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The Relation Between Early Adolescent Physical Activity and Internalizing Problems: Variations in Exercise Motivations as a Critical Moderator

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The Relation Between Early Adolescent Physical Activity and Internalizing Problems:
Variations in Exercise Motivations as a Critical Moderator

by

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ABSTRACT

Although research suggests there is a bidirectional relation between Physical Activity (PA) and internalizing symptomology, there are inconsistencies in the literature regarding this relation for early adolescents and little research exists that investigates potential moderators that may account for these discrepancies in underserved (i.e. low SES and minority status) populations. The current study was the first to utilize a Self-Determination Theory (SDT) framework to investigate the main effects five key motivations to exercise and their moderating effects between PA and internalizing problems in an underserved sample of early adolescents ($N = 167$; M age = 12.19 years; 58.1% female and 73% African-American). These motivations were compiled into composite Intrinsic and Extrinsic Motivation Scales and assessed individually using hierarchical linear regression models. Moderate-to-vigorous physical activity (MVPA) was measured using omni-directional accelerometers and multiple imputations were used to account for missing data. Results showed that MVPA was only protective against internalizing problems when intrinsic motivations were high and had iatrogenic effects when intrinsic motivations are low. There was also a main effect for motivations whereby intrinsic motivations were negatively related to internalizing problems and extrinsic motivations were positively related. Exploratory analyses further delineated the effects of motivational orientations to exercise and identified the need for further investigation into social and fitness/health motivations for exercise to gain a more

nuanced understanding of these constructs. The findings in the study can be used to guide the development of interventions targeting underserved populations during the critical early adolescent years and emphasize the importance of assessing for motivations to exercise.

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LIST OF ABBREVIATIONS

CDC	Center for Disease Control
IMI	Intrinsic Motivation Inventory
IRB	Institutional Review Board
MPAM	Motivations for Physical Activity Measure
MPAM-R	Motivations for Physical Activity Measure-Revised
MVPA	Moderate-to-Vigorous Physical Activity
OIT	Organismic Integration Theory
PA	Physical Activity
SDQ.....	Strengths and Difficulties Questionnaire
SDT	Self-Determination Theory
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

Research suggests that early adolescence represents a time in which there are declines in overall mental health and high risk for initial onset and life-long struggles with depression and anxiety (Kessler et al., 2007). In a national representative sample of American adolescents (ages 9-16), approximately 36.7% met criteria for at least one internalizing disorder (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003) and suicide accounts for approximately 8.5% of adolescent deaths (WHO, 2017). Experiencing these disorders in adolescence has been shown to predict a two- to three-fold increased risk of experiencing a disorder again in adulthood (Pine et al., 1998). Research suggests that increasing physical activity (PA) in adolescence can serve to reduce the risk of depressive symptoms and increase psychological well-being across the lifespan (Ussher et al, 2007; Wiles et al., 2008). However, inconsistencies in these relations across studies has led some researchers to assert that motivations (e.g., mastery, appearance) youth have for their regular engagement in PA may influence the degree in which PA is beneficial for mental health (Skrove, Romundstad, & Indredavik, 2013; Spruit et al., 2016; Szabo, 2000). A sizable increase in PA initiatives and interventions have spurred in recent years as a result of the alarming high and stable rates of adolescent inactivity (Marques, & Gaspar de Matos 2014) and obesity (Ogden, Carroll, Kit, & Flegal, 2012). Examining motivational processes by which we can promote youth mental health along with

increases in PA (prevention of internalizing problems along with obesity), can contribute to developing highly efficacious cost-effective interventions that address two primary health issues among today's adolescents. The current study aims to address inconsistencies found in the relation between PA and internalizing problems in early adolescence through examination of the influence of youth exercise motivations.

There is empirical support that a dynamic coaction of obesity and depression exists, with previous research indicating a bidirectional causal relationship between depression and both sedentary lifestyle (inactivity) and obesity (Roshanaei-Moghaddam, Katon, & Russo, 2009; Dankel, Loenneke, & Loprinzi, 2016; Luppino et al., 2010). Early adolescence is a critical time period for PA intervention as there is a distinct decline in time spent engaged in PA across race and gender observed at this developmental period. For example, one study found that among a diverse sample of youth, 6 to 11-year olds spend more than twice the amount of time (88 min per day) in moderate-to-vigorous Physical Activity (MVPA) than 12 to 15-year olds (33 min per day; Belcher et al., 2010). Consequently, the rate of adolescent obesity has tripled since the late 1970s (CDC, 2008) and remains alarmingly high (Ogden et al., 2012). Additionally, research suggests anxiety and depression are the most common disorders seen in adolescents (Merikangas et al., 2008) and that persistent or escalating stressful events which occur in adolescence may increase the risk for internalizing disorder onset in early adulthood through their direct association with high or increasing symptom levels (Rueter, Scaramella, Wallace, & Conger, 1999). Research shows that increasing the

amount of time that youth engage in physical activity (PA) has shown to be an effective intervention for the prevention of obesity (American Heart Association 2001; Centers for Disease Control and Prevention, 2001) and the promotion of mental health (Ussher et al, 2006) which has been shown to reduce obesity in a reciprocal fashion (Paluska & Schwenk, 2000; Richardson et al., 2005; Wiles et al., 2007).

However, findings on the relation of PA to mental health during the adolescent years have been mixed. Some research has demonstrated that particular motivations to exercise (e.g., appearance and fitness/health) have been associated with maladaptive psychological symptomology (i.e. body image disorders and exercise addiction; Sicilia, Sáenz-Alvarez, González-Cutre, & Ferriz, 2014; Fox, 1999), and can ultimately undermine the positive impacts of PA on both psychological well-being and weight status. There is also considerable lack of rigor in the methodology across studies as many do not control for PA and the majority of those that have used self-report as opposed to omni-directional (i.e. able to detect movement in all directions) accelerometers which have been shown to be more effective in determining actual time spent in PA (Bassett, Mahar, Rowe, & Morrow Jr., 2008).

The goal of the current study was to examine intrinsic (enjoyment, competence, and social relatedness) and extrinsic (appearance and fitness/health) motivations as critical mechanisms that may moderate the relation between PA and internalizing symptomology among early adolescents. Given underserved populations of youth (i.e. low SES, minority status) have differentially high risk for inactivity, obesity, and internalizing disorders, (McLaughlin, Hilt, & Nolen-Hoeksema, 2007; Anderson & Mayes, 2010) the current study examined the relations of PA and motivations for PA on

the mental health of a primarily underserved sample of low-income African American adolescents.

1.1 PHYSICAL ACTIVITY AND WELL-BEING

The positive effects of PA on psychological well-being have been well-documented (Biddle, Fox, & Boutcher, 2006). For example, in a cross-sectional study of 2,623 adolescents between the ages of 13 and 16, Ussher et al. (2007) found that lower levels of self-reported PA and higher levels of self-reported sedentary behavior were associated with higher amounts of total difficulties as represented by the Strength Difficulties Questionnaire (SDQ). Similarly, Wiles and colleagues (2008) found that youth who reported participating in at least 60 minutes per day of PA were less likely to have emotional problems at a 1-year follow-up than youth who did not meet PA recommendations.

However, the literature is not unanimous in supporting a distinct positive relationship between PA and well-being (Skrove, Romundstad, & Indredavik, 2013; Spruit et al., 2016; Biddle & Asare, 2016). Two large scale meta-analyses showed that overall, the effects of PA on psychosocial outcomes in children and adolescents (age range = 10-21) were small to moderate and generally inconsistent (Biddle & Asare, 2011; Spruit et al., 2016). Although results were aggregated in these studies to calculate effect sizes, making it difficult to identify specific findings for each study, these researchers noted that not all interventions showed significant positive effects for PA. Further, Spruit and colleagues' (2016) suggested that there were instances in which PA interventions had iatrogenic effects on mental health and warned against implementing them indiscriminately in youth before examining characteristics and potential moderating

variables more thoroughly. Although these reviews analyzed some potential moderators (i.e. outcome of interest, study design characteristics, sample characteristics, intervention characteristics), the researchers were unable to adequately code these due to a lack of detail provided in the descriptions of each study and inconsistent methodologies employed. In an investigation into the negative psychosocial outcomes associated with exercise, Szabo (2000) posited that the motivational profile of an individual, a critical moderator typically left unexplored, may be imperative to assess to understand how exercise positively or negatively impacts mental well-being.

1.2 MOTIVATIONS TO ENGAGE IN PHYSICAL ACTIVITY

Self-Determination Theory (SDT) has been frequently used as a framework for understanding human motivation in various contexts. The theory has been used to assess motivations along a continuum ranging from intrinsic to extrinsic in multiple domains such as: academic achievement (e.g., Early et al., 2016), workplace productivity (e.g., Gillet, Colombat, Michinov, Provost, & Fouquereau, 2013), psychotherapeutic processes (e.g., Ryan, Lynch, Vansteenkiste, & Deci, 2011), health care (e.g., Shah et al, 2016), and PA (e.g., Ryan & Deci, 2007). A basic premise of SDT is that humans share an innate need to satisfy three basic psychological needs. These include competence (feeling efficacious in given actions associated with an outcome), relatedness (feeling connected with others), and autonomy (being in control and self-regulating one's own actions) (Deci, Vallerand, Pelletier, & Ryan, 1991). Intrinsically-motivated behaviors may satisfy one or more of the three basic needs or give an individual some other form of inherent pleasure. These behaviors are done through an individual's own sense of volition void of specific external rewards for performing the activity. On the opposing side of the

continuum are purely extrinsic motivations which are those that are thought to be instrumental for another purpose. Purely extrinsically-motivated behaviors are dependent on specific contingencies and do not satisfy the inherent basic needs which intrinsically-motivated behaviors do.

Organismic Integration Theory (OIT), a sub-theory of SDT, provides nomenclature for some of these motivations that fall along the continuum (Deci & Ryan, 2000). For instance, introjected regulations are behaviors which are slightly more internalized than pure extrinsic motivations and involve preserving the ego (e.g. avoiding shame and guilt) but are still not integrated with an individual's sense of self. Identified regulations are slightly more intrinsic than those which are referred to as introjected regulations. These are described as behaviors that align with values which an individual has identified as personally important. Research shows that motivations which lie closer on the continuum to purely intrinsic lead to greater adherence to the targeted activity being investigated (Ryan & Deci, 2000). As an example, those seeking to increase exercise adherence in a given population could increase the effectiveness of their intervention by shifting individuals' motivations away from engaging to gain 'bragging rights', a form of introjected regulation, and move towards identified regulations. This could be accomplished by imparting health as a value and then assisting in integrating behaviors that are aligned with these values into individuals' routines.

A multitude of studies have applied SDT as a framework for investigating how intrinsic and extrinsic motivations relate to exercise adherence (see Teixeira, Carraça, Markland, Silva, & Ryan, 2012 for a review). Ryan et al. (1997; Motivations for PA Measure [MPAM]) identified five key PA motivations for exercise adherence that can be

categorized as either more intrinsic or extrinsic in nature. Intrinsic motivations include competence, social, and enjoyment. Competence motivations involve developing technical mastery and a sense of accomplishment in a given activity. Enjoyment motivations stem from an individual's intentions of satisfaction and positive mood that directly results from engaging in PA. Social motivations relate to what extent an individual engages in an activity for the purposes of connecting with others and is aligned with the relatedness component of the SDT framework which fosters intrinsic motivation.

Extrinsically-based motivations of the MPAM include both appearance-based motivations and fitness/health motivations for PA. Appearance motivations for exercise involve engaging in PA for the purposes of improving one's appearance (e.g. losing weight, increasing muscle tone, or becoming more attractive). Fitness and health motivations relate to an individual's desire to increase livelihood and physical capabilities. There is evidence to suggest that fitness/health motivations are may be characterized as identified regulations rather than introjected regulations in the targeted population (Reboussin et al., 2000).

Research has demonstrated that intrinsic motives, including competence, social-relatedness, and enjoyment, positively predict exercise adherence in adults. Conversely, extrinsic motives related to appearance and fitness were not predictive of adherence (Ryan et al., 1997). However, not all research demonstrates that intrinsic motivations increase exercise adherence more so than extrinsic motivations. One study measured four of the five key motivations mentioned above (i.e. competence, enjoyment, appearance, and fitness/health) in two different sub-groups of exercisers (individual

exercisers and team sport groups; Frederick & Ryan, 1993). These researchers found that having competency and enjoyment motivations predicted greater adherence in the team sport group as expected, however, the body-related motivations (a combination of the current appearance and fitness/health subscales from the MPAM-R) predicted greater adherence in the individual exercise group. These findings suggest that individuals who tend to engage in general exercise may develop a motivational profile which consists of primarily extrinsic motivations.

There are fewer studies which apply an SDT framework when investigating exercise adherence in children and adolescents (see Owen, Smith, Lubans, Ng, & Lonsdale, 2014 for a review). Owen and colleagues (2014) suggest that the literature is not entirely conclusive due to methodological differences amongst studies, but that it suggests a similar trend that is seen in the adult research whereby intrinsic motivations positively predict adherence, but extrinsic motivations do not. Given the majority of youth PA opportunities that are available to adolescents (i.e. sport-based organized activities instead of exercise classes), there is more consistency in the adolescent PA literature which supports the notion that intrinsic motivations are predictive of greater adherence. There is also a substantial evidence base that shows motivational orientations for PA can influence mental health, however, there are important gaps in the literature which need to be addressed (e.g. Gillison, Standage, & Skevington, 2006; Standage et al., 2012).

1.3 EXERCISE MOTIVATIONS AND PSYCHOLOGICAL HEALTH

Similar to the literature on motivations for PA and exercise adherence, much of the research on the relation between motivations for PA and mental health centers around

older adolescent and adult populations. One study using an adult sample which investigated all but one (i.e. social motivations) of the five key motivations for exercise that will be investigated in this study, showed that intrinsic motivations predicted fewer symptoms of depression and anxiety while both fitness/health and appearance-related motivations to exercise predicted higher amounts of these internalizing problems (Frederick & Ryan, 1993). Although these body-related extrinsic factors predicted higher amounts of PA participation in certain populations (i.e. exercise-focused activity grouping; Frederick et al., 1997) the iatrogenic effects related to mental health warrant consideration and may contribute to some of the inconsistencies seen in the relation between PA and well-being in the literature.

Among adolescents, intrinsically-motivated exercise has also been shown to predict indicators of psychological well-being (e.g. Gillison, Standage, & Skevington, 2006). One study of early adolescents (mean age = 12.53) found that motivation orientations related to fulfilling the need for competency in PA predicted higher amounts of physical self-concept, those related to fulfilling the need for relatedness in PA (social) and intrinsic motivations for exercise (enjoyment) were associated with more adaptive emotional functioning (Standage et al., 2012). This study also showed that external regulations for exercise, those which are dependent on obtaining some specific reward for engaging in the activity, and introjected regulations, a form of extrinsic motivation used to attain ego enhancements (e.g. protecting one's self-image or pride within a group context; Ryan & Deci, 2000) were related to maladaptive emotional functioning.

Another study (Sicilia et al, 2014) also evidenced that introjected regulations (e.g. "I feel guilty when I don't exercise," positively predicted higher amounts of anxiety

related to one's appearance whereas competence motivations (an intrinsic motivation orientation for PA) negatively predicted this appearance-related anxiety in adolescents ages 12 to 19. These findings are particularly disconcerting as body dissatisfaction tends to increase throughout adolescence and has been shown to predict greater risk and severity of depressive symptoms (Fox, Page, Peters, Armstrong, & Kirby, 1994; Mueller et al., 1995; Tiggemann & Dyer, 1995; Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006; Almeida et al., 2012).

Although some research suggests female adolescents are more likely to experience body dissatisfaction and appearance-related anxiety (e.g., Wood, Becker, & Thompson, 1996; Ricciardelli, & McCabe, 2001; Gillison, Standage, & Skevington, 2006), there is also increasing evidence that adolescent males have been affected by media portrayals of a mesomorphic body type (characterized as being muscular with little body fat) as representative of the masculine ideal (McCreary & Sasse, 2000). This suggests that body dissatisfaction may negatively impact both males and females despite this occurring through different processes. Females tend to have negative perceptions of being overweight, where being underweight is generally more undesirable for males and research suggests that differences in overall body dissatisfaction is negligible (Silberstein, Striegel-Moore, Timko, & Rodin, 1988). Any type of dissatisfaction with one's appearance can lead to appearance-related extrinsic motivations to exercise and in turn lead to maladaptive psychological adjustment (Fox, Page, Peters, Armstrong, & Kirby, 1994; Mueller et al., 1995; Tiggemann & Dyer, 1995; Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006; Almeida et al., 2012).

Although previous studies have investigated different aspects of these research questions (e.g. Gillison, Standage, & Skevington, 2006; Standage et al., 2012; Frederick & Ryan, 1993), most of these studies merge appearance and fitness/health motivations into one construct (i.e. extrinsic motivations) and only one study has examined these relations during the critical years of early adolescence (Gillison, Standage, & Skevington, 2006). Also, no studies to our knowledge have used an SDT framework to assess motivations to exercise as a moderator between accelerometry-estimated PA and internalizing symptomology in a sample of early adolescents. Further, the current study examines these relations among a primarily African-American sample of low income adolescents who are understudied, yet important to investigate as research suggests they are at-risk for obesity and the development of internalizing problems (Flegal, Carroll, Kit, & Ogden, 2012; Young-Hyman, Schlundt, Herman-Wenderoth, & Bozylinski, 2003; Gaylord-Harden, & Cunningham, 2009).

1.4 RACE- AND ECONOMIC-RELATED DISPARITIES

For over a decade, the higher prevalence of overweight and obesity among African American adolescents within the US has remained stagnantly high at forty percent (Ogden et al. 2012) and regardless of ethnic identity, low income children aged 2 to 19 have higher rates of obesity than children from higher income families since 1980 (Kumanyika & Grier, 2006). Along with disparities in food access, low and decreasing rates of physical activity across the adolescent years is a key contributor to this overall increase in adolescent obesity, and the disparities found by race and SES (Sinha et al., 2002; Berenson, 2005; Schwimmer et al., 2003; Zimetkin et al., 2004). Further, research shows that adolescents who perceive themselves as overweight are more likely to endorse

extrinsically-motivated exercise goals (i.e. appearance or fitness motivations). Despite initiatives to address the increased risk of obesity in these populations, research pays little attention to PA motivations and their potential impact on psychological well-being.

Given underserved youth are at greatest risk for overweight and obesity, and in turn, may be more likely to engage in PA for extrinsic motivations, they are a critical population understudied in the current literature. It is particularly important to intervene with at-risk populations during early adolescence as the majority of body image and eating disorders, which similar to and often comorbid with internalizing disorders, (Holm-Denoma, Hankin, & Young, 2014) appear shortly after the onset of puberty and continue to worsen throughout late adolescence. This process may in turn trigger a cycle of extrinsically-motivated exercise, continued body dissatisfaction, and poor long-term impact on psychological health (Fox, Page, Peters, Armstrong, & Kirby, 1994; Mueller et al., 1995; Tiggemann & Dyer, 1995).

Moreover, many studies have shown a reciprocal link between obesity and depression (e.g. Luppino et al. 2010), which would suggest that depression may be more prevalent in underserved populations. Although this relation was observed in some studies (e.g. Young-Hyman, Schlundt, Herman-Wenderoth, & Bozylinski, 2003; Gaylord-Harden, & Cunningham, 2009) there are mixed findings in the literature as African-Americans tend to report experiencing less internalizing symptomology throughout the lifespan in other studies (e.g. Breslau, Aguilar-Gaxiola, Kendler, Su, Williams, & Kessler, 2006). These contrary findings warrant consideration and a further exploration into this critical yet understudied population. Therefore, the current study aims to disentangle the relations between PA, exercise motivations, and internalizing

symptoms among a primarily underserved population of youth, of which 46.7% are classified as overweight or obese. Given the relations between obesity and internalizing symptoms and the high prevalence of overweight and obesity in the current sample, the current study controlled for BMI in all statistical models.

1.5 CURRENT STUDY

The current study used a SDT framework to examine the moderating effects of intrinsic and extrinsic motivations to engage in PA on the relations between early adolescents' MVPA and internalizing problems (See figure 1.1). We evaluated both the broad/cumulative intrinsic and extrinsic motivational constructs as well as the five individual motivational subscales of the broader constructs (competence, social relatedness, enjoyment, fitness/health, and appearance) (Frederick & Ryan, 1993; Ryan et al., 1997; Duda & Nicholls, 1992) to provide a comprehensive understanding of how exercise motivations may influence the impact of PA on youth internalizing. First, we expected to find a main effect of MVPA, whereby higher rates of MVPA predict less internalizing symptomology. Second, we hypothesized that there would be a main effect of motivations for PA on internalizing after controlling for PA, whereby intrinsic motivations would predict fewer internalizing problems and extrinsic motivations would predict more internalizing problems. Third, we expected that motivations for PA would moderate the effect of MVPA on internalizing problems. Depending on whether an individual has intrinsic or extrinsic motivations to exercise, we expected that high rates of PA would have differing effects on internalizing (See Table 1.1). In particular, among youth with high rates of MVPA, we predicted that youth with intrinsic motivations to exercise would benefit most from their activity (significantly fewer internalizing

problems compared to all others) where similarly active youth with extrinsic motivations to exercise would not show any benefits of PA on internalizing problems (rates of internalizing symptomology would be similar to inactive youth) or iatrogenic effects (higher rates of internalizing compared to inactive youth). Among inactive youth (low rates of MVPA) we expected youth would have high rates of internalizing symptomology despite exercise motivations. Finally, we explored whether the five individual subscales that comprise the broader extrinsic and intrinsic composite scales would provide additional contributions to our understanding of the critical motivational mechanisms necessary for PA interventions to support mental health along with physical health.

The current study addresses several gaps in previous research with the goal of understanding inconsistencies in the literature regarding the relation between youth PA and well-being (Spruit et al., 2016). We are the first study to our knowledge to use omnidirectional accelerometers to provide an objective measure of PA to predict internalizing problems in a low income, underrepresented population of early adolescents. Additionally, no studies to our knowledge have investigated the potential moderating effects of intrinsic and extrinsic motivations on internalizing symptomology in a sample of primarily African-American early adolescents. Finally, we are one of only a few studies using a SDT framework (see Owen et al., 2014 for a review) to utilize omnidirectional accelerometers in a sample of adolescents and the first of these to assess the unique contributions all five of these motivational orientations for exercise. The results of this study will support the importance of ensuring that adolescents develop PA motivations that do not have deleterious effects on mental health.

1.6 HYPOTHESES

The current study analyzed self-report data from the Connect through PLAY intervention at baseline. This 12-week intervention was designed to increase PA through enhancing the social-motivational climate. In particular, the intervention promotes the development of friendships through PA, creating a sense of group belonging, mastery, and sense of agency/autonomy. It used time spent in MVPA as measured by omnidirectional accelerometer data and used self-report at baseline to measure adolescents' motivations to exercise and internalizing problems.

Using baseline data from the Connect through PLAY intervention, we tested three main hypotheses. First, we predicted MVPA, as measured by omnidirectional accelerometer, would have an inverse relation with youth self-reported internalizing problems. Second, we tested the main effects of PA motivations on internalizing symptomology, controlling for MVPA: it is predicted that intrinsic motivations to engage in exercise (i.e. the composite Intrinsic Motivation Scale comprised of the individual Enjoyment, Competence, and Social Subscales) would negatively predict internalizing problems and; extrinsic motivations (i.e. the composite Extrinsic Motivation Scale comprised of the individual subscales of Appearance and Fitness/Health Subscales) would positively predict internalizing problems with the presence of MVPA in the model. Our third and final hypothesis would be a critical and novel contribution to the literature, expecting that greater amounts of MVPA will only predict fewer internalizing problems when intrinsic motivations for PA are high or extrinsic motivations are low. After testing these hypotheses using the composite Intrinsic and Extrinsic Motivation Scales, each of these five separate subscales were entered into two different hierarchical linear

regression models in a similar manner. One of these models included the separate intrinsic subscales (i.e. Enjoyment, Competence, and Social Subscales) while controlling for the composite Extrinsic Scale, and the other model included the separate extrinsic subscales (i.e. Appearance and Fitness/Health Subscales) while controlling for the composite Intrinsic Scale. Assessing these main effects and moderating effects between PA and internalizing problems of each of these separate subscales is a novel contribution to the literature and exploratory in nature.

Table 1.1 Hypotheses

MVPA	High	High	High	High	Low	Low	Low	Low
Motivation	Intrinsic High	Intrinsic Low	Extrinsic High	Extrinsic Low	Intrinsic High	Intrinsic Low	Extrinsic High	Extrinsic Low
Internalizing Problems	↓	↑	↑	↓	↑	↑	↑	↑

Note: Intrinsic = Enjoyment (IMI for PA), Competence, and Social (MPAM-R) and Extrinsic = Appearance and Fitness/Health (MPAM-R)

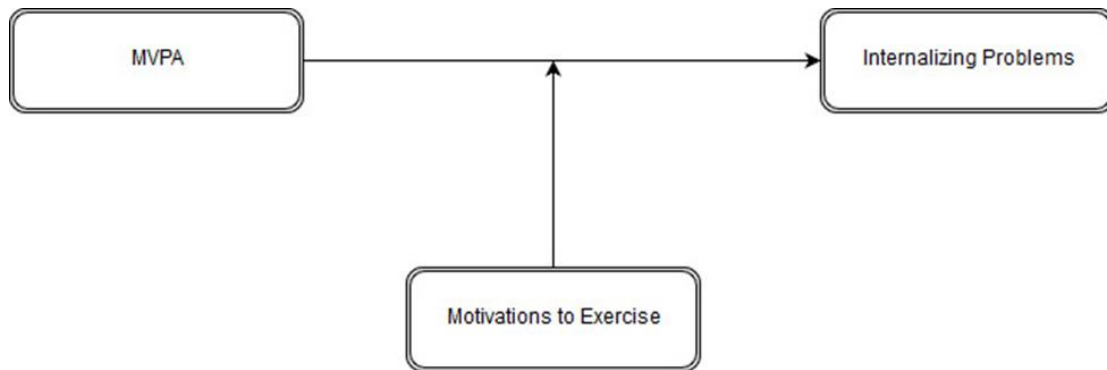


Figure 1.1 Motivations to Exercise as a Moderator Between MVPA and Internalizing Problems

CHAPTER 2

METHOD

2.1 PARTICIPANTS

This study used baseline data from the Connect through PLAY project (PI: Nicole Zarrett), a PA intervention designed for middle school after-school programs. The data were collected in 6 middle school after-school programs (3 intervention vs 3 control) between March of 2015 and December of 2016 that provided services to a primarily underserved population of youth (defined by at least 50% of youth enrolled that are minority status and receiving free/reduced lunch). Year 1 of the project took place in two underserved after-school programs in Columbia, South Carolina from March to May of 2015. Year 2 of this study took place in two underserved after-school programs in Columbia, South Carolina from March to May of 2016. Year 3 of the study took place in two underserved after-school programs in Columbia, SC from October to December of 2016. These programs were randomly assigned to either receive the intervention or serve as an active wait-list control group which received the intervention during the following term. The intervention was designed to increase PA through enhancing the social-motivational climate of afterschool programs. The current study used youth questionnaires and 1-week (7-day) accelerometer data collected at baseline. IRB approval was granted for the study.

Two hundred and twenty-five 6th to 8th grade students between the ages of 11 and 14 assented to the study and received parental consent to participate. After randomization of participants, there were 131 students in the intervention group and 94 in the control group. There were no drop-outs from the study, however, 57 of the participants included missing data on one of the variables being examined (i.e. SDQ Peer Problems and Emotional Problems subscales). These cases were excluded in a list-wise manner from the analysis leaving a final sample size of 167 participants (mean age = 12.19 years). Chi-Squared tests showed no significant difference for race ($p = .752$) or gender ($p = .195$) for this missing data. Also, a one-way ANOVA predicting Z-BMI showed that there was no significant difference in Z-BMI score between participants who had missing SDQ data in comparison to those with non-missing data ($p = .243$). Of this final sample, 70 students were male and 97 were female. The sample was primarily non-Hispanic African American (73.6%), with 15.5% identifying as White (13.8% non-Hispanic; 3.0% Hispanic), 2.4% identifying as Multiracial, and the remaining % as “other”. The schools’ free or reduced lunch eligibility rates ranged from 57-98%.

2.2 PROCEDURE

After acquiring parental consent and youth assent, the researchers administered questionnaires to students for which consent and assent were granted. All measures were collected at baseline (1 week prior to the start of the intervention) and again at the end of the 12-week intervention (1-week post-intervention). All measures included in the current study were collected at baseline. Youth were asked to complete a battery of self-report measures and report on key demographics such as gender, race/ethnicity, age, grade, and free/reduced lunch status. Further, students received an omni-directional

accelerometer to wear for one full week at baseline and again at post-intervention to track energy expenditure throughout the week. Research assistants provided assistance to any youth who had questions or needed help reading/comprehending self-report questionnaire items, and provided detailed instructions and assistance to youth on how to properly wear the accelerometer.

2.3 MEASURES

PHYSICAL ACTIVITY Participants within each program wore an omnidirectional Actical accelerometer (Mini Mitter, OR) for one full week (7 consecutive days). Measurement of free-living PA using omnidirectional accelerometry estimates have been established as a more objective measurement of PA that is less susceptible to bias than self-report measures (Bassett, Mahar, Rowe, & Morrow Jr., 2008; Sallis & Saelens, 2000). Accelerometer belts were worn at the hip and collected data on the students' energy expenditure (i.e. duration and intensity) in METs (ratio of the metabolic rate to the resting metabolic rate). The data was processed using Actiware Version 6.0.8. and managed using SAS version 9.4. The amount of 60 second epoch lengths (count intervals) in which an individual was categorized as being sedentary or engaged in light, moderate, or vigorous PA were summed together. The cut-points developed for youth were used to classify activity counts into MVPA for this study (≥ 1500 ; >3 METs; Puyua, Vohra, Zakeri, & Butte, 2004).

Participants' data were coded for missingness in SAS based on wear criteria established in previous literature (Mitchell et al., 2013; Troiano et al., 2008). Data was used only if participants had at least 10 hours of wear (600 total minutes) on 3 out of the

7 days they were in possession of the belts. Approximately 17% of participants (n=29) did not meet these wear criteria. Missing data was dealt with using multiple imputation using the mice R package (van Buuren & Groothuis-Oudshoorn, 2011). All available demographic and psychosocial data was included in imputations for each time point aside from the data collected on the SDQ (Peer Problems and Emotional Problems Subscales were utilized in the current study). Twenty imputations were completed for baseline data and one of these imputations was selected for analyses using a random number generator. Data from the SDQ were merged into this data set and it was used for subsequent analyses.

PA Motivation. For the current study, youth motivation orientations for PA were measured using the Motivations for Physical Activity Measure-Revised (MPAM-R; Ryan, et al., 1997), and the Intrinsic Motivation Inventory (IMI; Duda & Nicholls, 1992). The MPAM-R was designed using a SDT framework to measure individuals' motivations to engage in physical activity. The factor analysis of this measure revealed a 5-factor structure with adequate ratings of internal consistency across each of the subscales (Cronbach alpha coefficients ranged from .78 to .92; Ryan, Frederick, Lepas, Rubio, & Sheldon, 1997). Each of the five factors was represented by a subscale (Appearance, Competence, Enjoyment, Fitness/Health, and Social). The measure also demonstrated construct validity in a previous study as each subscale correlated with psychological variables associated with exercise in the expected directions (Achenbach, McConaughy, & Howell, 1987). The Cronbach's Alpha of the subscales in the current study range from .79 to .92. The version of the measure used in the study had 23 questions in total (see Appendix A). There were seven questions on the Competence Subscale, five on the

Social Subscale, six on the Appearance Subscale, and five on the Fitness/Health Subscale. The questions are scored on a 5-point Likert scale with a score of 1 indicating “Not at all true for me” and 5 indicating “Very true for me”.

The Enjoyment Subscale from the MPAM-R was replaced with the Enjoyment Subscale of the IMI in the current study because researchers aimed to reduce participant questionnaire burden and believed the IMI more adequately assessed the construct. The IMI was designed to measure intrinsic motivation during specific laboratory tasks (Ryan, 1982). The Enjoyment Subscale is recognized as the primary measure of intrinsic motivation, thus was selected for use in the study. The IMI was adapted to measure intrinsic motivation to engage in PA-specific tasks and the Enjoyment Subscale showed adequate levels of internal consistency ($\alpha = .78$). The scale in the study also showed adequate ratings of internal consistency ($\alpha = .92$). The measure included 11 questions rated on a 5 point Likert scale ranging from “very false” to “very true” (see Appendix A). Sample items include the following: “When I am active I find it fun”, “When I am active it feels good”, and “Being active is important to me”.

Among the subscales used in the current study, the Enjoyment (IMI), Competence (MPAM), and Social Subscales (MPAM) are associated with intrinsic motivations to exercise (Frederick & Ryan, 1993). The Enjoyment Subscale of the IMI measures the extent to which individuals want to engage in PA because they inherently enjoy it (“When I am active I enjoy it”). The Competence Subscale represents the extent to which individuals want to engage in PA to fulfill their need for competence in the activity (“it is because I want to get better at my activity”). The Social Subscale represents the extent to which individuals want to engage in PA to fulfill their need for social

connections/affiliation (“it is because I want to be with my friends”). The Appearance and Fitness/Health Subscales are associated with extrinsic motivations to exercise as they represent separate consequences that result from engaging in PA. The Appearance Subscale represents the extent to which individuals want to engage in physical activity to enhance their appearance (“it is because I want to improve my body shape”). The Fitness/Health Subscale represents the extent to which individuals want to engage in physical activity to increase their fitness or health (“it is because I want to maintain my physical health and well-being”).

Psychological Wellbeing. Strengths and Difficulties Questionnaire (SDQ).

The Strengths and Difficulties Questionnaire (SDQ), a 25-item measure of pro-social behavior and psychopathology in those between the ages of 3 and 16 (Goodman, 2001; Van Roy, Veestra, & Clench-Aas, 2008) was used to measure internalizing problems in the present study. There are 2 different methods of administration including self-report or informant-report by a parent or teacher. A 1998 study supported a five-factor model for the self-report version of the measure with a sufficiently high internal consistency (total scale $\alpha = .82$; Goodman, Meltzer, & Bailey, 1998). The self-report version was used in the current study and displayed adequate ratings of internal consistency ($\alpha = .75$).

The scale has been shown to effectively discriminate between clinical and non-clinical populations in total amount of problems among both genders showing strong predictive validity (Goodman, Meltzer, & Bailey, 1998). Additionally, the self-report version of the full scale correlated highly with parent ($r = .58$) and teacher ($r = .39$) reports among clinical youth samples (Goodman, Meltzer, & Bailey, 1998), supporting adequate convergent validity.

This study utilized the Emotional and Peer Problems Subscales from the SDQ (see Appendix A). The Emotional Subscale represents anxious and depressive symptomology (“I am nervous in new situations. I easily lose confidence”). The Peer Problems Subscale represents the extent to which individuals have social-relational issues (“Other children or young people pick on me or bully me”). All items are on 3-point scale with responses: “Not true”, “Somewhat true”, and “Certainly true”. Each of these is coded on a 1-3 scale respectively. Any items related to positive psychological adjustment are reverse-coded, thus, higher total scores on these scales represent higher amounts of maladaptive psychological symptomology within each domain. The analyses combined these two subscales to represent internalizing symptomology which was consistent with recommendations provided by the developer of the scale (Goodman, Lamping, & Ploubidis, 2010).

Covariates. Students’ height and weight were measured and Z-BMI scores were calculated by first dividing students’ weight in kilograms by their height in centimeters squared. This number is then standardized in accordance with the Center for Disease Control’s (CDC) growth charts based on an individual’s age and sex (CDC, 2009). The mean Z-BMI percentile of the sample was approximately half of a standard deviation (SD) above a population normed average for their respective age groups ($M = 68.5$ percentile). Of the current sample, 46.7% were categorized as overweight or obese (classified as 85th percentile or higher) which is reflective of the literature which shows that African-Americans are at higher risk for overweight and obesity (Ogden, 2008; Kumanyika & Grier, 2006; Sinha et al., 2002; Berenson, 2005; Schwimmer et al. 2003; Zametkin et al., 2004).

2.4 ANALYTIC PROCEDURES

All analyses were run using SPSS Version 21 software package (IBM Corp., Somers, NY). Initially, bivariate correlational analyses and Analysis of Variance models were run to investigate the relationships between all variables including potential covariates that may contribute added variance to the models. The covariates that were investigated include: Z-BMI, gender, and race. For aim 1 which involved testing the main effects of MVPA on internalizing problems, a linear regression was conducted that included MVPA and any covariates that had a significant relationship to MVPA. The parameters in this model were examined to determine whether MVPA is inversely related to internalizing problems. For aim 2, a hierarchical linear regression model was used to test the main effects of motivational orientations to exercise on internalizing problems while controlling for MVPA and covariates. The first step of the model included MVPA and predictive covariates. In the second step of the model we entered the composite Intrinsic and Extrinsic Motivation Scales. For aim 3, which included testing the moderating effects of motivational orientations to exercise on the relation between MVPA and internalizing problems, two interaction terms, one of intrinsic motivations with MVPA and one of extrinsic motivations with MVPA, were entered into the third step of the hierarchical linear model tested in Aim 2.

A similar procedure was used for our exploratory analyses which assessed the main effects and moderating effects of each separate motivational orientation subscale on internalizing problems. Each of the individual intrinsic subscales of the MPAM-R (Competence and Social Subscales) and the IMI for PA affect (Enjoyment Subscale) were entered into the second step of a hierarchical linear model that controlled for MVPA

and other covariates in step 1. This intrinsic motivations model also included the composite Extrinsic Motivation Scale as a covariate in the second step. Therefore, the intrinsic motivations model tested the main effects of these motivational orientations on internalizing problems while controlling for the effects of extrinsic motivations, MVPA, and covariates. Similarly, for the extrinsic motivations model, the extrinsic subscales of the MPAM-R (Appearance and Fitness/Health) were each entered into the second step of a model with the composite score of intrinsic motivations, and that controlled for MVPA and other covariates in the first step. This model assessed the main effects of each of the extrinsic motivational orientations while controlling for the effects of intrinsic motivations, MVPA, and covariates.

The final step of the intrinsic motivations model included three interaction terms between all of the separate intrinsic subscales (Social, Competence, and Enjoyment) with MVPA to assess the moderating effects of these motivations on the relation between MVPA and internalizing problems while controlling for extrinsic motivations and covariates. Finally, two interaction terms between the separate extrinsic subscales (Appearance and Fitness/health) with MVPA were entered into the final step of the extrinsic motivations model to assess the moderating effects of the extrinsic motivations to exercise on the relation between MVPA and internalizing problems. The models which included significant interactions were then plotted to determine the nature of these relationships.

CHAPTER 3

RESULTS

3.1 PRELIMINARY ANALYSES

Scores on the Internalizing Scale of the SDQ ranged from 2 to 5.67 with a mean score of 3.365 ($SD = .959$) and participants also reported being more intrinsically motivated ($M = 3.730$, $SD = .741$) than extrinsically motivated ($M = 3.287$, $SD = .996$) to exercise on average. Of the scales representing separate motivations, enjoyment motivations to exercise ($M = 4.01$, $SD = .875$) were highest on average and appearance motivations to exercise ($M = 2.887$, $SD = .1.207$) were lowest on average. The amount of epochs (60 seconds in length) which youth were characterized as being engaged in MVPA ranged from 7.67 to 121.75 ($M = 42.25$, $SD = 27.33$). Separate ANOVA models were run to assess differences on key study variables by race and gender. ANOVA models showed no differences between race in internalizing problems, MVPA, or motivations to exercise. There was a significant difference for gender ($F(1, 165) = 6.445$, $p = .012$) for appearance motivations with females endorsing more appearance-related motivations for exercise than males. Also, there was a gender difference for MVPA ($F(1, 165) = 44.713$, $p < .001$) as males engaged in more MVPA ($M = 59.060$, $SD = 30.901$) than females ($M = 33.564$, $SD = 18.156$). There were no significant gender differences for internalizing problems or any other motivations to exercise. Next, Bivariate correlations were computed among all continuous variables to identify relations among key study variables and assess Z-BMI as a potential covariate. Z-BMI was negatively

related to MVPA ($r = -.201, p = .009$), but there were no other significant relations between internalizing problems or motivations to exercise. Thus, only gender and Z-BMI were included as covariates in subsequent analyses as they were related to other key study variables and race was not included.

3.2 ANALYSES FOR PRIMARY AIMS

3.2.1 MVPA AS A PREDICTOR OF INTERNALIZING PROBLEMS A

linear regression model was used to test the main effect of MVPA on internalizing problems. The model included MVPA as a predictor of Internalizing Problems with gender and Z-BMI as covariates. Contrary to our hypotheses, MVPA was not predictive of fewer internalizing problems. Controlling for gender and Z-BMI, MVPA was not a significant predictor ($p = .620$) in this model. Neither gender ($p = .215$) nor Z-BMI ($p = .136$) were significant.

3.2.2 INTRINSIC AND EXTRINSIC EXERCISE MOTIVATIONS AS A PREDICTOR OF INTERNALIZING PROBLEMS Building on the main effects model in aim 1, we then tested the main effects of exercise motivations on internalizing problems using a hierarchical linear regression model. In the second step of this model, we included the composite Intrinsic and Extrinsic Motivation scales to assess the main effects of these broader motivational orientations on internalizing problems above and beyond that of MVPA and covariates. This step of the model explained 11.5% of the variance ($p < .001; R^2\Delta = .034, p\delta = .046$). As predicted, intrinsic motivations were related to fewer internalizing problems ($\beta = -.384, p < .001$; see Table 3.2) and extrinsic motivations were related to more internalizing problems ($\beta = .323, p = .002$).

3.2.3 INTRINSIC AND EXTRINSIC EXERCISE MOTIVATIONS AS MODERATORS BETWEEN MVPA AND INTERNALIZING PROBLEMS

Interactions between the composite Intrinsic and Extrinsic Motivation Scales and MVPA were computed and entered into the final step of the hierarchical linear regression model to test for the moderating effects of motivations. The final model that included the interaction terms explained 14.8% of the variance ($p < .001$; $R^2\Delta = .0$, $p\delta = .001$). The interaction between intrinsic motivations and MVPA was significant ($\beta = .244$, $p = .044$). A plot of the interaction (see Figure 3.1) indicated that higher rates of MVPA were protective against internalizing problems when intrinsic motivations were high but was iatrogenic when intrinsic motivations were low. The plot also indicated that for youth with lower rates of MVPA, youth who were more intrinsically motivated were faring better on internalizing symptomology than those who were less intrinsically motivated. That is, while youth with the highest rates of MVPA benefit most from intrinsic motivations, even less active youth can reap some benefits from an intrinsic motivation orientation towards for PA. Although the interaction between extrinsic motivations and MVPA was not significant ($p = .522$), there was still a significant main effect whereby extrinsic motivations predicted higher amounts of internalizing problems ($\beta = .378$, $p = .001$). These findings suggest that extrinsic motivations are equally detrimental to the mental health of active and inactive youth.

3.3 EXPLORATORY ANALYSES

3.3.1 MOTIVATION SUBSCALES AS PREDICTORS OF INTERNALIZING PROBLEMS

In order to test the unique effects of intrinsic subscales (Enjoyment, Competence, and Social) and extrinsic subscales (Appearance and

Fitness/Health) related to internalizing problems, two additional hierarchical linear regression models were conducted, that controlled for MVPA, gender, and BMI in step 1, and the IMI for PA and MPAM-R subscales entered into step 2. The first of these models, the intrinsic motivations model, included the IMI for PA (Enjoyment Subscale) and the MPAM-R Competence, and Social Subscales (i.e. the subscales which formed the composite Intrinsic Motivation Scale). The composite Extrinsic Motivation variable was also entered as a covariate in this step of the model. The second model, the extrinsic motivations model, included the separate Appearance and Fitness/Health Subscales (i.e. the subscales which formed the composite Extrinsic Motivation Scale) and the composite intrinsic motivation variable as a covariate.

The second step of the intrinsic motivations model explained 13.5% of the variance ($p = .001$; $R^2\Delta = .106$, $p\delta = .001$). Enjoyment motivations to exercise, as represented by the IMI for PA, was related to fewer internalizing problems ($\beta = -.234$, $p = .011$; see Table 3.3). Competency motivations to exercise, as represented by the Competence Subscale on the MPAM-R, was also related to fewer internalizing problems ($\beta = -.214$, $p = .042$). In contrast, social motivations to exercise, as represented by the Social Subscale of the MPAM-R, was not a significant predictor in the model ($p = .780$). The Extrinsic Motivation Scale was positively associated with internalizing problems ($\beta = .321$, $p = .003$).

In the second model that examined each of the extrinsic motivations, Appearance and Fitness/Health Subscales (i.e. the subscales which formed the composite Extrinsic Motivation Scale) were each added into the second step of a hierarchical linear regression model (the extrinsic motivations model) that controlled for MVPA, gender, and BMI in

step 1. The composite Intrinsic Motivation scale was also entered as a covariate in step 2. This step of the model explained 19.8% of the variance ($p < .001$; $R^2\Delta = .169$, $p\delta < .001$). Appearance motivations were related to higher amounts of internalizing problems ($\beta = .435$, $p < .001$; see Table 3.4), however, fitness/health motivations to exercise were not a significant predictor of internalizing problems ($p = .098$). Intrinsic motivation to exercise was a negative predictor of internalizing problems ($\beta = -.233$, $p = .023$).

3.3.2 MOTIVATION SUBSCALES AS MODERATORS BETWEEN MVPA AND INTERNALIZING PROBLEMS For the final intrinsic motivations model, interactions (three in total) were computed between each of the intrinsic subscales (Enjoyment, Competency, and Social) and MVPA and then entered into Step 3 of the model to assess how the separate intrinsic motivation subscales moderated the relation between MVPA and internalizing problems. This step of the model explained 18% of the variance ($p < .001$; $R^2\Delta = .046$, $p\delta = .037$). The interaction between enjoyment motivations and MVPA was significant ($\beta = -.204$, $p = .048$). A plot of the interaction (see figure 3.2) indicated that higher amounts of MVPA are protective against internalizing problems when enjoyment motivations are high. It also shows that high MVPA can have iatrogenic effects on youth mental health when enjoyment motivations are low. Specifically, youth with high rates of MVPA that do not endorse having enjoyment motivations for PA experienced higher amounts of internalizing problems than both their high PA/high enjoyment counterparts, and those low on both MVPA and enjoyment motivations. Youth low in both MVPA and enjoyment motivations, although faring slightly better than their high MVPA/low enjoyment counterparts, still had higher internalizing symptomology than youth high in both MVPA and enjoyment. The

interactions between competence motivations and MVPA and social motivations and MVPA were not significant ($p = .643$ and $p = .997$, respectively). The composite of extrinsic motivation remained significantly related to greater amounts of internalizing problems in the final step of the model ($\beta = .351$, $p = .001$).

For the extrinsic motivations model, two interactions with MVPA were computed with both the Appearance and Fitness/Health Motivation Subscales and entered into step 3 of the model to assess the moderating effects of these subscales on the relation between MVPA and internalizing problems. The final step of the extrinsic motivations model predicted 22.3% of the variance which was not a significant change from the previous step ($p < .001$; $R^2\Delta = .026$, $p\delta = .076$). Neither the interaction between MVPA and appearance motivations ($p = .536$) or fitness and health motivations ($p = .138$) were significant. Appearance motivations ($\beta = .422$, $p = .002$) remained a significant predictor of higher amounts of internalizing problems but fitness and health motivations ($\beta = -.242$, $p = .025$) predicted fewer internalizing problems. Intrinsic motivation was no longer a significant predictor ($p = .100$) when the interactions were entered in to the final step of the model.

Table 3.1. Correlation Matrix and Descriptive Statistics

Variable	1	2	3	4	5	6	7	8	9	10
1 – Z-BMI Percentile	-									
2 – Intrinsic Motivations	.053	-								
3 – Extrinsic Motivations	.065	.664*	-							
4 – IMI for PA - Enjoyment	.028	.793*	.449*	-						
5 – MPAM Social Subscale	.107	.678*	.444*	.294*	-					
6 – MPAM Appearance Subscale	.088	.438*	.865*	.225*	.423*	-				
7 – MPAM Competence Subscale	-.007	.833*	.622*	.569*	.296*	.355*	-			
8 – MPAM Fitness/Health Subscale	.021	.706*	.843*	.554*	.331*	.459*	.720*	-		
9 – MVPA	.201*	.171*	.287*	.118	.170*	.276*	.111	.212*	-	
10 – Internalizing Problems	-.104	-.201*	.018	-.242*	-.048	.193*	-.176*	-.174*	-.070	-
<hr/>										
Mean										
Females	.698	3.658	3.127	3.94	3.425	2.688	3.609	3.565	33.564	3.465
Males	.667	3.829	3.508	4.10	3.524	3.161	3.864	3.855	59.060	3.277
Total	.685	3.730	3.287	4.01	3.466	2.887	3.716	3.687	44.251	3.365
Standard Deviation										
Females	.286	.750	1.006	.915	.845	1.168	1.151	1.205	18.156	.966
Males	.300	.722	.944	.815	1.042	1.215	.955	.985	30.906	.937
Total	.291	.741	.996	.875	.931	1.207	1.077	1.124	27.329	.959

Table 3.2 Hierarchical Linear Regression Models Predicting Internalizing Problems from Broader Intrinsic and Extrinsic Motivation Subscales

Coefficients					
Variable	<i>B</i>	<i>SE(B)</i>	β	<i>t</i>	<i>p</i>
<u>Model 1^a</u>					
Step 1					
-Gender	.210	.169	.109	1.246	.215
-Z-BMI	-.389	.260	-.118	-1.497	.136
-MVPA	-.002	.003	-.044	-0.497	.620
Step 2					
-Gender	.222	.162	.115	1.368	.173
-Z-BMI	-.409	.252	-.124	-1.627	.106
-MVPA	-.002	.003	-.070	-0.789	.431
-Intrinsic	-.497	.128	-.384	-3.866	.000
-Extrinsic	.311	.099	.323	3.146	.002
Step 3					
-Gender	.211	.161	.114	1.375	.171
-Z-BMI	-.438	.249	-.133	-1.760	.080
-MVPA	-.001	.003	-.042	-0.450	.653
-Intrinsic	-.556	.139	-.430	-3.992	.000
-Extrinsic	.364	.111	.378	3.278	.001
-IntrinsicXMVPA	-.011	.006	-.244	-2.033	.044
-ExtrinsicXMVPA	.003	.004	.081	0.642	.522

Table 3.3. Hierarchical Linear Regression Models predicting Internalizing Problems from Separate Intrinsic Motivations and Controlling for Extrinsic Motivations

Coefficients					
Variable	<i>B</i>	<i>SE(B)</i>	β	<i>t</i>	<i>p</i>
<u>Model 2</u>					
Step 1					
-Gender	.210	.169	.109	1.246	.215
-Z-BMI	-.389	.260	-.118	-1.497	.136
-MVPA	-.002	.003	-.044	-0.497	.620
Step 2					
-Gender	.200	.162	.103	1.235	.219
-Z-BMI	-.460	.253	-.140	-1.821	.070
-MVPA	-.003	.003	-.088	-0.988	.325
-IMIEnjoyment	-.256	.100	-.234	-2.559	.011
-MPAMCompetence	-.191	.093	-.214	-2.053	.042
-MPAMSocial	-.024	.086	-.023	-0.279	.780
-Extrinsic	.309	.101	.321	3.061	.003
Step 3					
-Gender	.195	.159	.101	1.221	.224
-Z-BMI	-.484	.249	-.147	-1.943	.054
-MVPA	-.002	.003	-.049	-0.550	.583
-IMIEnjoyment	-.311	.104	-.284	-2.993	.003
-MPAMCompetence	-.204	.092	-.229	-2.222	.028
-MPAMSocial	.005	.087	.005	0.063	.950
-Extrinsic	.338	.100	.351	3.376	.001
-EnjoymentXMVPA	-.009	.004	-.204	-1.994	.048
-CompetenceXMVPA	-.001	.003	-.039	-0.464	.643
-SocialXMVPA	.001	.003	.000	0.003	.997

Table 3.4. Hierarchical Linear Regression Models predicting Internalizing Problems from Separate Extrinsic Motivations and Controlling for Intrinsic Motivations

Coefficients					
Variable	<i>B</i>	<i>SE(B)</i>	β	<i>t</i>	<i>p</i>
<u>Model 3</u>					
Step 1					
-Gender	.210	.169	.109	1.246	.215
-Z-BMI	-.389	.260	-.118	-1.497	.136
-MVPA	-.002	.003	-.044	-0.497	.620
Step 2					
-Gender	.245	.155	.127	1.582	.116
-Z-BMI	-.493	.241	-.150	-2.046	.042
-MVPA	-.003	.003	-.086	-1.021	.309
-MPAMAppearance	.346	.066	-.435	5.200	.000
- MPAMFitness/Health	-.147	.088	-.172	-1.665	.098
-Intrinsic	-.301	.132	-.233	-2.288	.023
Step 3					
-Gender	.266	.154	.137	1.727	.086
-Z-BMI	-.502	.239	-.153	-2.102	.037
-MVPA	.001	.003	-.023	-0.261	.794
-MPAMApp	.335	.066	.422	5.069	.000
-MPAMFitHlth	-.206	.091	-.242	-2.226	.025
-Intrinsic	-.224	.135	-.173	-1.654	.100
-AppearanceXMVPA	-.002	.003	-.058	-.620	.536
-Fitness/HealthXMVPA	-.005	.003	-.135	-1.489	.138

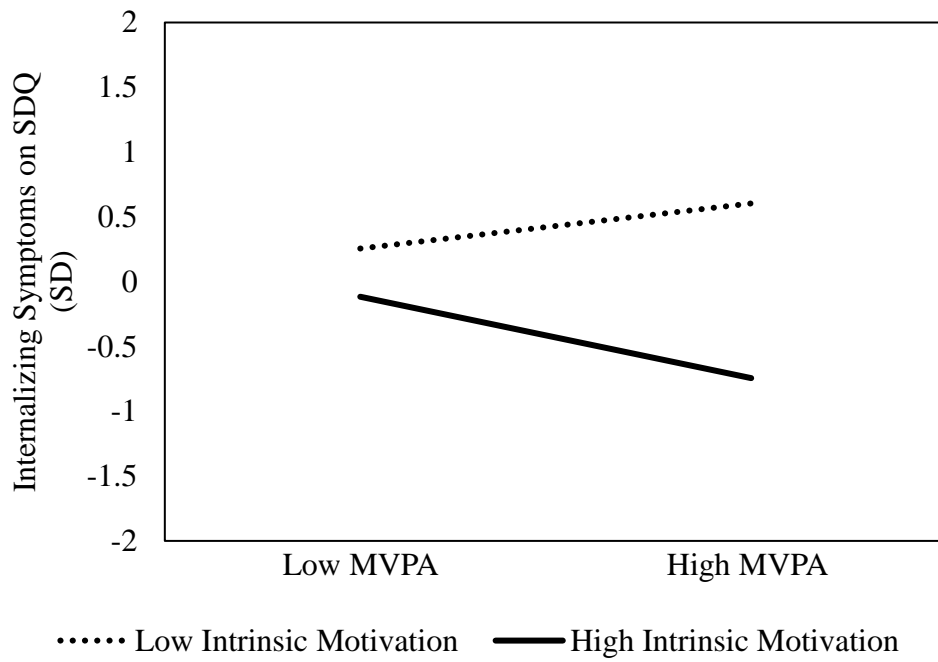


Figure 3.1 Internalizing Symptoms Predicted from MVPA Moderated by Intrinsic Motivations

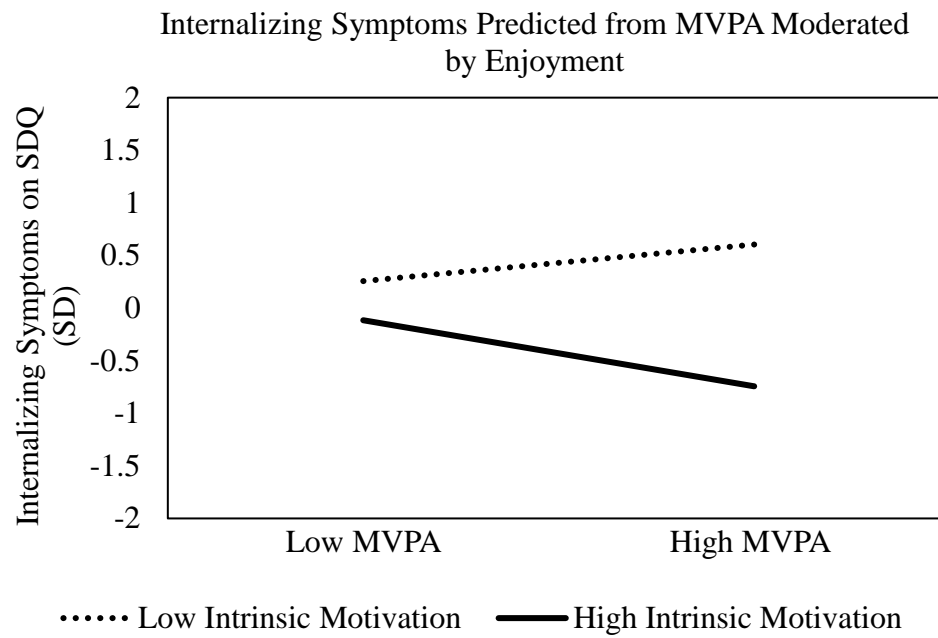


Figure 3.2 Internalizing Problems Predicted from MVPA Moderated by Enjoyment

CHAPTER 4

DISCUSSION

The current study set out to address inconsistencies found in the benefits of PA on youth internalizing problems during early adolescence by examining the critical role of youth exercise motivations. As one of the first studies to examine these relations within an underserved early adolescent sample, and employ a more rigorous measure of MVPA (using omni-directional accelerometers), we first set out to examine the direct effect of MVPA on internalizing symptomology. Our finding indicated that MVPA, measured by omni-directional accelerometers, was not a significant predictor of internalizing problems within our underserved early adolescent sample, after controlling for Z-BMI and gender.

Although a substantial evidence base supports the relation between PA and well-being in adults (e.g. Paluska & Schwenk, 2000; Richardson et al., 2005; Ussher et al., 2007), Szabo (2000) suggested that the underlying motivations for PA in relation to mental health are under-researched in adolescents. To address this gap, we used a SDT framework to assess intrinsic (enjoyment, competence, and social) and extrinsic (fitness/health and appearance) motivations for exercise. Drawing from previous research of adults and older adolescents, we hypothesized that extrinsic motivations would be associated with internalizing symptomology, where intrinsic motivations would be protective against internalizing problems (Frederick & Ryan, 1993; Sicilia et al. 2014). However, neither motivations nor MVPA act in isolation on youth mental health, but

rather the interaction between youth activity and motivations for this activity are likely to matter in whether PA is protective or even potentially detrimental on youth internalizing symptomology (Szabo, 2000). Therefore, as another primary aim of the study we examined how motivations moderated the relation between MVPA and internalizing problems in an underserved sample of early adolescents. Unique to our study, we not only examined these moderating relations using composite variables of intrinsic and extrinsic motivations, but followed with an additional set of analyses that assessed the effects of each of the five separate motivation subscales in order to gain a more nuanced understanding of the relations between motivations, MVPA, and internalizing symptomology.

Main effects of both intrinsic and extrinsic motivations on internalizing problems were in the expected direction: intrinsic motivations predicted fewer amounts of internalizing problems where extrinsic motivations predicted higher amounts. In a separate set of models that examined the unique contributions of each of the intrinsic and extrinsic subscales, enjoyment and competence motivations for PA were found to be particularly protective against internalizing problems, but social motivations for PA were not a significant predictor. Ryan and Deci (2000) posited that activities which support autonomy while promoting competence are more likely to facilitate enjoyment and therefore intrinsic motivation. They also state that humans have an inherent need for relatedness which, although not necessary for intrinsic motivation, can provide an environment in which intrinsic motivation is more likely to flourish. In our study, the notion that relatedness is more distal from these other constructs was supported as there was only a weak correlation between the Social Motivations Subscale with both the

Competence and Enjoyment Motivations Subscales ($r = .294$ and $r = .296$ respectively; see Table 3.2), but a moderate correlation between the latter of these two motivational subscales ($r = .569$; see Table 3.1).

Research suggests that adolescents are particularly sensitive to social stimuli and this phenomenon helps to explain the rapid increase in internalizing disorders during the adolescent years (Nelson, Leibenluft, McClure, & Pine, 2005). Given the types of PA typically offered in after-school programs, many youth in the study may have experienced social rejection during engagement in PA due to the nature of many activities being highly competitive. These types of PA opportunities may lead those with social motivational orientations to face peer rejection, teasing, or exclusion. These experiences may have led some who endorsed having social motivations for PA to also endorse higher amounts of internalizing problems (Nelson, Leibenluft, McClure, & Pine, 2005). This phenomenon may have washed out the positive effects of having intrinsically-driven social motivations for PA. Another speculation is that social motivations (e.g., engage in PA for positive experiences with peers) may be more tightly integrated with extrinsic motivations during early adolescence. The moderately high correlations between the Social Motivations subscale and both the Appearance ($r = .423$ see table 3.1) and Fitness/Health Subscales ($r = .331$) in the current study support this assertion, and suggests that there may be some more nuanced externalized components of the social motivations construct that we are not able to identify with the measurement used in this study. There is some literature which suggests there are differential categorizations of social motivations (e.g. Allen, 2003 which we did not assess for in the current study. For example, measures such as the Social Motivational Orientations in

Sport Scale (SMOSS; Allen, 2005) have been designed to differentiate between more intrinsic forms of social motivations (e.g. to facilitate the development of close social bonds) and extrinsic forms of social motivations (e.g. to establish or enhance one's social standing in a group context). In a study examining the validity of Allen's Social Motivational Orientation to Sport Scale (2005) among a similar sample of underserved early adolescents, Roberts et al. (under review) found that affiliation orientations towards PA (similar to the social subscale of MPAM) was intricately intertwined with youth recognition orientation for PA (e.g., receiving praise from friends) at this age (combined as one factor). Thus, perhaps part of building connection with youth through PA includes receiving the more extrinsic feedback of acceptance and praise by them through sport.

Among extrinsic subscales, only appearance motivations positively predicted internalizing problems. Although there was no relation between fitness/health motivations and internalizing problem in the second step of the extrinsic motivations model (i.e. where we tested for main effects of motivations), there was a main effect for fitness/health motivations whereby these motivations negatively predicted internalizing problems after entering the interactions between the different motivation scales with PA into the model. Previous literature (Frederick & Ryan, 1993) has shown that fitness/health motivations were predictive of higher amounts of anxiety and depression in an adult population. These researchers suggested that fitness/health motivations were closely tied with appearance motivations. In assessing the content of items on the MPAM-R, some items such as "I exercise because I want to be more physically fit" may coincide with appearance motivations and demonstrate more extrinsic motivations, but other items such as "I exercise because I want to maintain well-being" may represent

motivations which are more internalized (i.e. identified regulations as opposed to introjected regulations). Research suggests that adults' body image satisfaction is increasingly related to/associated with the competence or functionality of their bodies' as they age (Reboussin et al., 2000). Although fitness/health and appearance motivations may be interwoven in adults, our findings suggest that youth may not relate body image to physical health as strongly as adults and that fitness/health motivations may be classified as more intrinsic on the continuum (e.g. identified regulations) in this population. The high correlation between fitness/health motivations and intrinsic motivations ($r = .706$) supports this assertion.

In assessing motivations as moderators of MVPA and internalizing problems, the interaction between intrinsic motivations and MVPA was significant. As predicted, it appeared that MVPA was protective against internalizing problems when intrinsic motivations were high but was iatrogenic when intrinsic motivations were low as these individuals (i.e. those who engaged in high amounts of MVPA and had low intrinsic motivations for PA) appeared to have the most internalizing symptomology of any subgroup of youth. Our findings also suggest that even youth with lower rates of MVPA reported less internalizing symptomology when they were more intrinsically motivated for PA as opposed those who were less intrinsically motivated.

When breaking this down into separate motivations subscales in the subsequent models of our exploratory analyses, the interaction between MVPA and enjoyment motivations was significant. Similar to the findings for intrinsic motivations, a small difference in internalizing symptomology was observed when adolescents engaged in lower amounts of MVPA (i.e. slightly more internalizing symptomology for those that

did not endorse having as much enjoyment-related motivations for PA), the plot of the interaction between enjoyment motivations and MVPA showed that engaging in more MVPA was protective against internalizing problems when adolescents endorsed having enjoyment motivational orientations towards PA. In contrast, findings indicate that engaging in greater amounts of MVPA may have iatrogenic effects when adolescents do not endorse having high enjoyment-related motivations for PA. This would suggest that it is particularly important to focus on targeting enjoyment when providing PA opportunities for underserved youth as this motivational orientation appears to be the most beneficial for mental health when coupled with PA. Even though there is literature which supports that extrinsic motivations may increase exercise adherence in some circumstances (e.g. Frederick & Ryan, 1993), it appears that having these motivations can have a detrimental effect on internalizing symptomology. Further, these findings suggest that having enjoyment-related motivations is slightly more beneficial for mental health even for low activity youth so there should be a focus on facilitating enjoyment-related and also competence motivations for PA, and steering youth away from appearance-based motivations for PA.

4.1 LIMITATIONS

The current study has multiple limitations. It is important to note that there were missing data in our sample and although we adhered to recommendations provided by Trumpeter and colleagues (2012) to account for this missing data, we acknowledge it is a limitation of the study. Further, the type of omni-directional accelerometer this study used (Actical) is likely to underestimate activity that is performed above the waist and during activities such as bicycling (Arredondo et al., 2016) it may not have fully captured

an accurate representation of their typical weekly PA profile in our sample. Although these methods have been established as a more objective assessment of PA than other forms of measurement (Sallis & Saelens, 2000) and validated in our sample (Puyua et al., 2004; Trumpeter et al., 2012), this should be taken into consideration when interpreting the null effects of MVPA on internalizing problems.

Interestingly, the composite scales used to represent intrinsic and extrinsic motivations were significantly correlated ($r = .664, p < .001$; see Table 3.1). Although this appears to be a limitation of our study, it may also suggest that individuals who are motivated to exercise have a broad motivational profile in which they garner motivation to exercise from various avenues which are both intrinsic and extrinsic. Future research should conduct pattern-centered analyses (e.g., latent profile analyses) to identify how motivations interact in unique ways and how this influences the relations between PA and internalizing problems. However, despite these relations between motivational orientations, when entered into the model together, the majority of the motivational subscales still contributed unique variance in explaining internalizing problems. Further, the positive relation between intrinsic and extrinsic motivations may have been driven primarily by fitness/health motivations which exhibited primarily intrinsic properties despite being utilized to form the composite Extrinsic Motivation Scale.

There are also limitations in the extent to which the study is generalizable being that the sample was primarily low income and African-American (73%). Being that this population is understudied and at particularly high risk for inactivity, obesity, and depression, the current study makes multiple critical and novel contributions to the literature as it relates to adolescents in this specific demographic. However,

interpretations of these findings should not be generalized broadly across other demographics. Additionally, this study was cross-sectional in nature and no causal inferences should be made until future research investigates these relations using a prospective approach.

4.2 IMPLICATIONS AND FUTURE DIRECTIONS

The current study has significant implications for both research and practice, and can be used to inform the design of PA interventions for promoting both physical and psychological health in underserved early adolescents. First, contrary to findings in previous research which shows a negative association between MVPA and internalizing symptomology in adults and older adolescents (e.g. Paluska & Schwenk, 2000; Richardson et al., 2005; Ussher et al., 2007), MVPA was not directly related to internalizing symptomology for our sample of underserved early adolescents. Rather, youth motivations for exercise were found to be a critical mechanism that directly influenced early adolescent psychological well-being, and at times, interacted with PA to result in either promotive or iatrogenic effects.

In particular, and in line with our primary hypotheses, PA interventions for underserved early adolescents should aim to foster competence and enjoyment motivations for PA, as these negatively predicted internalizing problems and the latter (i.e. enjoyment motivations) interacted with MVPA to enhance the impact of PA on mental health. In contrast, the current study showed that appearance motivational orientations to exercise may be particularly harmful as it was positively related to internalizing problems regardless of engagement in MVPA. Such findings warrant

significant attention in applied settings. Adolescence is a critical time period in the course of the development of eating disorders and other internalizing disorders (e.g. Fox, Page, Peters, Armstrong, & Kirby, 1994; Mueller et al., 1995; Tiggemann & Dyer, 1995; Pine, Cohen, Gurley, Brook, & Ma, 1998; Almeida et al., 2012). Although much of the research on body dissatisfaction focuses on white adolescent female populations and research suggests that there are some cultural and interpersonal variations in perceptions of ideal body type (Altabe, 2009), research investigating differences in body dissatisfaction across gender and ethnicities shows small effect sizes across different populations (Grabe & Hyde, 2006) and provides evidence that low SES African-Americans are also at-risk of developing body dissatisfaction (Paxton, Eisenberg, & Neumark-Sztainer, 2006). Consequently, the greater risk for overweight and obesity in these underserved populations (Ogden et al., 2012); Kumanyika & Grier, 2006) may also make them more likely to identify with extrinsic PA motivations (Gillson, Standage, & Skevington, 2006) which are shown here to be particularly detrimental to mental health.

Although fitness/health motivations have been previously classified as an extrinsic motivation in the literature (e.g. Ryan & Frederick, 1997), in our analyses, which assessed these motivations separately from appearance-related motivations, fitness/health motivations accounted for some of the variance explained by the intrinsic motivations composite scale (see Table 4). As described above, there is some evidence to suggest that fitness/health motivations may be categorized more intrinsically (i.e. identified regulations as opposed to introjected regulations) in youth than in adults (Reboussin et al., 2000). Findings suggest that promoting fitness or health motivations may be another positive approach to supporting youth psychological health and increased

PA. More research is needed to gain a more thorough understanding of how fitness/health motivations for PA function in an SDT framework in underserved adolescent populations.

Further, among highly active youth, our findings suggest that PA may only protect against internalizing problems when enjoyment motivations are high but may be iatrogenic when these motivations are low. It may be the case that those who do not endorse enjoyment motivations for PA may feel as though the activity in which they engage in PA is a burden to them. Most PA opportunities for youth involve participation in an organized sport and there is literature which suggests that stress, burnout, or parental pressure can all undermine enjoyment (Smith, 1986; Coakley, 1992). Another possibility is that some of those who endorse having less enjoyment-related motivation for PA, but yet are highly active, may be engaging in PA for reasons related to body dissatisfaction and appearance, or another maladaptive motivational orientation that has not been identified in previous theory or research. Future work can be done to assess the mechanism which is driving this finding.

Our study also suggests there is a need for a more nuanced approach when investigated social motivations for PA in underserved early adolescents. Although this motivational orientation relates closely with one of the three inherent needs in SDT (i.e. relatedness), social motivations for PA were not predictive of internalizing problems in our study. Research shows that social bonding is closely tied with one's experience of enjoyment in a given activity (Wankel, 1993) so these findings were surprising. This suggests it may be important to explore a broader spectrum of social motivational orientations using measures such as the SMOSS (Allen, 2003; Allen, 2005) which can

tease apart the nuances of this construct and help gain a better understanding of how social motivational orientations may contribute to our findings. There is support in the literature that the facilitation of a more socially-supportive climate for PA could increase exercise adherence which may be beneficial for youths' mental health as well (Lawman, Wilson, Van Horn, & Zarrett, 2012). A path-centered analysis can more effectively assess trajectories of different sub-groups of youth and could help to differentiate outcomes for these individuals.

4.3 CONCLUSION

The results of the current study provide preliminary evidence to suggest that the inconsistent effects of PA on internalizing problems seen in the literature may be due in part to the moderating effects of motivations to exercise. Specifically, we found that PA is only related to fewer internalizing problems when intrinsic motivations are high and may actually be iatrogenic when intrinsic motivations are low in a sample of underserved early adolescents. Given the increased interest in the development of PA interventions to address the high obesity rates specifically in this population, the findings in the study can be used to guide the development of interventions targeting individuals during the critical early adolescent years. Further, the findings of the current study provide evidence to suggest the importance of assessing and adjusting adolescents' motivations to exercise given the significant relations between motivations to exercise and internalizing problems. Future studies should assess the effects of motivations, particularly social motivations, using prospective designs and path-centered approaches across broader populations that can expand on these findings and identify the long-term effects of different motivational profiles.

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APPENDIX A: MEASURES

Motives for Physical Activity Measure Revised (MPAM-R)

1 = Very False 2 = False much of the time 3 = Somewhat true
4 = True much of the time 5 = Very true

When I am active...

Competence Subscale

1. ...it is because I like engaging in activities which physically challenge me.

1 2 3 4 5

2. ...it is because I want to gain new skills.

1 2 3 4 5

3. ...it is because I want to improve existing skills.

1 2 3 4 5

4. ...it is because I like the challenge.

1 2 3 4 5

5. ...it is because I want to maintain my current skill level.

1 2 3 4 5

6. ...it is because I like activities which are physically challenging.

1 2 3 4 5

7. ...it is because I want to get better at my activity.

1 2 3 4 5

Social Subscale

1. ...it is because I want to be with my friends.

1 2 3 4 5

2. ...it is because I like to be with others who are also interested in the activity.

1 2 3 4 5

3. ...it is because I want to meet new people.

1 2 3 4 5

4. ...it is because my friends want me to participate.

1 2 3 4 5

5. ...it is because I enjoy spending time with others doing this activity.

1 2 3 4 5

Fitness/Health Subscale

1. ...it is because I want to be physically fit.

1 2 3 4 5

2. ...it is because I want to have more energy.

1 2 3 4 5

3. ...it is because I want to improve my cardiovascular fitness.

1 2 3 4 5

4. ...it is because I want to maintain my physical strength to live a healthy life.

1 2 3 4 5

5. ...it is because I want to maintain my physical health and well-being.

1 2 3 4 5

Appearance Subscale

1. ...it is because I want to lose or maintain weight so that I look better.

1 2 3 4 5

2. ...it is because I want to define my muscles so I look better.

1 2 3 4 5

3. ...it is because I want to be attractive to others.

1 2 3 4 5

4. ...it is because I want to improve my body shape.

1 2 3 4 5

5. ...it be because I feel physically unattractive if I don't.

1 2 3 4 5

Intrinsic Motivation Inventory (IMI) for Physical Activity

1 = Very False

2 = Mostly False

3 = Somewhat true

4 = Mostly True

5 = Very true

Please choose how much the following statements are true for you.

- | | | | | | |
|---|---|---|---|---|---|
| 1. When I am active I enjoy it. | 1 | 2 | 3 | 4 | 5 |
| 2. When I am active I find it fun. | 1 | 2 | 3 | 4 | 5 |
| 3. When I am active it gives me energy. | 1 | 2 | 3 | 4 | 5 |
| 4. When I am active it's very pleasant. | 1 | 2 | 3 | 4 | 5 |
| 5. When I am active my body feels good. | 1 | 2 | 3 | 4 | 5 |
| 6. When I am active I get something out of it. | 1 | 2 | 3 | 4 | 5 |
| 7. When I am active it is exciting. | 1 | 2 | 3 | 4 | 5 |
| 8. When I am active it gives me a feeling of success. | 1 | 2 | 3 | 4 | 5 |
| 9. When I am active it feels good. | 1 | 2 | 3 | 4 | 5 |
| 10. I am active because I enjoy it. | 1 | 2 | 3 | 4 | 5 |
| 11. I am active because it is fun. | 1 | 2 | 3 | 4 | 5 |

Strengths and Difficulties Questionnaire (SDQ)

1 = Not true 2 = Somewhat true 3 = Certainly true 0=Not comfortable
answering

Please choose which is the most correct statement about you.

Emotional Problems Subscale

- | | | | | |
|--|---|---|---|---|
| 1. I get a lot of headaches, stomachaches, or sickness. | 1 | 2 | 3 | 0 |
| 2. I worry a lot. | 1 | 2 | 3 | 0 |
| 3. I am often unhappy, depressed, or tearful. | 1 | 2 | 3 | 0 |
| 4. I am nervous in new situations. I easily lose confidence. | 1 | 2 | 3 | 0 |
| 5. I have many fears, I am easily scared. | 1 | 2 | 3 | 0 |

Peer Problems Subscale

- | | | | | |
|--|---|---|---|---|
| 1. I would rather be alone than with people my age. | 1 | 2 | 3 | 0 |
| 2. I have one good friend or more. | 1 | 2 | 3 | 0 |
| 3. Other people my age generally like me. | 1 | 2 | 3 | 0 |
| 4. Other children or young people pick on me or bully me. | 1 | 2 | 3 | 0 |
| 5. I get along better with adults than with people my own age. | 1 | 2 | 3 | 0 |