hours of reported screen time per week ($p=.004$, $r^2=.48$). For middle school males, being older in age ($\beta=2.7$, $p=.04$), decreased SB self-efficacy ($\beta=-.65$, $p=.006$), and nominated friends' screen time ($\beta=.4$, $p=.03$) were associated with total hours of reported screen time. For middle school females, the overall regression model was not significantly associated with total hours of reported screen time per week ($p=.32$, $r^2=.07$). For middle school females, less enjoyment of PA ($\beta=.86$, $p=.03$) was significantly associated with total hours of reported screen time. For high school males, the overall regression model was significantly associated with total hours of reported screen time ($p<.0001$, $r^2=.64$). For high school males, minority status ($\beta=5.13$, $p=.0001$), increased PA barriers ($\beta=.86$, $p=.02$), decreased SB self-efficacy ($\beta=-.51$, $p=.006$), and lower levels of nominated friends' MVPA ($\beta=-1.44$, $p=.04$) were associated with total hours of screen time. For high school females, the overall regression model was not significantly associated with total hours of reported screen time ($p=.1$, $r^2=.21$). For high school girls, increased PA barriers ($\beta=1.1$, $p=.02$) were significantly associated with total hours of reported screen time (Table 21).

QUALITATIVE RESULTS

School level and participant characteristics are reported in Table 22. A total of 108 participants (57% female, 51% middle school students) participated in the focus

groups. Participants were from the Albemarle County Public Schools, which included 3 middle schools, and 2 high schools. Overall, there were 13 groups total (7 middle school, 6 high school), with the smallest group containing 4 participants and the largest group containing 12 participants. All focus groups took place during the school day, and were typically held in a private conference room or classroom. Two researchers were present at each focus group, with one researcher acting as the facilitator, and the other researcher acting as a passive observer, taking detailed notes. All participants were offered refreshments, and each group began with the moderator posing an “icebreaker” question to help participants feel comfortable.

Two researchers coded the transcriptions from the focus groups independently, met to refine code definitions, and any inconsistencies were addressed. Cohen’s K statistic was .85, suggesting that there was good inter-rater reliability.

The first issue of interest was the types of PA and SB that participants engaged in after school and on the weekends. The second issue was the types of friendship groups that participants belonged to, and what activities they participated in with these groups. The third issue of interest was the influence of friends, and any additional sources, on PA and SB. The following results will first summarize overall themes, and then stratify the categories by gender and school level.

Overall Common Themes

Focus groups were asked to discuss themes associated with PA and SB levels, friendship groups, and influence of friends and others on PA and SB. Overall themes that were reported by majority of subjects are summarized in Table 24. The majority of participants reported sports as the most popular type of PA. Types of sports included

basketball, baseball, soccer, track, swimming, football, and lacrosse. It is interesting to note that the most talkative participants played organized sports, and appeared to be the most active. This was more apparent for female focus groups, and the moderator of the group would make an effort to include the quieter participants. For SB, television watching was reported by participants across all categories. It was interesting that many of the females, particularly those in middle school, were confused by the question of SB. One middle school female group, in particular, reported that they rarely watched television or talked on the phone, and therefore, had very little SB. When explained by the moderator that screen time using any type of mobile device could count as SB, 4 of the 6 females in the group changed their initial answers, reporting that while they do not typically watch television or talk on the phone, they do watch movies on their mobile devices, and engage in texting and the use of social media.

Friendship groups

The most popular friendship groups described were friends from school and friends from sports teams, with neighborhood friends and family friends also commonly mentioned. A few additional groups included church friends, opposite sex friends, and activities (not sports) friends. Most participants reported that the activities they engaged in were largely dependent on which friendship group they were with. A summary of all of the friendship groups is presented in Table 23, and the most common groups are discussed in the following sections.

School friends

All participants reported that they had strong friendships with children and adolescents from school with whom they spent considerable time with outside of school.

Participants reported that they were the least active with this friendship group, commenting that time together is spent doing homework. It also appeared that these friendships may be based more on convenience, rather than common interests.

Sports team friends

Many participants reported that they had close friendships with children and adolescents who were on their sports teams. To be categorized as a sports team friend, the participants had to have met and formed the friendship with the individual during that time they were on the same team. If the participant had a friend from school who had joined the participant on the team, the friend would still be considered a “school friend”. Participants reported being the most physically active with these friendship groups. As one high school male reported:

“My friends I play sports with, yeah we are always doing something active, but, like, my friends from church prefer to watch TV or go eat”
(High school male, 35 MVPA min/day, 4.5 hrs. screen time/wk.).

Neighborhood friends

Many participants reported spending time with children and adolescents around their neighborhood that did not attend their school. Participants tended to spend more time with this friendship group during the summer when school is out of session. Participants reported being active with these friendship groups though there could be a seasonality effect since participants spent more time with this group outside during the summer.

Family friends

Several participants reported spending time with children and adolescents who were friends of the family. This included siblings' friends, or children who had parents that were friends of the family. Participants who had friends in this category reported knowing these friends the longest, and the activities they engaged in together tended to vary. Though this was not directly compared by participants, it was interesting to note that friends of siblings tended to engage in more active pursuits with participants than friends whose parents were friends with the participants' parents. A middle school male commented on this theme:

“For me, if I’m with my school friends, we do more sitting around and playing videogames. If I’m with my brother’s friends, we’ll definitely do something more active” (middle school male, 57 MVPA min/day, 10.5 hrs. of screen time/wk.).

Other friends

Participants also reported having friends from church, friends from organized activity groups (Boy Scouts, music club). Activities with these friendship groups varied greatly, with church friends engaging in primarily sedentary types of activities, and friends from Boy Scouts engaging in highly active PA. When participants were prompted to speak further on these groups, it appeared that the activities they did with these friendship groups were pre-planned, and therefore, it was not the friendship group itself that drove the activity choice, but rather the organized activity (e.g., planned camping with Boy Scouts).

Influence of Friends on PA

All participants reported that friends were a large source of influence on their PA behavior. This influence was mainly through participation in activity together, verbal encouragement to engage in PA, and modeling of PA.

“My friends definitely influence me to be more active. If I don’t feel like running for track, they’ll come and keep me company. Makes the running feel a little easier if we’re talking and they’ll push me to go harder”
(Middle school female, 84.17 MVPA min/day, 9 hrs. screen time/wk.).

Many of the participants reported that they would be less active without their friends, and that they wouldn’t have participated in certain sports and activities, if their friends hadn’t been already participating or encouraging them to join.

Influence of Friends on SB

Across the groups, participants similarly reported that friends did not positively influence their levels of SB (i.e., friends did not influence them to be more sedentary). They reported that friends were more likely to want to engage in PA than watch television. In fact, several participants reported that their friends indirectly decreased their SB and screen time by being active with the participants.

“Not really (asked if friends influence SB). Most of my friends don’t watch much TV or play video games. They always want to play sports or go out and do something” (High school male, 55 MVPA min/day, 6 hrs. of screen time/wk.).

While the previous quote was the norm for many of the participants, there was an exception with video game participation. Participants who regularly played video games tended to prefer playing with friends, and reported that if friends wanted to play video

games, they were more likely to play video games than engage in PA. This theme was most common for middle school males who reported the most video game playing out of all the groups.

PA with Friends or Alone

All participants reported that they preferred to do PA with a friend or group of friends, stating that it's more enjoyable and makes time go faster.

“ I think it's more fun to do things with a friend, especially something like running where it's kind of boring” (High school female (44 MVPA min/day, 3.5 hrs. of screen time/wk.)

There were 2 participants, both high school females, who reported that certain activities, such as running, are better alone, however, they also admitted that they were more likely to engage in PA with their friends than by themselves. When asked to elaborate why they preferred engaging in certain activities alone, both female participants reported that running was a way to relieve stress and allow them to be alone with their thoughts.

Other Sources of Influence

Participants were asked if there were anyone or anything else that influences their activity levels. While this question was asked in a general way, all focus groups remarked that family was another source of influence, though the degree of influence depended on gender and school level.

“Yeah, my dad he works out probably like every day except the weekends, and he says hey, want to work out with me, and in that way he influences me” (High school female, 45.3 MVPA min/day, 13 hrs. of screen time/wk.)

This influence was mainly driven by family modeling of activity, though engaging in activity with participants, and verbal encouragement were also mentioned. Support of activity, which included driving participants to practices or recreational facilities, purchasing athletic equipment, and registering participants for teams and activities, was more important for middle school participants.

Greatest Influence on Activity

Participants were asked whom they felt had the greatest influence on their PA and SB. Majority of answers were friends or family, though a few named themselves as their own greatest source of influence. As one middle school female reported:

“I’d say I’m the biggest influence on my activity because I like will tell my friends we should do something active. I hate sitting around and doing nothing” (middle school female, 64 MVPA min/day, 8.5 hrs. of screen time/wk.).

Many of the participants reported that the people who they spent the most time with had the greatest influence on their activity. One middle school male reported:

“I’d say definitely my family because, like (name of another participant) said, I spend most of my time with them” (Middle school male, 25 MVPA min/day, 16 hrs. of screen time/wk.).

Results by Gender

Themes were split up according to gender, and several key differences were noted. Table 27 summarizes these results. The majority of males preferred being active with a group of friends, while females preferred activity with a single friend, namely a best or close friend. Although the reasoning for why females preferred activity with a

friend wasn't clear, one high school female focus group discussed that it was easier to engage in PA with a single, close friend. The following is a discussion that took place between 2 high school females:

"I think when there are a lot of people around, you just like sit and talk, but if it's just another person, like my friend (name of friend), then we just want to do something more active" (High school female, 40 MVPA min/day, 10 hrs. of screen time/wk.).

"Kind of true what (name of the previous participant) said. For example, I was with one friend and we went hiking, but then I hung out with a big group and we just sat around and didn't do anything" (High school female, 35 MVPA min/day, 2 hrs. of screen time/wk.).

Males primarily engaged in activity with friends due to competitive reasons or to enhance performance, though this was more of a theme for high school males.

"My friends influence me because we are always competing with each other. It's kind of like we have a common goal to be the best" (high school male, 81 MVPA min/day, 11.5 hrs. of screen time/wk.).

Females, on the other hand, reported that companionship and enjoyment were their reasons for engaging in PA with a friend. As one middle school female reported:

"I do have a friend who wants to swim with me or go for a run, and it makes time go faster because you can like talk and laugh together" (middle school female, 53 MVPA min/day, 2.5 hrs. of screen time/wk.).

For females, competition was not a major theme, and only 2 females in one high school focus group mentioned competition as a reason they played sports with their friends. Both were highly involved in organized sports, however, the remaining participants in the focus groups disagreed with them, reporting that overly competitive individuals deterred them from playing.

Preferences for SB also differed among males and females, though both genders named television watching as a popular SB. While a majority of males reported playing video games, only one female in the sample reported this specific SB. Males also preferred to engage in SB, such as video game playing, with friends, though this was apparent more in middle school males.

Females were more likely to engage in phone use for activities such as texting, playing games, and using social media sites. Few also reported talking on their phone. The majority of females preferred to engage in SB alone. The one exception was sitting around and socializing. As one middle school female reported:

“I’d rather watch TV by myself. If I’m with a friend just hanging out, I’m fine just talking and hanging, but it feels weird to..like..sit there in silence watching TV” (middle school female, 31 MVPA min/day 5 hrs. of screen time/wk.).

Finally, while the majority of females reported their family as having the greatest influence on their activity behavior, males tended to have mixed results, with several of them reporting that friends were more of an influence to them. A female participant stated the following:

“My mom is a long distance runner, and she always wants me to, you know, go for runs with her, and encourages me to do active stuff all the time” (middle school female, 62 MVPA min/day, 11 hrs. of screen time/wk.).

There were also several females who describe activity with a parent as a bonding experience. As one high school female explained:

“....sometimes I’ll go to the gym with her [my mother] since she wants me to do active stuff. It’s good bonding though since we’re all so busy. It’s hard to spend time together, so being active is a way to spend time with her” (high school female, 63 MVPA min/day, 4 hrs. of screen time/wk.)

For males, there were mixed results regarding who had the greatest influence on their activity behavior, with several of them reporting that friends were more of an influence to them, as demonstrated by the following statement:

“My family, I guess, think it’s important to be active, but they aren’t really active themselves. My dad likes to watch TV a lot and he’ll tell me to go outside and practice, but he doesn’t really care that much” (high school male, 55 MVPA min/day, 6 hrs. of screen time/wk.).

Results by school level

Results from the analysis were also divided according to school level, and a few differences between middle school and high school participants were noted. Middle school participants reported more PA on weekends, while high school participants had mixed results, with some reporting more PA during the weekdays. An example of the mixed results for the high school participants can be seen in the following 2 responses:

“Weekends [when most active]. I like to out hiking around here like on the Rivanna trail” (middle school male, 84 MVPA min/day, 4 hrs. of screen time/wk.).

“I’m...uh...probably more active during the week because that’s when I have practice and see my friends more often” (high school male, 115 MVPA min/day, 13.5 hrs. of screen time/wk.).

Screen time was increased for both middle and high school participants on the weekend. For middle school participants, screen time was mainly in the form of television watching and video game playing, whereas in high school participants, computer use was much more emphasized.

Finally, it is important to note that the influence of friends differed slightly among middle school and high school participants. While both groups reported verbal encouragement of PA and friend’s engagement in PA with the participant as important sources of influence, high school participants also reported that modeling of PA by their friends also influenced their PA behavior.

“It’s easier to be like active when I see someone doing something rather than just asking it, so if I see my friend going for a jog, then I’ll just go jog with them” (high school female, 20.5 MVPA min/day, 3 hrs. of screen time/wk.).

For middle school students, modeling of PA by their parents was more important. When discussing their parents’ influence on PA, it was interesting that participants often noted what types of activity their parents would do.

“Well, sometimes my family likes to go for walks. It’s kind of a way to spend time together. My mom is also a big runner, so sometimes we’ll run together too” (middle school female, 49 MVPA min/day, 4.5 hrs. of screen time/wk.).

Results by gender and school level

Results were categorized according to gender and school level. Several differences among the groups included types of friendship groups, activities with friends, influence of friends on activities, and family influence. Table 27 summarizes these differences.

In general, high school males were the least talkative of the groups, while high school females tended to be the most talkative. Typically, there were usually 1 to 2 participants who were more domineering of the conversation, particular for female groups, and the moderator worked to include others in on the conversation. Also of interest was that both middle and high school females tended to have at least one friend in the focus group. This appeared to be more the case in middle school females, where they showed up in pairs for the groups.

While all four groups reported having school friends, sports team friends, and neighborhood friends, high school girls also reported having male friends or boyfriends, whom were different than other types of friendship groups. It was interesting to note that when asked initially asked about friendship groups, male friends/boyfriends were not mentioned. Further on in the discussion, the most talkative female of one the groups mentioned a boyfriend/male friend, and said the following: then 5 of the remaining 7

females of the group agreed with her. The high school female who was the first to talk about boyfriends/male friends said the following:

“Yeah, with guy friends, you’ll talk about different things. With girls you talk about guys, but with guys you goof around, you don’t get too in depth, and you definitely are more active with them” (high school female, 28 MVPA min/day, 10 hrs. of screen time/wk.).

After this particular high school female reported boyfriends/male friends having a different influence on PA levels, 5 of the 7 remaining females in the group agreed with her. One high school female had this to say on the topic:

“I think guys and guy friends have an influence on activity definitely. Like if a guy plays sports, and you want him to like you, then you’ll try to do sports to impress him” (high school female, 26 MVPA min/day, 6 hrs. of screen time/wk.).

Of the remaining 2 females in the group, one did not speak on the topic, while the other partially agreed with males causing an increase in PA, however, acknowledging that was not the case for her

“That’s true [playing sports to impress males] unless you’re no good at sports like me (laughs)” (high school female, 18 MVPA min/day, 6 hrs. of screen time/wk.).

Boyfriends and male friends were brought up in 2 of the remaining 3 high school female focus groups, but were not discussed in great detail, though it was noted that they did tend to increase PA. Neither males nor middle school females mentioned opposite sex friends when asked to describe their friendship groups.

Friends did not appear to have a large influence on SB or screen time in females, and high school males. However, middle school males reported that friends influenced them to play video games, and that they would not play them if they were alone. As one middle school male reported:

“I’ll only play video games if my friends want to play. It’s no fun to play by yourself” (middle school male, 60 MVPA min/day, 10 hrs. of screen time/wk.).

It was interesting to note that within one middle school males group, the participants started comparing their video game scores on several games, noting that video game playing was much more of a group activity, with a competitive aspect. The moderator had to then redirect the group back to the original discussion.

Another key difference among the groups was who or what they felt was the greatest source of influence on their behavior. Middle school boys and girls, and high school girls tended to report that parents and/or siblings had the most influence on their activity behavior. One middle school female emphasized that her older brother was a role model for her in that he was always active, and encouraged her to be active as much as possible:

“My brother really encourages me to be active. He’ll go running or skiing with me. My parents will somewhat, but not as much as my brother” (middle school female, 62 MVPA min/day, 3 hrs. of screen time/wk.).

However, parents having the greatest influence on behavior depended on two components: 1) whether participants typically spend more time with family than friends, 2) whether parents themselves were active. High school boys reported that they spent

more time with their friends than their family, and that their friends would participate in PA with them which is why they were a major source of influence. As stated by one high school male:

“Friends definitely [who has the greatest influence on activity]. I see them more” (high school male, 57 MVPA min/day, 9.5 hrs. of screen time/wk.).

All four categories reported that the influence was lessened if parents weren't active themselves, however this appeared to be stronger for high school males. In one group of 6 high school males, 4 of them expressed frustration at their parents, especially their fathers, instructing them to be active, but not being active themselves. As one high school male reported:

“Same thing [on parents telling him to be active, but not active themselves]! My parents encourage me to be active, but aren't active themselves! It's actually really frustrating to me. (High school male, 62 MVPA min/day, 12 hrs. of screen time/wk.)

In addition, high school girls reported that parents could actually have a negative influence on their PA levels, through forcing them or demanding that they be active. What was interesting to note is that, similar to the topic of male friends, high school females were reluctant to discuss negative influence of parents until it was brought up by the “most talkative” female of the group.

“It's funny like friends influence you more by doing an activity and then you want to do it too you know, but parents can influence you by pushing you into an activity which doesn't always work” (high school female, 25 MVPA min/day, 14 hrs. of screen time/wk.).

Finally, another important difference that appeared among the four groups was the way in which friends influenced the participants and what aspects of PA were important to participants. High school boys, in particular, placed a large emphasis on competition, and competing with friends being a great motivator to be active. One high school male who reported that he was motivated to be active primarily through competition with his friends, said the following:

“...like when you’re with a group of friends playing basketball or something, you’ll compete against each other. We’ll play games or shoot free throws against each other. Definitely makes you work harder” (high school male, 61 MVPA min/day, 12 hrs. of screen time/wk.).

This sentiment was echoed by another male:

“It’s really about the competition and being part of the team [why PA is important]” (high school male, 39 MVPA min/day, 6 hrs. of screen time/wk.).

High school girls emphasized companionship and the chance to socialize with their friends.

“You can branch out by joining a sport and doing something active like going to a class. It can be a way to meet new people [why PA is important]” (high school female, 68 MVPA min/day, 3 hrs. of screen time/wk.).

In addition, high school females also reported that they felt more psychological benefits such as stress relief, decreased anxiety, and less depressive feelings when they are active, especially when they’re with a friend. As one high school female reported:

“Definitely important to stay active. It makes you physically healthy. Also mentally and emotionally. When I just go on a short hike, I come back feeling more relaxed and happier” (high school female, 49 MVPA min/day, 10 hrs. of screen time/wk.).

Both middle school boys and girls reported that PA with friends was more about having fun.

“Yeah it’s [PA] fun. I try to do something active everyday” (middle school female, 31 MVPA min/day, 5 hrs. of screen time/wk.)

CHAPTER 5: DISCUSSION

The purpose of the present study was to examine the influence of friends on MVPA, SB, and screen time in a sample of middle and high school males and females using a mixed-methods analysis. It was hypothesized that adolescent MVPA and screen time would be associated with nominated friends' MVPA and screen time, and that this association would be moderated by demographic variables and mediated by psychosocial factors. It was also hypothesized that the strength of these associations would differ according to gender and school level.

Major Findings of Quantitative Analysis

Results from the present study indicate that nominated friends' MVPA was significantly associated with participants' objective MVPA, particularly for females. For both middle school males and high school females, nominated friends' MVPA was also significantly associated with subjective MVPA. PA and SB self-efficacy were also significantly associated with objective and subjective MVPA. Only high school males had significant associations with objective sedentary time, and it was found that primarily psychosocial factors (decreased PA self-efficacy, decreased PA enjoyment, increased SB enjoyment) were associated with increased sedentary time. Finally, higher levels of reported screen time were found to be associated with psychosocial factors and nominated friends in males only, with decreased SB self-efficacy and increased levels of

friends' screen time associated with increased screen time in middle school males, and increased SB enjoyment and lower levels of friends' MVPA in high school males.

Major Findings of Qualitative analysis

In this sample of children and adolescents, all participants reported that their friends influenced their PA behavior. Interestingly, with the exception of middle school males, friends did not influence participants to increase their SB, and may have actually induced lower levels of SB. Family appeared to have a large influence on participants' behavior, except for high school males, who reported friends having the greatest influence on their activity levels. Females preferred to participate in PA with one friend, and enjoyment of PA was their reason for engaging in PA with friends. Males preferred to participate in PA with a group of friends, and cited competition as their main reason for engaging in PA with friends. All participants reported that PA was important to them, citing reasons such as improved health, enjoyment of PA, increased social interactions, and the competitive aspect of PA.

Quantitative Analysis

Objective MVPA

The overall sample engaged in approximately 47 minutes of MVPA per day (Table 2). Compared to previous studies examining PA in youth, this sample of adolescents had a higher level of MVPA (49, 80, 104). For example, Ross et al. (80) reported that adolescents engaged in approximately 22 minutes of MVPA per day. Similar to previous findings, the present study found that males had significantly greater objective MVPA levels than females (56 MVPA min per day vs 42 MVPA min/day)

(Table 2) (49-50). High school females had the least amount of objective MVPA which is supported by findings suggesting that older female adolescents engage in the least amount of PA compared to males and younger females (11). Previous research suggests that social pressure (MVPA discouraged for females) and psychosocial factors (lack of perceived confidence) may account for this decrease in MVPA in females (48, 107, 112). There was no difference in MVPA between middle school and high school males which was surprising given that previous results report that both adolescent males and females decrease MVPA levels as they age (11) (Table 2). Although the exact determinants are uncertain, similar to females, this decline in MVPA in older adolescents is thought to be due to increases in school demands, less parental and friend support, and psychological factors such as an increase in self-consciousness during MVPA (64, 70). Results from the present qualitative analysis indicate that our sample reported a high level of support from friends and family, and that friends also engaged in high levels of MVPA, which may account for the lack of decrease in MVPA from middle to high school. Both the high level of MVPA and social support in the sample may be due to the high levels of parental education, and subsequently, SES. Previous studies show an association among SES, amount of parental support, and MVPA (25).

Unlike other studies, we examined the interaction between gender and school level. Contrary to our hypothesis, when stratified by gender and school level, demographic factors did not moderate the association between nominated friends' MVPA and objective MVPA for middle and high school females. Interestingly, being from a minority group was associated with increased objective MVPA in middle school males (Table 6). This is in contrast to previous literature findings that adolescents from minority

groups tend to have lower levels of MVPA (92). On further examination, it was found that African-Americans in our study ($n=14$), but not other minority groups, had significantly higher MVPA levels than Caucasians (58.51 min/day vs. 45.25 min/day, $p=.02$). The results from the qualitative analysis support this finding in that the majority of African-American males and females in the present study reported playing one or more organized sports, which is directly linked to higher PA levels (91). Previous research also suggests that lower SES and parental education are associated with minority groups, which may partly explain lower levels of MVPA (68), however, in the present study, the parental education of participants from minority groups did not differ from Caucasian participants.

Similar to previous studies that have examined the association of psychological correlates of MVPA in adolescents (18, 63), the present study found that increased PA and SB (confidence to walk away from the television) self-efficacy were associated with increased MVPA in the total sample. The present study extends the literature with the addition of the nominated friends' variables in the regression model, finding that both a greater number of friends and friends' MVPA were associated with greater MVPA of the participants (Table 3). The present study is in agreement with a study by Jago et al. (50) finding that number of friends is associated with increased MVPA. While Jago et al. (49-50) only examined middle school students, we separated the present study by school level and extend these findings to high school students, as both middle and high school students' MVPA was positively associated with friends' MVPA. We also extend the previous literature by examining the interaction of gender and school level on the association of nominated friends' variables, along with demographic and psychological

factors, on objective MVPA. Interestingly, nominated friends' MVPA was significantly associated with objective MVPA in middle and high school females, but not for middle nor high school males (Table 6). Only increased SB self-efficacy was associated with increased MVPA for high school males, and being from a minority group was significantly associated with increased MVPA for middle school males. The results from the present study are similar to some previous studies suggesting that nominated friends' MVPA may be more associated with MVPA for females, but not for males (49, 93). In contrast, other studies have found support for friends having an influence on male adolescents as well (50, 107). In the present study, we observed a trend that approached statistical significance ($p=.08$) toward an association between increased MVPA for friends and male participants. When stratified by school level, the association was stronger for middle school males ($p=.09$) than high school males ($p=.43$). The lack of statistically significant findings in middle school males may have been due to the small sample size ($n=37$). A post hoc sample size calculation indicated that a sample size of 70 – 75 participants would have been needed to detect a significant association between objective MVPA and nominated friends' MVPA. In high school males, although not significant, it is interesting to note there was a trend between lower levels of nominated friends' screen time and greater levels of participants' objective MVPA ($p=.10$). The observed trend of the present study is in agreement with Leatherdale et al. (53) who found that lower levels of screen time were associated with greater levels of MVPA between participants and their friends.

It is also interesting to note that increased PA and SB self-efficacy were both significantly associated with greater levels of MVPA for the entire sample, however,

when the sample was stratified by gender and school level, these factors lost statistical significance when nominated friends' variables were entered into the model, particularly for females. These findings were surprising given that previous literature found that PA self-efficacy was one of the strongest predictors of youth MVPA (52, 63, 91), however, none of those previous studies examined nominated friends' behavior. The findings from the present study suggest that nominated friends' MVPA may be a more important factor for MVPA behavior in females than individual psychological variables.

Subjective MVPA

Similar to previous studies that suggest participants overestimate subjective MVPA, all participants reported significantly higher subjective levels of MVPA compared to the objective data (40, 82). In the present study, although significant, subjective and objective MVPA levels did not strongly correlate with each other ($r=.31$), which is similar to correlation coefficients reported by previous studies that have compared objective and subjective activity (40, 82, 104). When compared to objective MVPA, males overestimated their MVPA by approximately 20 minutes per day, while females overestimated their MVPA by approximately 30 minutes per day. In contrast to objective MVPA measured in the present study, as well as previous research (92), there were no significant differences in amount of subjective MVPA between middle and high school males and females. This finding was surprising, and may be due to the overestimation of MVPA by participants, especially females. A study by Sabia et al. (82) suggested that individuals tend to overestimate MVPA more than lower intensity activity because individuals have difficulty in differentiating between lower and higher intensity levels, thus incorrectly classifying lower intensity activity as "moderate" or "vigorous".

Therefore, the findings of studies that assess MVPA with self-report measures only should be interpreted with caution. Assessment of MVPA should be done using a form of objective MVPA measurement, if feasible. Unfortunately, the majority of studies that have examined nominated friends' association with adolescents' MVPA have used self-report to assess activity (2, 20, 93).

The present study agrees with previous studies (8, 18) that used self-report measures to examine MVPA, finding that greater PA self-efficacy was associated with greater levels of MVPA. The present study also extends previous literature by demonstrating that adding the nominated friends' variables to the model, greater levels of nominated friends' MVPA were associated with subjective MVPA as well (Table 7). However, when stratified by gender and school level, these results remained significant only for middle and high school males. It also should be noted that while the total regression model was not significant, greater nominated friends' MVPA was the only factor found to be associated with MVPA for high school females. While it is difficult to explain the discrepancy in the association of nominated friends with objective and subjective MVPA in males, there are a few plausible explanations. Previous studies indicate that males engage in higher intensity levels of activity than females do, so if the discrepancy was indeed due to misclassification of intensity, males may have more accurately reported their intensity levels than females on the questionnaire. Also, while studies have concluded that accelerometers are valid and reliable measures of MVPA (55), there are some activities that are not captured accurately by these devices (55). For example, weight lifting, reported by several males in the present study, has been shown to be underestimated by accelerometers (55). Finally, four high school males participating

in organized contact sports reported that they did not wear their accelerometers during games or practices due to the potential of damage to the device. The finding in the present study that high school males had a lower correlation coefficient ($r=.11$) for the association between subjective and objective MVPA compared to the total sample ($r=.31$) supports the above.

Objective Sedentary Time

Unlike previous studies, we examined sedentary behavior (SB) using objective measures rather than self-report, finding that the overall sample spent approximately 536.3 minutes/day (slightly less than 9 hours) in SB (Table 12). These findings are similar to results reported by Ruiz et al. (80) who reported that the average amount of time spent in sedentary behavior as assessed by accelerometers was 9 hours/day. High school students had significantly higher amounts of SB than middle school students (Table 12), which was supported by previous studies that have found that sedentary time increases as adolescents age (11, 81, 92). Researchers have suggested that this increase in sedentary time in older adolescents is due to increased school demands (more time spent on homework). In agreement with Ruiz et al. (81), we found no differences in objective sedentary time between males and females (Table 12). Other studies that examined SB with self-report have found males to have greater levels of SB than females, however, this may be due to their SB measures focusing more on reported screen time rather than overall SB measured by accelerometry (11-12).

The present study expands on previous literature by being the first study, to our knowledge, that examines the association of nominated friends on objectively measured

sedentary time. Contrary to our hypothesis, there were no associations between nominated friends' variables and objective sedentary time (Table 13). Consistent with previous findings, only PA barriers, such as greater amounts of school work, were associated with greater sedentary time (Table 13) (67). When stratifying the sample by both gender and school level, we found that psychosocial factors such as increased PA barriers and SB enjoyment are associated with greater SB in all females (Table 14), and greater BMI and PA barriers are associated with more time in SB in high school students (Table 15). King et al. (52) found similar results, reporting that greater BMI and psychosocial correlates, such as decreased PA enjoyment and PA barriers, were associated with increased objective sedentary time. Our findings also support reports that older adolescents spend more time in SB, and less time being active due to PA barriers such as homework (81), and because they are more self-conscious about being active (PA barrier), which may lead to increases in SB (80).

The present study is the first to examine the interaction between gender and school level on the association of nominated friends with objective SB. With the exception of high school males, none of the overall regression models for middle school participants and high school females were significantly associated with objective SB, and, similar to the previous models, none of the nominated friends' variables were associated with objective sedentary time in middle and high school males and females (Table 16). The majority of studies that have examined nominated friends have used self-report measures of SB, and have found mixed results, with only certain screen time measures having an association with friends' behavior (2, 93). The present study is in agreement with the previous findings indicating that overall time spent in SB was not

associated with nominated friends' behavior. The present study is the first, to our knowledge, to report that, similar to self-reported SB (67), psychosocial factors may play a greater role in explaining objective sedentary behavior, particularly in high school males, than friends. Our qualitative results support these findings as well, suggesting that friends do not significantly influence participants' SB.

One explanation for the lack of significant findings may be related to not distinguishing between sedentary behaviors. It is not known how much of the time spent in SB was sitting in class, which would be out of participants' control, or how much of the SB was spent in screen time, which has been associated with more adverse health risks than other types of SB (16). In the present study, correlations between objective SB and reported screen time were not significant ($r=.07$) suggesting that participants who had greater amounts of SB may have been spending more time on school work or other activities instead of screen time

Reported Screen Time

The overall sample reported an average of 10 hours per week of screen time which is within the recommended levels of 2 hours or less of screen time per day (3), and lower than findings from previous studies (2, 93). Sirard et al. (93) found that adolescent males reported 45.15 hours of screen time per week, and females reported 36.51 hours per week. Similar to previous reports (11-12, 93), we found that males reported significantly greater amounts of screen time per week than females (11.76 vs 8.58 hours per week). In contrast, studies that report no gender differences focused on overall SB,

rather than screen time behavior (81), consistent with our findings that there were no differences in males and females for overall SB measured by accelerometry.

The present study found no differences in screen time between middle and high school students, which is not consistent with studies that have found that children and adolescents increase their levels of screen time as they age (11-12, 94). Investigators have speculated that a decrease in both leisure-time PA and organized sports, as well as less parental supervision in monitoring screen time may account for this increase in screen time (70, 101, 107, 109). In the present study, we may not have observed increases in screen time because MVPA did not decrease from middle to high school males. This may be related to the high SES in the present sample, as studies that have found increases in screen time, examined samples that were more diverse (lower SES, higher BMI percentile) than the current sample, and that may account for the differences. Finally, results from our qualitative analysis indicate that high school participants did not engage in large amounts of screen time, with males preferring other activities such as sports, and females preferring activities that had more social interactions.

Three studies previously examined the association of nominated friends' screen time with adolescents' screen time and MVPA, finding mixed results (2, 20, 93). These studies suggested that demographic and psychological factors may be associated with adolescent screen time behavior to a greater extent than friends' behaviors, however, none of the studies examined psychosocial factors (2, 20, 93). In the present study, we examined demographic, psychosocial, and nominated friends' influence on adolescent screen time. The regression results for the overall sample suggest that decreased SB self-efficacy and greater SB enjoyment are associated with increased screen time behavior,

which agrees with other studies that found low SB self-efficacy and greater SB enjoyment were significantly associated with increased screen time (67, 111). When stratified by gender, low SB self-efficacy and greater SB enjoyment remained associated with increased screen time which supports the findings of Norman et al. (67). We also stratified by both gender and school level, allowing us to test previous hypotheses (8, 37, 51, 78) that psychosocial correlates differ between older and younger males and females. For middle school boys, less SB self-efficacy remained significantly associated with increased screen time, while less PA enjoyment and greater PA barriers were significantly associated with greater screen time for middle and high school females, respectively (Table 21). The results from our qualitative analysis provide support for these findings by suggesting that psychosocial and environmental factors were the driving factor for participants for screen time behavior. For example, it was reported that if there were perceived barriers such as feeling self-conscious about engaging in a sport or factors such as poor weather, participants were more likely to engage in screen time behaviors, such as watching a movie.

We also stratified the results by school level and found partial support for our hypothesis that lower levels of friends' MVPA would be associated with increased screen time, though this finding was only significant for high school participants (Table 20), and is consistent with previous research (53). The results from our qualitative analysis provide further support for this finding, with high school participants reporting that highly active friends influenced participants to watch less television.

We also examined the interaction between gender and school level on associations of nominated friends' behaviors with screen time. In contrast to Ali et al.

(2), the present study found that, for middle school males, nominated friends' screen time was positively associated with increased screen time in the participants (Table 21).

However, Ali et al. (2) only examined television viewing, while the present study examined various forms of screen time including television viewing, computer use, and video game playing. Our findings partially support those of De la Haye et al. (19) who reported significant associations among both males and females' screen time with nominated friends' screen time, however, the present study did not find any association with friends and screen time for either middle or high school females. A difference between the present study and De la Haye et al. (19) was that the females in our sample reported lower levels of screen time, and according to our qualitative results, the majority of females did not engage in any video game playing. In contrast, De la Haye et al. (19) reported higher levels of screen time in their female sample, and found an association with video game playing among females and nominated friends.

Data from the present study provide only limited support for the hypothesis that lower levels of nominated friends' MVPA would be associated with greater levels of screen time. This association was only observed in high school males (Table 21), consistent with the observation that students reporting a greater number of active friends had lower levels of screen time (53).

The present results indicated that friends' screen time may be important for middle school males' screen time, and that lower levels of friends' MVPA for high school males were associated with greater levels of screen time. In addition, the present findings that psychosocial variables were associated with screen time in females provide partial support for the speculations proposed by De la Haye et al (19) that such factors

may be more associated with screen time than their friends' behavior. The findings from our qualitative analysis support this evidence, indicating that females reported that friends do not influence their screen time, and they prefer to engage in screen time alone, rather than with friends.

Qualitative Data

Individual and social factors appeared to have the most influence on PA, with psychosocial factors such as PA enjoyment, and social factors such as friends and family influence impacting PA. Similar to previous research, environmental factors don't have a large impact on behavior (12), however, bad weather did appear as a barrier to PA.

Types of PA

Sports, particularly organized sports, were the most common types of PA discussed in the focus groups. Evidence suggests that children and adolescents who participate in organized sports have higher PA levels, which may help to explain the high PA levels of the present sample reported from the quantitative analysis (91, 104). It was surprising that a large number of females, particularly high school females, reported playing organized sports, considering previous literature suggests that females tend to dropout of organized sports as they continue into adolescence due to negative pressure from friends, lack of parental support, and increased self-consciousness (1, 70). However, the females in the present study reported high levels of support from family and friends for their PA, thus negating the common reasons for dropping out of sports.

Types of SB

In agreement with previous research that found children and adolescents spend almost half of sedentary time watching television or participating in other screen time behaviors (14-15), watching television was the most common type of SB reported by participants. Males reported playing more video games, while females spent more time on their phone, though participants reported that they spent more time playing games, utilizing social media sites, and texting on their phones rather than talking. Interestingly, all participants reported not engaging in large amounts of SB (< 9 hrs/wk.), which was supporting the quantitative results indicating that the overall sample was within the recommended levels of screen time per week which is < 14 hours per week (3). These data suggest that participants were not engaging in screen time behaviors for the majority of SB time, suggesting that sedentary time may have been spent at school or doing school work.

Friendship groups

The three most common friendship groups reported were school friends, sports team friends, and neighborhood friends (Table 23). This is partially similar to the study of Jago et al. (48) who found that school friends and neighborhood friends were the most common friendship groups. Due to the large number of participants who reported belonging to sports teams, it is not surprising that friends from sports teams were one of the most popular friendship groups.

Although not directly measured, friends from sports teams appeared to encourage participants to be the most active through participation in activity together, outside of organized sports. This agrees with previous studies that found participants with friends who participated in organized sports were more likely to be active themselves (2). Neighborhood friends were also reported to engage in PA with participants. There appeared to be a seasonality effect, with several participants reporting that they spent more time with neighborhood friends during the summer months, playing outside. Interestingly, school friends were reported to be the least active friendship group. Participants indicated that school friends preferred SB such as sitting and talking or watching movies. In fact, participants reported that they were more likely to influence their school friends to participate in PA. A weakness cited by previous studies that have examined nominated friends is that they have only focused on school friends, however, studies have argued that school friends are the main source of interaction with participants (2, 19-20, 93). Although it is true that school friends were a common friendship group, the present study identified several other types of friendship groups, and indicates that activities differ depending on the friendship group, with school friends being the least active group. Previous studies that examined only school friends may have underestimated the effect of adolescents' complete friend networks.

Influence of friends on PA

All participants reported that their friends have a large influence on their PA levels, which is in agreement with Jago et al. (48) who found that friends were associated with PA in children. In addition, the possible reasons for friends influence on PA were similar between the present study and Jago et al. (48) who found that participation in

activity with a friend, modeling of PA by a friend, and verbal encouragement of PA were the most common mechanisms by which friends influenced PA. For females, enjoyment of PA and social interactions were the most important reasons they preferred to engage in PA with friends. For males, enjoyment and competition, especially for high school males, were cited as the main reasons for engaging in PA with friends. Similarly, Jago et al. (48) found that enjoyment of PA was the most cited reason for why children engaged in PA with friends, however, Jago et al. did not find competition to be an important source of motivation in males

The present study also examined social preferences for engaging in PA, SB, and screen time. In a study by Salvy et al. (88), results indicated that adolescents engaged in greater levels of PA when they were with friends rather than alone, and adolescents were more likely to be sedentary when they were by themselves. However, it was unknown whether these social contexts were participants' preferences. In the present study, all participants reported that they would rather be active with a friend or group of friends, rather than engage in PA alone. For SB and screen time, there were mixed results, however, the majority of participants reported that they preferred watching television alone, which is similar to De la Haye et al. (19) who found that friends' television watching was not associated with participants' television habits.

An additional finding of interest in the present study is that high school females reported a difference in friends' influence depending on the gender of the friend. The high school females in the study suggested that having male friends or a boyfriend tended to motivate them to be more active, either as a way to impress the males or because the males themselves wanted to engage in PA. Neither high school males nor middle school

participants in the present study reported similar findings. Similarly, Keresztes et al. (51) found that adolescent females' participation in sports was influenced by their romantic partners, while that was not the case for males.

A key finding in the present study is that females preferred to engage in PA with one close friend, while males preferred to be active with a group of friends. A possible explanation is that females reported enjoying the social interaction and companionship of having a friend join in PA while males emphasized sports and competition, while explaining that a large group of friends is necessary to play sports. This finding from the present study has practical implications for designing interventions based on social dynamics for increasing PA in males and females.

Influence of friends on SB

Although the qualitative study by Jago et al. (48) did not place a large emphasis on screen time in their study, they did find that participants preferred engaging in PA, rather than watching television, with friends. Our study both agrees with and expands on that finding. The present study found that friends did not greatly influence the SB of participants, and that, with the exception of middle school males, most participants preferred engaging in PA with friends rather than SB with friends. Participants in our study also reported that friends indirectly reduced the amount of time spent in SB because of their friends' preference for PA, which was supported by the quantitative findings by Leatherdale et al. (52) who reported that having active friends was associated with lower levels of screen time behavior.

Middle school males reported that they enjoyed playing video games with friends, which was reflected in the quantitative analysis, indicating that greater levels of friends' screen time was associated with greater levels of participants' screen time. Interestingly, middle school males reported that they were not influenced by their friends to engage in any other type of SB or screen time behavior. This is the first study, to our knowledge, that has examined the influence of friends on screen time in middle and high school males and females from a qualitative perspective.

While the majority of participants in this study reported that friends did not positively influence SB or screen time levels, it should be noted that this may be a result of the sample, since it was reported that both individuals and their friends preferred PA to SB.

Influence of family on PA and SB

The present study found that family had a large influence on PA behavior for many of the participants, with the exception of high school males. A review of qualitative studies by Allender et al. (1) found similar results that parents play a large role in encouraging PA behavior in children. However, in the present study, the influence appeared to depend on both the amount of time the children and adolescents spent with parents, as well as parents' PA levels. Parents who encouraged activity, but were not active themselves, had less influence on participants. These results were in contrast to a study by Welk et al. (109) who found that modeling of PA by parents was less important than verbal encouragement. However, Welk et al. (109) did find that active parents tended to have a greater influence on children's PA.

Interestingly, high school males reported that their parents had little to no influence on their PA levels. The high school males in our study reported that friends had the most influence on their PA because they spent more time with their friends than family, and friends were highly active themselves, and engaged in PA with participants. In support of the present findings, Welk et al. (108) reported that sources of influence on PA are directly associated with who participants spend the most time with during the day. It is important to note that several high school males reported that their parents would verbally encourage them to be active, however, since parents were not active themselves, participants expressed frustration and noted that only verbal encouragement for PA was ineffective.

In addition, while high school females reported that parents influenced their PA levels, they also suggested that this influence could be a negative one, such as when parents criticized participants or forced them to be active. While there has not been much research conducted on the negative influences of parental support on PA, a study by Ornelas et al. (70) found that parents who are too strict or demanding are associated with less active children. The qualitative results from the present study that found that parental influence was more important than friends influence in females was surprising given that previous studies have reported that as adolescents age, parents become less influential than friends (34).

Friends did not appear to have a large influence on SB or screen time in adolescents, and while participants reported that family played a large role in influencing PA, there was no mention of influence on SB or screen time. The results from the present study are in contrast to the findings of Thompson et al. (101) who like us,

reported that friends do not influence SB, but also reported that parents played a major role in adolescent SB and screen time behaviors. Reasons for the discrepancy between the present study and Thompson et al. (101) may be related to differences between the samples, as findings in the Thompson et al. study were based solely on middle school participants and were based on a small sample ($n = 30$).

Importance of PA

All participants reported that engaging in regular PA was important to them, however, the reasons why it was important to them varied depending on school level and gender. Enjoyment of PA was the most popular reason for engaging in PA which is in agreement with Jago et al. (48) who found that enjoyment of activity was the strongest reason for continuing activity. The majority of participants reported that engaging in PA with friends made PA even more enjoyable. Males, particularly high school males, reported that the competitive aspect of sports and PA were what motivated them to engage in PA, and wanting to improve for sports was the main reason that they maintained their level of activity (Table 25). This finding is consistent with the results of Thompson et al. (101) who reported that male adolescents were driven to play sports by a desire to improve their level of play, as well as for competitive reasons. In addition, the reported importance of sports and competition for males is consistent with Eccles' Expectancy Model of Activity Choice (28) which suggests that gender differences in youth's attitudes towards sports affect how adolescents estimate their abilities and what values they attach to sports (28, 107). For example, males in the present study placed a greater emphasis on achievement and competition. While the majority of middle school students reported enjoyment, a few mentioned the importance of not being overweight as

another reason that PA was important, which was similar to qualitative findings of Allender et al. (1) who reported that enjoyment was a crucial factor in choosing to be active, while weight management was a secondary reason. Similar to findings of Thompson et al. (101), high school females cited social reasons (meeting new friends), and emphasized psychosocial benefits (decreased stress, more positive mood) as factors that motivated them to be active (Table 27). For high school students, psychological benefits, such as decreased stress and anger management, were reasons that PA was beneficial to them, however, middle school students did not report any psychological benefits as reasons to be physically active. This difference, however, may be due to lower levels of reported stress among middle school students, with high school students naming several stressors such as school work and college applications, while middle school students did not emphasize high stress levels during focus group discussions.

Limitations of the study

Some limitations of the current study should be noted. The majority of participants in this sample were of a high SES, had parents who had at least a 4 year college degree or greater, had high levels of MVPA, and were of normal weight, thus limiting generalizability. In addition, the sample was limited to a single community, and therefore, these results are not generalizable to large urban or rural areas. Nominated friends' MVPA and screen time were measured using self-report, which may be prone to bias (98). Several participants were missing nominated friends' data, and therefore had to be excluded from the analysis. The sample was therefore small when stratified by school level and gender. In addition, while participants nominated an average of 3.49 friends, only an average of 1.74 friends responded, leading to the assumption that MVPA

among the subgroup was representative of the entire group. However, this result is similar to Sirard et al. (93) who found that participants nominated an average of 5.2 friends, but only had usable data on an average of 2.1 friends per participant.. Although participants were randomly selected from a class or school roster, it was still voluntary to participate which may have biased the sample towards those interested in the topic of the discussion, despite having snacks available as an incentive. Finally, within the focus groups, social desirability cannot be ruled out. Since this was a highly active sample, it is possible that answers to questions about PA levels were inflated in order to achieve a higher social status within the group.

Strengths of the study

Several key strengths of the study should be noted as well. The present study adds to previous literature by utilizing a mixed-methods approach that allowed us to both examine associations of nominated friends' variables with adolescent behavior, and determine causality through data collected from the focus groups. For example, while previous studies found an association between friends' MVPA and adolescent' MVPA (94), our results both support and expand on those association with our qualitative findings that reported friends of high school males encourage MVPA through competition in sports, while enjoyment of MVPA with friends was important for females.

This is also the first study, to our knowledge, that allowed participants to nominate friends outside of school. This is important since a major friendship group reported was neighborhood friends who did not belong to schools. In addition, this was one of the first studies to utilize objective measures of PA and sedentary behavior in conjunction with self-report measures. This was also the first study to stratify analyses

by grade level (middle and high school) and gender. Lastly, the sample size for the qualitative analysis (N=108) was very large and a definite strength of the present study.

Implications

The findings from the present study have several implications for increasing PA and decreasing SB and screen time. Overall, psychosocial variables (mainly PA self-efficacy from the quantitative data and PA enjoyment from the qualitative data) and friends' MVPA were the strongest correlates of participants' MVPA. These findings suggest that increasing self-efficacy and friends' MVPA should be taken into consideration when designing interventions. Since all participants preferred to engage in PA with friends rather than alone, interventions could be designed to include group PA, where participants can bring friends to take part in activity. In addition, the differences among gender and school level should be taken into consideration for future studies. For example, interventions for females might be most effective when focused on increasing enjoyment and self-efficacy of PA, while encouraging the participant to bring a close friend to the PA intervention. For males, however, increasing self-efficacy and competition could be emphasized, while having participants engage in a sports-related activity with a group of friends.

Also, while the present study focused on friend influence, the influence of parents and family could not be ignored. In aiming to increase PA, future studies should also include family support, however, this influence appeared to be directly related to amount of time spent with the family, and if the family members themselves were active. A combined family and friend intervention may be more beneficial for younger children

and female adolescents since high school males did not report strong parental influence on their activity.

The results of the qualitative component of the study suggest that friends have a large influence on participants' MVPA levels, and provide further detail into how and why friends are important. These results may help in the development of questionnaires that better assess friends' influence on PA. Currently, there are no detailed questionnaires to assess friends' influence except for general questions asking about friends' support of MVPA. The results of the present study may enable us to design questionnaires that tap into the specific roles that friends may play in adolescent males and females MVPA.

Finally, attention should be paid to developing more current screen time questionnaires for children and adolescents. Many of the participants reported watching shows and movies on electronic devices such as tablets rather than television sets. Current questionnaires that focus only on television watching and talking on the telephone likely underestimate actual screen time levels.

More research in the area of social influences on children and adolescents' PA is warranted. The current study was focused on nominated friends, however, there is evidence that peers (defined as an individual who is equal to another with respect to certain characteristics such as age) also may be a source of influence on MVPA, though the mechanisms may differ from friends' influence (20). Also, due to the small sample of overweight individuals in the sample, we were unable to stratify by weight status. There is evidence that the effect of social influences, such as friends, and psychological

variables may differ in overweight, compared to normal weight, adolescents (88-89).

The present sample was derived from a high SES area, and future studies should examine samples from other demographic areas such as inner cities where there may be additional barriers to PA, and to examine the influence of friends across a wide range of SES in adolescents. There is support from previous research that there may be differences in the roles of friends on participants' activity behavior depending on SES (48). Although participants' MVPA and SB were assessed with both subjective and objective measures, it would be important to assess nominated friends with objective measures as well, considering the tendency for overestimation of self-report MVPA.

Conclusions

In the present study, both the quantitative and qualitative analyses revealed that friends were a source of influence on MVPA levels in middle and high school males and females, with psychological factors such as PA self-efficacy and enjoyment mediating this relationship. Although friends were not a large source of influence on SB for females or high school males, screen time in middle school males was associated with friends' screen time, mainly through video game playing. Future studies should consider the influence of friends and family to increase PA and/or decrease screen time in adolescents

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Table 1: Demographics among Middle School and High School Males and Females

Variable	Middle school boys (n=37)	Middle school girls (n=39)	High school boys (n=35)	High school girls (n=41)
Caucasian N (%)	30 (81)	29 (74)	30 (86)	33 (80)
Overweight or “At risk” (> 85%) N (%)	7 (19)	3 (8)	7 (20)	4 (10)
Parent education of 4 years degree or greater, N (%)	21 (81)*	25 (81)**	27 (77)	31 (76)
Age, M (SD)	13.3 (.81)	12.86 (.87)	16.11 (.8)	16.07 (.79)
Nominated friends M (SD)	3.05 (1.72)	4.0 (1.12)	3.23 (1.4)	3.61 (1.3)
Avg # of friends responded, M (SD)	1.81 (1.08)	1.74 (1.02)	1.57 (.88)	1.83 (1.02)

*analysis conducted on 26 of 37 middle school males – 11 reported “do not know” for parental education status

**analysis conducted on 30 out of 39 middle school females – 9 reported “do not know” for parental education status

Table 2: Objective MVPA Minutes per Day

	Mean (SD)	Range
Overall sample	46.87 (21.03)	4.5 – 114.81
Gender		
Males	53.29 (21.39)*	12.78 – 114.81
Females	41.08 (19.04)	4.5 – 97.16
School Level		
Middle School	48.3 (20.83)	12.78 – 112.2
High School	45.43 (21.27)	4.5 – 114.81
Gender and School level		
Middle School boys	52.1 (21.93)	12.78 – 112.2
Middle School girls	44.69 (19.32)	18.63 – 97.16
High School boys	54.56 (21.04)	21 – 114.81
High School girls	37.65 (18.36)**	4.5 – 84.17

*Males had significantly higher MVPA min/day than females, $p < .05$

**High school females had significantly lower MVPA min/day than either middle or high school males, $p < .05$

Table 3: Objective MVPA Beta Coefficients for Overall Sample (n=152)

Variable	Model 1	Model 2	Model 3
Age	-.77	-1.2	-.43
Gender	13.64*	11.03*	7.86*
Weight Status	6.49	5.02	7.69
Race	10.38*	11.47*	9.72*
Class level	-.47	-4.99	-1.71
Parent education	-.21	.25	.18
PA self-efficacy		1.96*	1.45*
PA barriers		-.66	-.34
No PA enjoyment		-1.04	-.63
SB self-efficacy		.77*	.87*
SB enjoyment		-.07	-.04
# of friends			.17*
# of close friends			-.3
Friends' MVPA			3.26*
Friends' screen time			-.4

Model 1: Demographics, adjusted $r^2=.09$

Model 2: Demographics + Psychosocial, adjusted $r^2=.19$

Model 3: Demographics + Psychosocial + Nominated Friends, adjusted $r^2=.29$

* $p < .05$

Table 4: Objective MVPA Beta Coefficients for Males (n=72) and Females (n=80)

Variable	Model 1		Model 2		Model 3	
	Males	Females	Males	Females	Males	Females
Age	-.34	-.1	-.64	-.83	-.6	-.37
Weight status	13.62*	-7.99	14.92*	-13.8	15.93*	-7.73
Race	19.7*	6.72	19.83*	.62	18.37*	-1.46
Class level	-4.85	-.19	-7.69	1.86	-3.2	.85
Parent education	.87		1.66	.1	1.17	.09
PA self-efficacy			1.57	2.24*	1.19	1.46
PA barriers			-1.5	-.15	-1.12	.04
No PA enjoyment			-1.08	-.46	-1.16	.07
SB self-efficacy			.85	-.72	1.06*	-.55
SB enjoyment			.4	-.29*	.46	-.27*
# of friends					.11	.21
# of close friends					.01	-.5
Friends' MVPA					2.47	4.45*
Friends' screen time					-.32	-.17

Model 1: Demographics: Males: adjusted $r^2=.1$, Females: adjusted $r^2=.01$

Model 2: Demographics + Psychosocial: Males: adjusted $r^2=.21$, Females: adjusted $r^2=.11$

Model 3: Demographics + Psychosocial + Nominated Friends: Males: adjusted $r^2=.24$, Females: adjusted $r^2=.3$

* $p < .05$

Table 5: Objective MVPA Beta Coefficients for Middle (n=76) and High (n=76) school

Variable	Model 1		Model 2		Model 3	
	Middle	High	Middle	High	Middle	High
Age	-.7	.55	-.31	-1.87	-1.15	-.99
Gender	10.65*	15.71*	9.86*	12.32*	10.7*	4.25
Weight status	17.88*	-6.29	11.72	-2.07	12.66	1.48
Race	13.41*	2.81	13.81*	6.65	12.52*	5.93
Parent education	.67	-1.52	1.24	-.98	.49	-.8
PA self-efficacy			1.09	2.46*	.42	1.83*
PA barriers			-1.06	-.37	-.79	.03
No PA enjoyment			-1.14	-.83	-1.03	-.74
SB self-efficacy			-.29	1.57*	-.36	1.76*
SB enjoyment			-.12	.38	-.1	.43
# of friends					.11	.2
# of close friends					-.71	-.12
Friends' MVPA					4.32*	3.18*
Friends' screen time					-.67	-.03

Model 1: Demographics: Middle school: adjusted $r^2=.12$, High school: adjusted $r^2=.13$

Model 2: Demographics + Psychosocial: Middle school: adjusted $r^2=.14$, High school: adjusted $r^2=.26$

Model 3: Demographics + Psychosocial + Nominated Friends: Middle school: adjusted $r^2=.31$, High School: adjusted $r^2=.32$

* $p < .05$

Table 6: Objective MVPA Beta coefficients for Middle School males (n=37), Middle School Females (n=39), High School Males (n=35), & High School Females (n=41)

Variable	Model 1				Model 2				Model 3			
	MM	MF	HM	HF	MM	MF	HM	HF	MM	MF	HM	HF
Age	2.3	-2.58	- 2.13	2.3	1.04	-.79	- 4.34	.47	-.56	-1.11	-1.93	3.31
Weight status	8.13*	9.49	5.79	-19.76*	15.67	-3.27	12.95	-24.96*	17.43	.59	12.84	-17.76
Race	25.45*	.29	4.57	12.91*	28.74*	.41	5.07	-2.81	26.57*	1.04	16.93	-5
Parent education	-.21	1.22	.32	-.21	-.53	2.9	4.38	-1.72	-.84	1.71	5.14	-.04
PA self-efficacy					.48	1.83	1.32	1.65	.19	-.39	1.2	.23
PA barriers					-.26	-1.57	-1.99	1.23	.01	-2.04	-.58	1.2
No PA enjoyment					-.62	-1.01	-1.01	-.42	-.29	-1.66	-1.69	.29
SB self-efficacy					.37	-.71	2.83*	-.47	.46	-.45	3.43*	-.32
SB enjoyment					.18	-.27	.55	-.97	.27	-.25	.67	-.96
# of friends									.13	.13	.11	.25
# of close friends									-.4	-.95	.26	.84
Friends' MVPA									3.33	5.14*	1.1	4.09*
Friends' screen time									-.21	-.95	-1.14	.72

MM: middle school males, MF: middle school females, HM: high school males, HF: high school females

Model 1: Demographics: MM: adjusted $r^2=.27$, MF: adjusted $r^2=-.06$, HM: adjusted $r^2=-.09$, HF: adjusted $r^2=.09$

Model 2: Demographics + Psychosocial: MM: adjusted $r^2=.19$, MF: adjusted $r^2=.04$, HM: adjusted $r^2=.46$, HF: adjusted $r^2=.11$

Model 3: Demographics + Psychosocial + Nominated Friends: MM: adjusted $r^2=.21$, MF: adjusted $r^2=.35$, HM: adjusted $r^2=.48$, HF: adjusted $r^2=.29$

* $p < .05$

Table 7: Subjective MVPA Hours per Week

	Mean (SD)	Range
Overall sample	8.25 (2.05)	2 – 12+
Gender		
Males	8.51 (7.12)	2 – 12+
Females	8.01 (1.96)	3 – 12+
Class level		
Middle School	8.33 (2.06)	2 – 12+
High School	8.17 (2.05)	3 – 12+
Gender and Class level		
Middle School males	8.3 (2.37)	2 – 12+
Middle School females	8.36 (1.75)	4 – 12+
High School males	8.74 (1.84)	5 – 12+
High School females	7.68 (2.11)	3 – 12+

Table 8: Subjective MVPA Beta Coefficients for Overall Sample (n=152)

Variable	Model 1	Model 2	Model 3
Age	-.17	-.3	-.24
Gender	.63	.53	.2
Weight Status	.46	.29	.5
Race	.12	.54	.41
Class level	-.42	-1.1	-.97
Parent education	.14	.2	.23
PA self-efficacy		.33*	.28*
PA barriers		-.02	-.009
No PA enjoyment		-.05	-.004
SB self-efficacy		.02	.01
SB enjoyment		.005	.006
# of friends			.003
# of close friends			-.006
Friends' MVPA			.37*
Friends' screen time			-.01

Model 1: Demographics, adjusted $r^2=.005$

Model 2: Demographics + Psychosocial, adjusted $r^2=.23$

Model 3: Demographics + Psychosocial + Nominated Friends, adjusted $r^2=.32$

* $p < .05$

Table 9: Subjective MVPA Beta Coefficients for Males (n=72) and Females (n=80)

Variable	Model 1		Model 2		Model 3	
	Males	Females	Males	Females	Males	Females
Age	-.11	-.13	.006	-.44	.07	-.36
Weight status	.46	.4	-.01	.55	.04	.7
Race	.06	.16	1.23*	.42	1.14*	.32
Class level	-.86	.22	-.28	-1.32	.08	-1.2
Parent education	.24	.07	.19	.14	.27	.14
PA self-efficacy			.41*	.32*	.32*	.29*
PA barriers			-.007	-.07	.0005	-.06
No PA enjoyment			.005	.002	.03	.03
SB self-efficacy			.11*	-.04	.06	-.05
SB enjoyment			-.02	.007	-.01	.008
# of friends					-.0003	.005
# of close friends					-.02	.04
Friends' MVPA					.62*	.18
Friends' screen time					-.05	-.003

Model 1: Demographics: Males: adjusted r^2 = -.03, Females: adjusted r^2 = -.03

Model 2: Demographics + Psychosocial: Males: adjusted r^2 = .32, Females: adjusted r^2 = .15

Model 3: Demographics + Psychosocial + Nominated Friends: Males: adjusted r^2 = .54, Females: adjusted r^2 = .15

*p < .05

Table 10: Subjective MVPA Beta Coefficients for Middle (n=76) and High (n=76) School

Variable	Model 1		Model 2		Model 3	
	Middle	High	Middle	High	Middle	High
Age	.18	-.41	.12	-.71*	.14	-.85*
Gender	.03	1*	.26	.9*	.31	.07
Weight status	1.5*	-.63	.77	-.55	.8	-.1
Race	.48	-.58	.8	.02	.61	-.12
Parent education	.19	.05	.22	.15	.21	.39
PA self-efficacy			.29*	.37*	.27*	.32*
PA barriers			.007	.01	.009	-.001
No PA enjoyment			-.08	.02	-.05	.06
SB self-efficacy			.05	-.04	.05	-.05
SB enjoyment			.01	-.07	.01	-.03
# of friends					.01	-.02
# of close friends					.008	.03
Friends' MVPA					.27*	.57*
Friends' screen time					.0003	.05

Model 1: Demographics: Middle school: adjusted $r^2=.03$, High school: adjusted $r^2=.05$

Model 2: Demographics + Psychosocial: Middle school: adjusted $r^2=.23$, High school: adjusted $r^2=.3$

Model 3: Demographics + Psychosocial + Nominated Friends: Middle school: adjusted $r^2=.29$, High school: adjusted $r^2=.42$

* $p < .05$

Table 11: Subjective MVPA Beta Coefficients for Middle School Males (n=37), Middle School Females (n=39), High School Males (n=35), & High School Females (n=41)

Variable	Model 1				Model 2				Model 3			
	MM	MF	HM	HF	MM	MF	HM	HF	MM	MF	HM	HF
Age	.39	.03	-.69	-.22	.37	-.06	-.54	-.88	.34	-.05	-.65	-.71
Weight status	1.75	.9	-.76	-.1	.59	.58	-1.2	.13	.72	.55	-.8	1.15
Race	1.02	.06	-.79	.006	.85*	.12	-.35	.43	.67*	.14	.16	.19
Parent education	2.05	-.14	-.47	.54	.35	.05	-.13	.21	.34	.05	.36	.34
PA self-efficacy					.25*	.33	.49*	.35*	.21*	.32	.54*	.24
PA barriers					.06	-.07	.12	-.04	.06	-.04	.11	-.07
No PA enjoyment					.05	-.02	.03	.04	.1	-.03	.1	.12
SB self-efficacy					.16*	-.03	.003	-.05	.15*	-.04	-.03	-.06
SB enjoyment					-.003	.007	-.07	-.07	.007	.01	-.04	-.05
# of friends									.02	.004	-.02	.003
# of close friends									.02	.02	.01	.1
Friends' MVPA									.57*	-.14	.53*	.54*
Friends' screen time									-.03	-.03	-.01	.09

MM: middle school males, MF: middle school females, HM: high school males, HF: high school females

Model 1: Demographics: MM: adjusted $r^2=.13$, MF: adjusted $r^2=-.07$, HM: adjusted $r^2=.07$, HF: adjusted $r^2=-.03$

Model 2: Demographics + Psychosocial: adjusted MM: $r^2=.32$, MF: adjusted $r^2=.07$, HM: adjusted $r^2=.43$, HF: adjusted $r^2=.06$

Model 3: Demographics + Psychosocial + Nominated Friends: MM: adjusted $r^2=.65$, MF: adjusted $r^2=.04$, HM: adjusted $r^2=.58$, HF: adjusted $r^2=.22$

* $p < .05$

Table 12: Objective Sedentary Minutes per Day

	Mean (SD)	Range
Overall sample	536.3 (86.83)	308.17 – 766.64
Gender		
Males	527.8 (86.28)	365.9 – 766.6
Females	544 (87.14)	308.2 – 724.3
School Level		
Middle School	522.8 (89.68)	308.2 – 766.6
High School	549.8 (82.25)*	327.2 – 724.3
Gender and School Level		
Middle School boys	505.36 (90.9)	365.94 – 766.64
Middle School girls	539.32 (86.42)	308.17 – 702.87
High School boys	551.36 (75.3)	387.29 - 667
High School girls	548.39 (88.66)	327.17 – 724.26

Table 13: Objective Sedentary Time Beta Coefficients for Overall Sample (n=152)

Variable	Model 1	Model 2	Model 3
Age	-6.89	-9.03	-5.46
Gender	-13.41	-8.31	-8.4
Weight Status	9.72	17.57	16.32
Race	-1.51	-.69	-1.35
Class level	-47.24	-49.95	-29.41
Parent education	-4.29	-6.15	-7.69
PA self-efficacy		-.7	-1.12
PA barriers		3.9	5.33*
No PA enjoyment		1.95	2.17
SB self-efficacy		.74	.52
SB enjoyment		.77	.84
# of friends			.49
# of close friends			1.81
Friends' MVPA			-2.17
Friends' screen time			-1.08

Model 1: Demographics: adjusted $r^2=.001$

Model 2: Demographics + Psychosocial: adjusted $r^2=.008$

Model 3: Demographics + Psychosocial + Nominated Friends: adjusted $r^2=.12$

* $p < .05$

Table 14: Objective Sedentary Time Beta Coefficients for Males (n=72) and Females (n=80)

Variable	Model 1		Model 2		Model 3	
	Males	Females	Males	Females	Males	Females
Age	.23	-11.03	1.88	-19.66	1.38	-14.97
Weight status	-26.2	78.17*	-15.33	94.37*	-9.91	91.81*
Race	-32.4	30.27	-43.86	39.78	-50.13	39.95
Class level	-42.97	-49.89	-48.92	-81.17	-36.37	-73.12
Parent education	-1.64	-9.73	1.85	-8.35	-2.74	-8.26
PA self-efficacy			-4.18	3.62	-3.3	3.21
PA barriers			-.07	8.88*	1.85	10.05*
No PA enjoyment			5.23	-1.5	4.77	-1.05
SB self-efficacy			-1.86	1.83	-1.94	1.2
SB enjoyment			.51	1.53*	.53	1.63*
# of friends					.71	-.17
# of close friends					-.92	3.32
Friends' MVPA					-2.58	.23
Friends' screen time					-1.4	-.93

Model 1: Demographics: Males: adjusted $r^2=.03$, Females: adjusted $r^2=.01$

Model 2: Demographics + Psychosocial: Males: adjusted $r^2=.05$, Females: adjusted $r^2=.08$

Model 3: Demographics + Psychosocial + Nominated Friends: Males: adjusted $r^2=.04$, Females: adjusted $r^2=.05$

* $p<.05$

Table 15: Objective Sedentary Time Beta Coefficients for Middle (n=76) and High (n=76) School

Variable	Model 1		Model 2		Model 3	
	Middle	High	Middle	High	Middle	High
Age	-.37	-11.49	-1.89	-19.13	2.15	-12.83
Gender	-37.97	10.57	-30.51	7.5	-21.54	11.92
Weight status	-62.27*	68.28*	-46.36	70.04*	-50.29	72.51*
Race	33.49	-28.87	34.64	-21.05	28.44	-18.14
Parent education	-8.76	3.42	-9.41	3.15	-9.23	-1.6
PA self-efficacy			-5.86	6.57	-5.64	6.94
PA barriers			2.31	7.86	3.07	9.06*
No PA enjoyment			4.03	-2	5.49	-2.73
SB self-efficacy			2.87	-1.89	2.36	-2.03
SB enjoyment			.31	1.17	.39	.89
# of friends					.3	.8
# of close friends					3.69	-2.03
Friends' MVPA					1.93	-5.63
Friends' screen time					-.64	-2.6

Model 1: Demographics: Middle school: adjusted $r^2=.08$, High school: adjusted $r^2=.09$

Model 2: Demographics + Psychosocial: Middle school: adjusted $r^2=.08$, High school: adjusted $r^2=.11$

Model 3: Demographics + Psychosocial + Nominated Friends: Middle school: adjusted $r^2=.09$, High school: adjusted $r^2=.1$

* $p < .05$

Table 16: Objective Sedentary Time Beta Coefficients for Middle School Males (n=37), Middle School Females (n=39), High School Males (n=35), & High School Females (n=41)

Variable	Model 1				Model 2				Model 3			
	MM	MF	HM	HF	MM	MF	HM	HF	MM	MF	HM	HF
Age	6.62	-6.88	-13.62	-10.29	8.49	-15.37	-23.42	-15.39	8.11	-7.03	-4.49	-24.74
Weight status	-88.95	-20.1	41.61	135.4*	-75.96	25.43	48.56	124.7*	-77.69	2.02	68.1*	116.81*
Race	10.55	7.43	-67.44	3.51	6.08	6.42	-37.47	10.8	8.52	5.13	-66.53	15.6
Parent education	-7.23	-10.35	3.85	-10.96	-5.48	-14.66	6.11	-12.11	-6.02	-17.1	-6.31	-17.2
PA self-efficacy					-4.79	-.48	-12.57	8.95	-5.01	-1.59	-17.2*	11.19
PA barriers					-.46	9.54	9.49	11.21	.35	11.91	9.5	10.24
No PA enjoyment					-.12	6.05	11.81*	-7.3	-.03	9.32	15.52*	-8.57
SB self-efficacy					-1.39	4.32	-1.49	-3.96	-1.6	2.94	-2.32	-4.25
SB enjoyment					-.84	1.13	4.2	-1.88	-.96	1.16	3.37	-2.49
# of friends									-.09	.61	1.99	.07
# of close friends									-1.35	5.02	-8.94*	-3.91
Friends' MVPA									-.17	8.29	-3.19	-5.57
Friends' screen time									-1.26	-1.06	-2.95	.3

MM: middle school males, MF: middle school females, HM: high school males, HF: high school females

Model 1: Demographics: MM: adjusted $r^2=.08$, MF: adjusted $r^2=.01$, HM: $r^2=.1$, HF: adjusted $r^2=.11$

Model 2: Demographics + Psychosocial: MM: adjusted $r^2=.03$, MF: adjusted $r^2=.14$, HM: adjusted $r^2=.3$, HF: adjusted $r^2=.15$

Model 3: Demographics + Psychosocial + Nominated Friends: MM: adjusted $r^2=.03$, MF: adjusted $r^2=.26$, HM: adjusted $r^2=.46$, HF: adjusted $r^2=.06$

* $p < .05$

Table 17: Reported Hours of Screen Time per Week

	Mean (SD)	Range
Overall sample	10.09 (6.3)	.5 - 30
Males	11.76 (6.52)*	1 - 30
Females	8.58 (5.72)	.5 - 26
Middle School	9.53 (6.49)	.5 - 30
High School	10.65 (6.09)	1 - 27
Middle School boys	12.04 (7.28)	2 - 30
Middle School girls	7.14 (4.56)**	.5 - 20
High School boys	11.47 (5.69)	1 - 27
High School girls	9.95 (6.39)	1 - 26

*p<.05: males have significantly greater screen time per week than females

**p<.05: middle school girls have significantly lower screen time per week than middle or high school boys

Table 18: Screen Time Beta Coefficients for Overall Sample (n=152)

Variable	Model 1	Model 2	Model 3
Age	.67	.51	.44
Gender	2.74*	2.97*	2.64
Weight Status	-2.31	-.79	-.64
Race	1.01	.66	.41
Class level	.89	.42	1.32
Parent education	-.48	-.63	-.72
PA self-efficacy		-.1	-.1
PA barriers		.19	.17
No PA enjoyment		.36*	.35
SB self-efficacy		-.25*	-.2*
SB enjoyment		.09*	.09*
# of friends			.05*
# of close friends			-.02
Friends' MVPA			-.22
Friends' screen time			.12

Model 1: Demographics: adjusted $r^2=.11$

Model 2: Demographics + Psychosocial: adjusted $r^2=.21$

Model 3: Demographics + Psychosocial + Nominated Friends: adjusted $r^2=.24$

* $p < .05$

Table 19: Reported Screen Time Beta Coefficients for Males (n=72) and Females (n=80)

Variable	Model 1		Model 2		Model 3	
	Males	Females	Males	Females	Males	Females
Age	1.27	.09	1.12	-.37	.54	-.18
Weight status	-3.65*	-.05	-2.42	2.33	-1.21	1.7
Race	4.81*	-1.48	2.66	-1.2	1.34	-1.13
Class level	4.41	-2.41	2.59	-2.89	3.22	-2.07
Parent education	-1.04	.17	-.86	-.19	-1.21*	-.16
PA self-efficacy			-.21	.11	-.37	.11
PA barriers			.03	.51*	.08	.54*
No PA enjoyment			-.1	.52*	-.21	.5*
SB self-efficacy			-.51*	-.01	-.45*	-.02
SB enjoyment			.11	.11*	.14	.11*
# of friends					.07*	.008
# of close friends					-.12	.12
Friends' MVPA					.32	-.31
Friends' screen time					.22	-.03

Model 1: Demographics: Males: adjusted $r^2=.17$, Females: adjusted $r^2=.01$

Model 2: Demographics + Psychosocial: Males: adjusted $r^2=.31$, Females: adjusted $r^2=.26$

Model 3: Demographics + Psychosocial + Nominated Friends: Males: adjusted $r^2=.37$, Females: adjusted $r^2=.23$

* $p < .05$

Table 20: Reported Screen Time Beta Coefficients for Middle (n=76) and High (n=76) School

Variable	Model 1		Model 2		Model 3	
	Middle	High	Middle	High	Middle	High
Age	.87	-.02	.85	-.68	.98	-.27
Gender	4.15*	1	3.58*	.78	3.42*	2.16
Weight status	-3.19	-.98	-.34	.59	-.25	-.11
Race	.82	1.45	.37	2.07	-.4	2.49
Parent education	-.28	-1.11	-.19	-1.38*	-.08	-1.86*
PA self-efficacy			-.34	.37	-.27	.46
PA barriers			-.16	.52	-.23	.59*
No PA enjoyment			.5	.05	.61*	-.04
SB self-efficacy			-.21	-.25	-.14	-.24
SB enjoyment			.05	.42*	.05	.36*
# of friends					.06	.04
# of close friends					.11	-.04
Friends' MVPA					.24	-1.03*
Friends' screen time					.21	-.17

Model 1: Demographics: Middle school: adjusted $r^2=.01$, High school: adjusted $r^2=.004$

Model 2: Demographics + Psychosocial: Middle school: adjusted $r^2=.26$, High school: adjusted $r^2=.28$

Model 3: Demographics + Psychosocial + Nominated Friends: Middle school: adjusted $r^2=.23$, High school: adjusted $r^2=.3$

* $p < .05$

Table 21: Reported Screen Time Beta Coefficients for Middle School Males (n=37), Middle School Females (n=39), High School Males (n=35), & High School Females (n=41)

Variable	Model 1				Model 2				Model 3			
	MM	MF	HM	HF	MM	MF	HM	HF	MM	MF	HM	HF
Age	2.43	-.45	.1	.71	3.27*	-.98	-.81	1.28	2.7*	-.83	-.18	2
Weight status	-3.45	-2.15	-3.62	1.89	.51	1.98	-2.07	1.13	2.05	1.33	-3.53	-.06
Race	1.56	-.62	7.27*	-2.09	.29	-.16	7.65*	-2.84	-.44	-.33	9.04*	-2.72
Parent education	-.96	.47	-1.03	-.43	-.9	.06	-1.06	.02	-.95	.11	-1.61*	.57
PA self-efficacy					-.26	-.11	.34	.08	-.4	.11	.39	-.02
PA barriers					.03	.02	.29	.85	-.07	.01	.52	1.12*
No PA enjoyment					-.17	.71*	.29	.12	-.31	.86*	-.01	.09
SB self-efficacy					-.75*	.002	-.29	-.08	-.65*	-.04	-.32	.05
SB enjoyment					.02	.08*	.35*	.29	.09	.07	.27*	.29
# of friends									.06	-.03	-.02	.05
# of close friends									-.09	.16	.33	-.11
Friends' MVPA									.64	.02	-1.44*	-.52
Friends' screen time									.4*	.15	-.27	-.38

MM: middle school males, MF: middle school females, HM: high school males, HF: high school females

Model 1: Demographics: MM: adjusted $r^2=.07$, MF: adjusted $r^2=-.08$. HM: adjusted $r^2=.35$, HF: adjusted $r^2=-.07$

Model 2: Demographics + Psychosocial: MM: adjusted $r^2=.32$, MF: adjusted $r^2=.14$, HM: adjusted $r^2=.54$, HF: adjusted $r^2=.26$

Model 3: Demographics + Psychosocial + Nominated Friends: MM: adjusted $r^2=.48$, MF: adjusted $r^2=.07$, HM: adjusted $r^2=.64$, HF: adjusted $r^2=.21$

* $p < .05$

Table 22: Qualitative Descriptive Results

Class Level	# of focus groups	# of schools	N	Males	Females
Middle School	7	3	55	28	27
High School	6	2	53	18	35

Table 23: Characteristics of Most Common Friendship Groups

Group	Characteristics of group
School friends	Friends from school and classes
Sports team friends	Friends that play on the same sports team as the participant. Includes school sports team and non-school sports team. Were not friends prior to meeting on the team
Neighborhood friends	Friends who reside close to participant's house
Family friends	Children that participants met through family member, can also include relatives that are thought of more as a friend than family
Church friends	Friends met at church youth groups
Activities friends	Friends from activities not including sports (boy scouts, clubs)

Table 24: Overall Themes (n=108)

Topic Area	Notable Themes
Types of PA	Playing sports most popular PA
Types of SB	Watching television most popular SB
Friendship groups	School friends & sports team friends most popular friendship groups
Activities with Friendship groups	Most active with sports team friends
Friends' influence on PA	Large source of influence through participation in PA with friend, verbal encouragement, & modeling of PA
Friends' influence on SB	Not a large source of influence
Family influence on PA	Majority reported family having a large influence, mainly through modeling of PA
Greatest influence on activity	Largely depended on whom participants spent the most time with
Importance of PA	All participants reported that it was important to be physically active

Table 25: Notable Themes for Males (n=46) vs Females (n=62)

Males	Females
Activity with more than one friend	Activity with a single friend
Active with friends for competition	Active with friends for fun & companionship
Mixed results, playing video games with friends, watching television alone	Preferred engaging in SB alone
Friends were a larger source of influence	Family was a larger source of influence

Table 26: Notable Themes for Middle (n=55) vs High School (n=53)

Middle School	High School
More active on weekends	Mixed results
Less likely to be on sports teams	Majority were on sports teams
Verbal encouragement & participation in PA with friends	Friends' modeling of PA became more important
PA more important due to enjoyment of activity	PA more important for competitiveness, psychological reasons (less stress), and health reasons

Table 27: Notable Themes Categorized by both Gender and Class Level

	Middle School boys (n=28)	Middle School girls (n=27)	High School boys (n=18)	High School girls (n=35)
Types of PA	Mainly sports	Mainly sports	Mainly sports	Mainly sports
Types of SB	TV & video games	TV & phone	TV, video games, computer	TV, phone, & computer
Weekends vs Weekdays	More PA on weekends	More PA & screen time on weekends	Mixed results – more screen time on weekends	Mixed results – most reported no major difference
Teams or fun	More for fun	Mainly teams	Almost all teams	Mainly teams
Friendship groups	Mainly school, sports, family friends, neighborhood	School & sports team friends, neighborhood, family friends, church friends	School & sports team friends, family, church, neighborhood friend	School & sports team friends, guy friends, neighborhood friends
Activities with friends	Most active with sports team friends, family, & neighborhood friends Least active with school friends	Most active with sports team friends Least active with school friends	Most active with sports team friends Least active with church friends	Most active with sports team friends & guy friends Least active with school friends
Friend influence on PA	Participation in activity & verbal encouragement	Participation in activity & verbal encouragement	Participation in activity, modeling of PA, & verbal encouragement Competition was emphasized	Participation in activity, modeling of PA, & verbal encouragement
Friend influence on SB	Verbal insistence to play video games	Not a large source of influence Friends more of a positive influence on SB	Not a large source of influence, decrease SB in participants	Not a large source of influence, friends more of a positive influence
Family influence	Mixed results - influence by modeling, verbal encouragement, support of activity - more of an influence if parents	Major influence – participation in activity and modeling of PA – more of an influence if parents weren't	Mixed results – more of an influence of parents are active themselves	Major influence – participation in activity, modeling, verbal encouragement, & support of activity. Report

	are active themselves	active themselves		of negative influence
Greatest influence	Family – spend most time with them Friends – direct influence	Family – spend more time with them	Friends – spend most time with them	Family – spent most time with them Friends – make activity more enjoyable
PA solo or with friends	Prefer PA with a group of friends – more enjoyable	Prefer PA with a friend – more enjoyable	Prefer PA with a group of friends – competitive aspect	Prefer PA with a friend – more enjoyable & work harder
SB solo or with friends	Majority preferred SB with a group of friends – video games	Preferred SB solo – watch television by themselves	Mixed results – prefer to watch television alone, play video games with friends	Mixed results – depends on the type of SB – watching television solo, sitting around & talking with friends
PA importance	Majority report PA is important due to reasons that it is fun & competitive aspect	All report PA is important due to its enjoyable & prevents obesity	All report PA is important due to becoming competitive at sports & makes you healthier	All report PA is important, mainly due to psychological & social reasons

APPENDICES

Appendix A: Informed Consent Documents

Parent/Guardian Informed Consent Agreement

Please read this consent agreement carefully before you decide to participate in the study. Your child will also receive an assent form; please review the assent form with your child.

Purpose of the research study: The purpose of the study is to examine the influence of friends on both physical and sedentary activity in middle and high school students.

What your child will do in the study: We will come to your child's school on 2 occasions. The first visit will involve a focus group, a demographic questionnaire, and being fitted with a small activity device. The second visit will consist of collection of the devices, answering a few questionnaires, and nomination of friends. The following discusses these procedures in more detail.

1. We will ask your child to participate in a focus group that will last approximately 45 – 60 minutes. Questions will focus on activities that your child enjoys doing, and friends your child spends time with. These sessions will be audio taped, but no names will be mentioned in the study. Your child will have the right to skip or refuse to answer any questions.
2. Your child will then be fitted with a device that will measure physical activity and sedentary behavior for the week.
 - a. The Physical Activity Monitor will detect your child's body movement during the study.
 - i. The monitor is small (1"x 1" x ¼") and should not interfere with your child's activities during the week.
 - ii. Project staff will position the monitor just in front of your child's right hip bone, under or over his/her shirt, using an elastic belt. The belt will be snug to prevent accidental movement of the monitor, but not tight.
3. Fill out several short questionnaires. Your child will have the right to refuse or skip any question on that makes them uncomfortable. The following questionnaires will be distributed:
 - a. Demographic questionnaire
 - b. Physical activity self-efficacy questionnaire
 - c. Sedentary behavior self-efficacy questionnaire
 - d. Enjoyment of physical activity questionnaire
 - e. Enjoyment of sedentary activities questionnaire
 - f. Barriers to physical activity questionnaire
 - g. Physical activity recall questionnaire
 - h. Screen time recall questionnaire
4. Nominate up to 5 friends whom will be emailed a short questionnaire.

- a. A short questionnaire asking for the names of up to 5 friends will be distributed to your child. This questionnaire will also ask a few general questions about friends.
- b. Your child will be given envelopes containing consent/assent forms to give to the nominated friends and their parent/guardian to sign and return.
- c. After the nominated friends are listed, we will email those friends a short questionnaire asking about past week physical activity and screen time.

Time required: The first visit of the study will take about 65 – 80 minutes of your child’s time. The focus groups will take about 45 – 60 minutes each, and then an additional 15 – 20 minutes to answer the (demographic, physical activity and sedentary behavior self-efficacy, physical and sedentary activity enjoyment, barriers to physical activity) questionnaires, have the monitors fitted, and nominate friends. The second visit, which will occur approximately 7 days after the first visit, will take about 10 minutes to collect the monitors, answer 2 short (Physical activity and screen time recall) questionnaires, and nominate friends.

Risks: There are minimal risks to participating in this study. It is possible that your child may feel uncomfortable answering questions pertaining to activities and their friends in front of other adolescents during the focus groups, however, he/she has the right to skip any questions.

Benefits: There are no direct benefits to you or your child for participating in this research study. The study may help us understand how friends may influence adolescents’ physical activity and sedentary behavior.

Confidentiality cannot be guaranteed: Because of the nature of this data, I cannot guarantee that your child’s data will be confidential and it may be possible that others participating in the same focus group will know what your child has reported. The focus groups will be audio recorded, however, once the data has been transcribed, the recordings will be destroyed. Any information obtained from the questionnaires, and the transcriptions from the focus groups will be handled confidentially. Your child’s information will be assigned a code number. The list connecting your child’s name to this code will be kept in a locked file. Data from the focus groups will be used in a way that will not identify your child. When the study is completed and the data have been analyzed, this list will be destroyed. Your child’s name will not be used in any report.

Voluntary participation: Your child’s participation in the study is completely voluntary.

Right to withdraw from the study: You have the right to withdraw your child the study at any time without penalty.

How to withdraw from the study: If your child wants to withdraw from the study, tell the researcher. There is no penalty for withdrawing. Your child will still receive partial payment of a \$10 Dick’s Sporting Goods gift card if he/she participates in the first visit of the study. If you

would like to withdraw after your materials have been submitted, please contact Jeanette Garcia.

Payment: Your child will receive a \$20 Dick's Sporting Goods gift card for completing the study.

If you have questions about the study, contact:

Jeanette Garcia, MS
210 Emmet Street South, Room 225
University of Virginia, Charlottesville, VA 22904.
Telephone: (412) 443-8797
Email: jmg3df@virginia.edu

Arthur Weltman, Ph.D.
210 Emmet Street South, Suite 225A
University of Virginia, Charlottesville, VA 22904.
Telephone: (434) 924-6191
Email: alw2v@virginia.edu

If you have questions about your rights in the study, contact:

Tonya R. Moon, Ph.D.,
Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr Suite 500
University of Virginia, P.O. Box 800392
Charlottesville, VA 22908-0392
Telephone: (434) 924-5999
Email: irbsbshelp@virginia.edu
Website: www.virginia.edu/vpr/irb/sbs

Agreement:

I agree to allow my child to participate in the research study described above.

I agree to participate in the research study described above.

Signature: _____ **Date:** _____

You will receive a copy of this form for your records

Minor Informed Assent Agreement 13-17

Please read this assent agreement with your parent(s) or guardian(s) before you decide to participate in the study. Your parent or guardian will also give permission to let you participate in the study.

We want to learn about how friends influence physical activity and sedentary behavior.

As part of our study, we will come to your school and ask you to do the following:

1. Participate in a focus group that will last around 45 – 60 minutes. We will have you join 6 -9 other kids who are of the same gender and grade and ask you questions about what type of activities you like to do on the weekend and weekdays, and to tell us about your friends and activities you do with them. You can skip any questions that you don't want to answer. These sessions will be audio recorded, however, once we have written down your groups' answers, we will destroy the tapes.
2. Answer several questions about yourself, including your feelings towards various activities. These questions will take about 10 – 15 minutes to complete. You may refuse to skip any questions that you don't want to answer. These questions include:
 - a. Questions about your age, gender, race, weight, height, parent education
 - b. Your confidence in your ability to do certain activities
 - c. Your enjoyment of certain activities
 - d. Your barriers to being physically active
3. Wear a device that will measure your activity. The device will fit around your waist, and we will ask you to wear it during the day for a period of 7 days.
4. Answer a few questions about your friends, and nominate up to 5 of your friends to participate in this study. We will give you envelopes contain a form similar to this one, that we will ask you to give your friends and their parents/guardians. If your friends agree to participate, we will then email your friends a few questions similar to the ones we will ask you.
5. Once you return your device, we will ask you to complete 2 short questionnaires that ask about the time you spent in certain activities the past 7 days. These questions should take no more than 5 – 10 minutes to complete.

If you participate in the study, you may feel uncomfortable answering questions about friends and activities in front of other kids in your focus group. However, you do not have to answer any questions you don't want to.

If you participate in this study, there won't be any benefit to you.

Confidentiality: Because you are in a focus group, we can't guarantee that your information will be kept private. It may be possible that others will know what you said. However, once we have copied the information from the audio recordings, we will destroy the tapes, and your name will not be used. Any information that you give to us

during the study will be kept private. The list linking the code name assigned to your real name will be destroyed after all the data is collected. No one who reads about our study will know it was you. We keep things locked up so that only our researchers see them.

You don't have to participate in this study.

You can stop doing the study at any time. You will receive a \$10 Dick's Sporting Goods gift card if you stop the study after the first visit.

If you want to stop doing the study, tell Jeanette Garcia. If you choose to stop before we are finished, any answers you already gave will be destroyed. There is no penalty for stopping. If you decide that you don't want your materials in the study but you already turned them in, contact Jeanette Garcia.

You will receive a \$20 Dick's Sporting Goods gift card for completing this study.

If you have questions about the study, contact:

Jeanette Garcia, MS
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If you have questions about your rights in the study, contact:

Tonya R. Moon, Ph.D.,
Chair, Institutional Review Board for the Social and Behavioral Sciences
One Morton Dr Suite 500
University of Virginia, P.O. Box 800392
Charlottesville, VA 22908-0392
Telephone: (434) 924-5999
Email: irbsbshelp@virginia.edu
Website: www.virginia.edu/vpr/irb/sbs

Agreement:

I agree to participate in the research study described above.

Signature: _____ **Date:** _____

You will receive a copy of this form for your records.

APPENDIX B: Focus Group Questions

1. What types of Activities do you do after school and on the weekends?
 - a. If participants answer mainly physical activities, try to question about more sedentary behaviors, and vice versa
 - b. If participants are vague (ex. Hang with friends), ask for more information
 - c. If participants name a lot of sports, ask if they're on teams or just for fun
2. Do you feel that you do more of these activities on the weekends or weekdays?
 - a. Can probe by asking "how do these activities differ on weekends vs weekdays?" You can give examples such as do you do more homework on weekdays and then have more time for sports or television on weekends?
 - b. Sometimes asking for amounts of time spent in activity helps participants
3. Tell us a little about your friends. Do you have different types of friends?
 - a. Give examples of friendship groups if needed
 - b. Specify the difference between friendship groups, particularly school friends and sports team friends
4. Do you do specific activities with certain friendship groups?
 - a. Can give examples such as "shopping with school friends" or "going out to eat with team friends". Try not to list active or screen time behaviors in examples so that you don't bias answers
5. Do your friends influence your activity? If so, how?
 - a. Try not to bias the response by saying that friends positively encourage PA, but if you have to give examples, use both positive and negative examples like "friends offer to play basketball with me" and "friends prefer to watch television"
 - b. Make sure to ask for both PA and SB/screen time
6. Do you prefer to do activity by yourself or with friends?
 - a. Probe both about PA and SB/screen time
7. Does anything or anyone else influence your activity level?
 - a. If silence, you can give examples such as people (family, coaches, teachers, participant themselves) or other things (weather, gym close by, equipment)
8. How do you feel about PA?
 - a. Can probe about why participants like PA or engage in it

Appendix C: Questionnaires

ID#: _____

Date: _____

Demographic Questionnaire

1. Are you..?
 - a. Male
 - b. Female
2. What is your birthdate? ____ (month) ____ (day) 19____ (year)
3. What grade are you in?
 - a. 6th
 - b. 7th
 - c. 8th
 - d. 9th
 - e. 10th
 - f. 11th
 - g. 12th
4. Do you think of yourself as....? (You may choose more than one)
 - a. White
 - b. Black or African American
 - c. Hispanic or Latino
 - d. Asian American
 - e. Native Hawaiian or other Pacific Islander
 - f. American Indian or Native American
 - g. Other: _____
5. How far in school did your mother go? (Mark the highest level)
 - a. Did not finish high school
 - b. Finished high school or got GED
 - c. Did some college or training after high school
 - d. Finished college
 - e. Advanced degree (Master's degree, PhD, MD)
 - f. I don't know
6. How far in school did you father go? (Mark the highest level)
 - a. Did not finish high school
 - b. Finished high school or got GED
 - c. Did some college or training after high school
 - d. Finished college
 - e. Advanced degree (Master's degree, PhD, MD)
 - f. I don't know
7. What would you estimate your height to be? ____ (ft) ____ (in)
8. What would you estimate your weight to be? _____(lbs)

ID#: _____

Date: _____

Physical Activity Self-Efficacy

1. I can be physically active during my free time on most days.....
 - a. No matter how busy my day is
 - i. Strongly disagree
 - ii. Somewhat disagree
 - iii. Neither agree nor disagree
 - iv. Somewhat agree
 - v. Strongly agree
 - b. Even if it is very hot or cold outside
 - i. Strongly disagree
 - ii. Somewhat disagree
 - iii. Neither agree nor disagree
 - iv. Somewhat agree
 - v. Strongly agree
 - c. Even if I have to stay at home
 - i. Strongly disagree
 - ii. Somewhat disagree
 - iii. Neither agree nor disagree
 - iv. Somewhat agree
 - v. Strongly agree

Physical Activity Barriers

2. How often do these things keep you from being physically active?
 - a. The weather is bad
 - i. Never
 - ii. Rarely
 - iii. Sometimes
 - iv. Often
 - v. Very often
 - b. I don't have time to do physical activity
 - i. Never
 - ii. Rarely
 - iii. Sometimes
 - iv. Often
 - v. Very often
 - c. It would take time away from my school work
 - i. Never
 - ii. Rarely

- iii. Sometimes
 - iv. Often
 - v. Very often
- d. I'm embarrassed about how I look when I'm active
- i. Never
 - ii. Rarely
 - iii. Sometimes
 - iv. Often
 - v. Very often

Physical Activity Enjoyment

3. When I am physically active.....
- a. I feel bored
 - i. Strongly disagree
 - ii. Somewhat disagree
 - iii. Neither agree nor disagree
 - iv. Somewhat agree
 - v. Strongly agree
 - b. I dislike it
 - i. Strongly disagree
 - ii. Somewhat disagree
 - iii. Neither agree nor disagree
 - iv. Somewhat agree
 - v. Strongly agree
 - c. It frustrates me
 - i. Strongly disagree
 - ii. Somewhat disagree
 - iii. Neither agree nor disagree
 - iv. Somewhat agree
 - v. Strongly agree

ID# _____

Date: _____

Self-efficacy for sedentary behaviors

1. How confident are you....?
 - a. Turn off the TV even when there is a program on you enjoy?
 - i. I know I can't do it
 - ii. I think I can't do it
 - iii. I don't know if I can do it
 - iv. I think I can do it
 - v. I know I can do it
 - b. Limit your computer game playing time to 1 hour a day?
 - i. I know I can't do it
 - ii. I think I can't do it
 - iii. I don't know if I can do it
 - iv. I think I can do it
 - v. I know I can do it
 - c. Leave the room where the TV is on even if others are watching TV?
 - i. I know I can't do it
 - ii. I think I can't do it
 - iii. I don't know if I can do it
 - iv. I think I can do it
 - v. I know I can do it
 - d. Plan ahead of time what TV shows you will watch during the week?
 - i. I know I can't do it
 - ii. I think I can't do it
 - iii. I don't know if I can do it
 - iv. I think I can do it
 - v. I know I can do it
 - e. Instead of just sitting listening to music, listen while you are being active?
 - i. I know I can't do it
 - ii. I think I can't do it
 - iii. I don't know if I can do it
 - iv. I think I can do it
 - v. I know I can do it
 - f. Set limits on how long you plan to talk on the telephone with friends?
 - i. I know I can't do it
 - ii. I think I can't do it
 - iii. I don't know if I can do it
 - iv. I think I can do it
 - v. I know I can do it
 - g. Limit TV, video, and computer games to only 2 hours per day?

- i. I know I can't do it
- ii. I think I can't do it
- iii. I don't know if I can do it
- iv. I think I can do it
- v. I know I can do it

Sedentary Behavior Enjoyment

- 2. I enjoy doing the following activities:
 - a. Computer use
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree
 - b. Television viewing
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree
 - c. Sitting and socializing
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree
 - d. Reading
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree
 - e. Sitting or laying down listening to music
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree
 - f. Talking on the telephone
 - i. Strongly disagree
 - ii. Disagree a little

- iii. Neither agree nor disagree
- iv. Agree a little
- v. Strongly agree
- g. Recreational driving
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree
- h. Relaxing, thinking, and resting
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree
- i. Texting and sitting
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree
- j. Playing video games
 - i. Strongly disagree
 - ii. Disagree a little
 - iii. Neither agree nor disagree
 - iv. Agree a little
 - v. Strongly agree

ID#: _____

DATE: _____

Godin-Shepard Physical Activity Recall

In a usual week, how many hours do you spend doing the following activities:

1. Strenuous exercise (heart beats rapidly)
Examples: biking fast, aerobic dancing, running, jogging, swimming laps, rollerblading, skating, lacrosse, tennis, cross-country skiing, soccer, basketball, football
 - a. None
 - b. Less than $\frac{1}{2}$ hour a week
 - c. $\frac{1}{2}$ - 2 hours a week
 - d. $2\frac{1}{2}$ - 4 hours a week
 - e. $4\frac{1}{2}$ - 6 hours a week
 - f. 6+ hours a week
2. Moderate exercise (not exhausting)
Examples: walking quickly, baseball, gymnastics, easy bicycling, volleyball, skiing, dancing, skateboarding, snowboarding
 - a. None
 - b. Less than $\frac{1}{2}$ hour a week
 - c. $\frac{1}{2}$ - 2 hours a week
 - d. $2\frac{1}{2}$ - 4 hours a week
 - e. $4\frac{1}{2}$ - 6 hours a week
 - f. 6+ hours a week
3. Mild exercise (little effort)
Examples: walking slowly (to school, a friend's house, etc.), bowling, golf, fishing, snowmobiling, yoga
 - a. None
 - b. Less than $\frac{1}{2}$ hour a week
 - c. $\frac{1}{2}$ - 2 hours a week
 - d. $2\frac{1}{2}$ - 4 hours a week
 - e. $4\frac{1}{2}$ - 6 hours a week
 - f. 6+ hours a week

ID#: _____

Date: _____

Screen Time Questionnaire

1. In your free time on an average weekday (Monday-Friday), how many hours do you spend doing the following activities?
 - a. Watching TV/DVDs/videos
 - i. 0 hours
 - ii. ½ hour
 - iii. 1 hour
 - iv. 2 hour
 - v. 3 hours
 - vi. 4 hours
 - vii. 5+ hours
 - b. Using a computer (not for homework)
 - i. 0 hours
 - ii. ½ hour
 - iii. 1 hour
 - iv. 2 hours
 - v. 3 hours
 - vi. 4 hours
 - vii. 5+ hours
 - c. Xbox/Play-station/other electronic games that you play when sitting
 - i. 0 hours
 - ii. ½ hour
 - iii. 1 hour
 - iv. 2 hours
 - v. 3 hours
 - vi. 4 hours
 - vii. 5+ hours
 - d. Interactive video games such as Wii Sport, Wii Fit, and Dance Dance Revolution
 - i. 0 hours
 - ii. ½ hour
 - iii. 1 hour
 - iv. 2 hours
 - v. 3 hours
 - vi. 4 hours
 - vii. 5+ hours
2. In your free time on an average weekend day (Saturday or Sunday), how many hours do you spend doing the following activities?
 - a. Watching TV/DVDs/videos
 - i. 0 hours

- ii. ½ hour
 - iii. 1 hour
 - iv. 2 hours
 - v. 3 hours
 - vi. 4 hours
 - vii. 5+ hours
- b. Using a computer (not for homework)
 - i. 0 hours
 - ii. ½ hour
 - iii. 1 hour
 - iv. 2 hours
 - v. 3 hours
 - vi. 4 hours
 - vii. 5+ hours
- c. Xbox/Play-station/other electronic games that you play when sitting
 - i. 0 hours
 - ii. ½ hour
 - iii. 1 hour
 - iv. 2 hours
 - v. 3 hours
 - vi. 4 hours
 - vii. 5+ hours
- d. Interactive video games such as Wii Sport, Wii Fit, and Dance Dance Revolution
 - i. 0 hours
 - ii. ½ hour
 - iii. 1 hour
 - iv. 2 hours
 - v. 3 hours
 - vi. 4 hours
 - vii. 5+ hours