

Spring 2019

# Examining Non-Targeted Effects of the Connect Through Play Project: Implications for Addressing Mental Health of Underserved Middle School Youth

Jessica Dandan

Follow this and additional works at: <https://scholarcommons.sc.edu/etd>



Part of the [Clinical Psychology Commons](#)

---

## Recommended Citation

Dandan, J.(2019). *Examining Non-Targeted Effects of the Connect Through Play Project: Implications for Addressing Mental Health of Underserved Middle School Youth*. (Master's thesis). Retrieved from <https://scholarcommons.sc.edu/etd/5244>

This Open Access Thesis is brought to you by Scholar Commons. It has been accepted for inclusion in Theses and Dissertations by an authorized administrator of Scholar Commons. For more information, please contact [dillarda@mailbox.sc.edu](mailto:dillarda@mailbox.sc.edu).

Examining Non-targeted Effects of the Connect Through PLAY Project: Implications for  
Addressing Mental Health of Underserved Middle School Youth

by

Jessica Dandan

Bachelor of Arts  
American University of Beirut, 2008

---

Submitted in Partial Fulfillment of the Requirements

For the Degree of Master of Arts in

Clinical Community Psychology

College of Arts and Sciences

University of South Carolina

2019

Accepted by:

Nicole Zarrett, Director of Thesis

Bret Kloos, Reader

Cheryl L. Addy, Vice Provost and Dean of the Graduate School

© Copyright by Jessica Dandan, 2019  
All Rights Reserved.

## Acknowledgements

Firstly, I would like to sincerely thank Dr. Nicole Zarrett, my thesis advisor, and Dr. Mark Weist for jointly giving me the opportunity to join the Clinical-Community Doctoral Program. Throughout this academic endeavor, Dr. Zarrett's pertinent feedback, guidance and data resources have been instrumental in completing this project. I would also like to thank Dr. Bret Kloos for his leadership and counsel and Dr. Amanda Fairchild for her help with statistical knowledge and collegial support.

As an incoming international student, I am also very thankful to Melek Yildiz Spinel, Rebeca Castellanos and Kinjal Pandya for helping me integrate into the program. To Vicki Lewter and Heather Gomes, I could not have been welcomed any better!

Last but not least, I am very grateful to my mother's cousin Paul Raad, who through a serendipitous conversation in very unusual circumstances, encouraged me to consider applying to the University of South Carolina to pursue my graduate studies. This journey couldn't have started without him! I also want to thank Paul, his wife Cathy and their children; Paul's sister Dolly Awkar and her family; and, his friend Elie Herro and his family, for their gracious hospitality and support in helping with my transition to the United States. To my dearest cousin Dr. Elias Feghali, I am lucky to have had such a brilliant mind accompany my growth through all these years. To my parents and brothers and to all my family across the continents, thank you for your support, phone calls and video calls, I wouldn't be here without you!

## Abstract

Early adolescence is a developmental phase accompanied by several changes occurring in various biopsychosocial domains, associated with an increased vulnerability to mental and physical health problems. Youth of minority status and/or low socio-economic status have been shown to be more susceptible, as they are more likely to incur greater exposure to stressors accordingly. Coincidentally, as psychological problems emerge such as internalizing disorders, physical activity engagement declines; those trends seem to persist into adulthood and have been associated with numerous negative health outcomes. Evidence points to the direct impact of physical activity, as well as, social variables such as social support and climate, on decreasing internalizing symptoms. However, there is a dearth of empirical studies particularly measuring both physical activity and social variables simultaneously within after-school based interventions in adolescent populations, specifically of minority and low socio-economic status. This study aimed to examine non-targeted effects of Connect Through P.L.A.Y., an after school based randomized controlled feasibility trial designed to increase physical activity engagement by positively impacting social and motivational factors identified to be conducive for physical activity. The current study tested the Connect Through P.L.A.Y. intervention effects on internalizing symptoms on a sample of underserved adolescents ( $N = 138$ ,  $M$  age = 12.18 years; 55% female and 74% African-American). Five subsequent regression analyses were performed to investigate

underlying mechanisms potentially contributing to intervention effects. Four additional regression models were carried out to explore interaction effects of the change in each social factor with change in physical activity in predicting change in internalizing features. Results indicated that participants in the intervention condition experienced a significant decrease in internalizing symptoms post-intervention. Analyses examining main effects of changes in physical activity, and social factors including social support for physical activity, peer climate, observed positive peer interactions and observed inclusive climate were not found to singularly predict change in internalizing symptoms. Although this finding needs to be interpreted with caution, only one interaction model was supported. Change in observed inclusive climate interacted with change in physical activity to predict change in internalizing symptoms; participants who were engaged in more than average moderate-to-vigorous physical activity and experienced a positive change in inclusive climate seemed to have experienced a more significant decrease in internalizing symptoms than others. Hence, further research is needed to identify mechanisms within interventions, which most strongly contribute to wellbeing in underserved minority adolescent populations, in order to provide more cost-effective after-school programs.

## Table of Contents

Acknowledgements.....	iii
Abstract.....	iv
List of Tables .....	vii
List of Abbreviations .....	viii
Chapter 1 Introduction .....	1
Chapter 2 Background and Significance .....	5
Chapter 3 Method.....	21
Chapter 4 Results .....	35
Chapter 5 Discussion.....	41
References .....	58
Appendix A: Measures .....	78

## List of Tables

Table 4.1 Sample Demographics by Site .....	37
Table 4.2 T-tests for Equality of Means of Study Variables by Group at Baseline .....	37
Table 4.3 T-tests for Equality of Means of Study Variables by Gender at Baseline .....	38
Table 4.4 One-Way Analyses of Variance of Study Variables by BMI.....	38
Table 4.5 One-Way Analysis of Variance of Intervention Components on Change in Scores of the Strengths and Difficulties Questionnaire ( $\Delta$ SDQ), controlling for school and biological sex.....	39
Table 4.6 Interaction Between Change in Inclusive Climate and Change in Moderate-to-vigorous Physical Activity on Post-Intervention SDQ .....	39

## List of Abbreviations

IC .....	Inclusive Climate
MVPA .....	Moderate-to-vigorous Physical Activity
PC .....	Positive Peer Climate
PP .....	Positive Peer Interactions
SDQ.....	Strengths and Difficulties Questionnaire
SS.....	Social Support

## **Chapter 1**

### **Introduction**

Early adolescence has repeatedly been identified as a critical period of development as maturing youth are faced with simultaneous changes in several domains including: biological, psychological, social and environmental. Neurophysiological plasticity allows for these astounding adjustments to take place but this phase of notable malleability also means an increased propensity for vulnerability; increasing the risk for psychological (e.g. depression, anxiety, suicide) and physical (e.g. obesity, diabetes) problems. Underserved populations such as African Americans were found to incur the highest risks; while teenage girls, have also been shown to be more susceptible (Anderson & Mayes, 2010; Van Voorhees et al., 2008). Consequently, there have been many efforts over the years to understand mechanisms involved in youth physical and psychosocial risk in order to guide evidenced-based interventions. Studies investigating health behaviors and associated outcomes have found that health behaviors tend to cluster; and based on the problem behavior theory, are believed to be driven by underlying social and psychological aspects (O'Connor, Dolphin, Fitzgerald, & Dooley, 2016). This clustering phenomena has been hypothesized to be behind the positive ripple effects observed to result from interventions primarily geared towards behavioral change (Wilson, 2015). Substantial evidence points to addressing behavioral and social factors as a cost-effective approach to improve mental and physical health

outcomes. As a result, further research on non-targeted effects necessitates further attention.

During adolescence, concerning trajectories pertaining to mental and physical health have been observed to emerge, and when they do they appear to be likely to continue in a similar track into adulthood. The incidence of affective and anxiety related difficulties has been found to rise dramatically as individuals enter puberty (Nelson, Leibenluft, McClure & Pine, 2005) and strong evidence points to the homotypic continuity and equifinality of internalizing psychopathological pathways (Costello & Maughan, 2015). Morbidity and mortality rates increase by about two hundred percent during this phase and the culprits contributing to this escalation mainly include depression, suicide, substance use, health related risky behavior, and accidents (Dahl, 2004).

Similarly, during adolescence negative changes in health choices such as eating habits and physical activity engagement contribute to increased rates of overweight/obesity and related disease during this period and continued health problems into adulthood (Currie et. al, 2009). From a global perspective, American youth have been found to be the least active and to have one of the highest prevalence rates of obesity comprising more than one third of the adolescent population (Lobstein et al, 2015). Overweight and obese adolescents are at higher risks for experiencing both physical and mental health problems. Health problems associated with adolescent obesity include glucose intolerance, hypertension, coronary atherosclerosis, fatty liver, sleep apnea, joint problems, gastric reflux and asthma (Bassett, John, Conger, Fitzhugh

& Coe, 2015). In turn, obese weight status situates youth at greater risk for developing mental health problems; with the risk for internalizing disorders almost doubled for obese adolescents (Halfon, Larson & Slusser, 2013). The reverse is also true with internalizing disorders, which are found to be associated with later obesity, with odds ratios varying between 1.30 and 4.62 (Liem, Sauer, Oldehinkel & Stolk, 2008). Over time, having comorbid physical and mental illnesses has been associated with increased emotional problems, somatic complaints and significant functional impairment (Chavira, Garland, Daley & Hough, 2008). Despite the observed differences in the sequence through which mental and physical health issues unfold, ample evidence exists pointing to the tendency for youth mental and physical health to be tightly clustered.

These alarming trends have spurred research focused on identifying factors associated with overall positive youth development and wellbeing, as well as, risk factors contributing to poor mental and physical health. Low socio-economic status, minority status and belonging to underserved populations have been associated with an increased risk to developing psychological difficulties (Bradley & Corwyn, 2002; Chou, Asnaani & Hofmann, 2012; Dumont & Provost, 1999). Meanwhile, physical activity as well as positive social experiences such as social support (Klasen et al., 2015) and contexts that support a positive peer climate (Hogue, Fry & Fry, 2017) have been proposed to be protective factors against developing psychological problems (Dumont & Provost, 1999; Peer, 2006). High levels of physical activity and social support in adolescence have been particularly shown to play a protective role against the development of internalizing disorders such as depression and its persistence into

adulthood (Colman et al., 2014). However, a recent review conducted by Biddle, Ciaccioni, Thomad and Vergeer (2018) reported mixed evidence of the positive effect of physical activity on mental health, underlining weak intervention effects and noticeably poor quality of studies available; indicating the dire need for further intervention based research.

Overall, adolescence is a key period where efforts should be invested to assist positive youth development and provide support, guidance, preventative measures and interventions where necessary. One of those areas where efforts have been found to show promise in promoting positive youth development are after school programs (Durlak & Weissberg, 2007; Zarrett & Eccles, 2006; Zarrett et al., 2015). Furthermore, evidence also shows that such programs are particularly beneficial in the case of underserved populations (Little, Wimer, & Weiss, 2008). Having access to resources, engaging in structured activities, being under adult supervision and being exposed to opportunities for positive learning and experiences were shown to play an important role among disadvantaged populations. In addition, while many available community resources have been found to be underutilized, programs carried out in school settings also appears to facilitate outreach (Reisner et al., 2007). The aim of this study is to investigate changes in youth mental health, as a non-targeted effect of an after school program intervention designed to increase physical activity in middle school youth through improvements in the social climate.

## **Chapter 2**

### **Background and Significance**

#### **2.1 Defining Internalizing Disorders**

The terms internalizing and externalizing have been used to describe certain psychopathologies since the late 1970's to aid in the differentiation of disorders which display internal conflicts as opposed to those which are associated with more overt behaviors (Achenbach, 1978; Cicchetti & Toth, 1991). More recently, statistical modeling procedures have been utilized to empirically assess common diagnoses described in the Diagnostic and Statistical Manual of Mental Disorders (DSM). Wright, Krueger, Hobbs, Markon, Eaton and Slade (2013), identified two latent constructs that aligned with previous conceptualizations; an internalizing dimension and an externalizing dimension. Both dimensions were found to be robust across several variables including gender, ethnicity, culture, informant type, and subsume multiple distinct disorders. Internalizing disorders include unipolar mood disorders (depression, dysthymia), anxiety disorders (generalized anxiety, panic, social anxiety and phobic disorders), as well as somatoform disorder (Wright et al., 2013; Liu, Chen & Lewis, 2011; Achenbach, 1978). Although the terms are typically used to define classes of disorders, they can also be used to describe symptoms where subclinical thresholds hold true. Addressing the early emergence of signs can hamper the progression of those symptoms into a clinical disorder. Furthermore, even if internalizing symptoms do not progress into a clinical disorder,

evidence supports that they pose a high risk for continued maladaptation in the future (Cicchetti & Toth, 1991; Durlak & Wells, 1997). In a recent review, Costello and Maughan (2015) found that at least 50% of adolescents who suffered from an internalizing disorder will also suffer from the same disorder in adulthood. Nonetheless, of those who do not continue to suffer from recurring episodes of psychological illness, 50% of them have been shown to face notable difficulties related to their work, health, relationships and tendency for criminal activity. In a 40-year longitudinal study on a sample of 3,279 adolescents, Coleman, Wadsworth, Croudace and Jones (2007), found that compared to mentally healthy adolescents, 70% of those who suffered from an internalizing disorder in adolescence had a mental disorder in adulthood as opposed to 25%. The emergence of those trends, continuation and impact on quality of life even in the absence of a current disorder, provide a strong rationale to better understand underlying mechanism and ways to positively deviate those trends.

While both internalizing and externalizing symptoms are common in adolescence, internalizing disorders are less likely to be identified in the youth. One proposed explanation is that internalizing problems are less disruptive to others including parents and teachers, and are characterized by internal states as opposed to observable overt behavior. Furthermore, it has been demonstrated that even in the case of diagnosis; they are less likely to be treated (Wu et al., 1999). In addition to causing interferences in the academic arena, internalizing disorders have been empirically associated with poor physical health as well as several chronic health problems (Van de

Pavert, Sunderland, Luijten, Slade & Teesson, 2017). For all of these reasons, special attention needs to be paid to the apparition of internalizing problems.

Over the recent years, the incidence of internalizing disorders in adolescence has dramatically increased. The 12-month prevalence of depression in adolescents grew from 8.7% in 2005 to 11.3% in 2014 (Mojtabai, Olfson & Han, 2016). This was accompanied by a 12% increase in suicide related outcomes and a 31% increase in deaths by suicide. Yet, it is important to highlight that the increased rates result from the more severe trends outlined in teenage girls. Between 2009 and 2015, there was a staggering 58% increase in depressive symptoms, 14% increase in suicide related outcome and a 65% in suicide rates. Those substantial shifts in yearly rates have been reckoned as rare over such short periods of time and to be more than two times larger than previously found (Twenge, Joiner, Rogers & Martin, 2018). Meanwhile, lifetime anxiety symptoms in teenagers have also accrued from 5.4% in 2003 to 8.4% in 2012; girls were also more vulnerable with a ratio of 2:1 (Bitsko et al., 2018). Concerning demographics, studies have highlighted that higher rates of incidence of internalizing disorders exist in specific populations such as: Native American, Latino American, Asian American and African American adolescents (Anderson & Mayes, 2010). Low socio-economic status was also associated with earlier onset of depressive symptoms and in some studies appeared to be a variable more strongly associated with internalizing disorders compared to race (Twenge et al., 2018; Van Voorhees et al., 2008; Anderson & Mayes, 2010).

## 2.2 Middle School Years as a Critical Period of Development

Although development occurs throughout the lifespan, when considering windows of opportunity to influence developmental pathways associated with biopsychosocial changes and impact on behavior, adolescence has been shown to be particularly important. From a biological perspective, the prefrontal cortex undergoes slow iterative alterations throughout the adolescent period while significant and more rapid changes are also occurring on the hormonal level. This necessitates some degree of adjustment including bodily transformations. Consistent evidence points to neuroendocrine adaptations influencing stress reactions; where, both the hypothalamic pituitary adrenocortical axis and autonomic nervous system stress responses increase during adolescence. While boys appeared to have a more stable increase in the stress response, post-pubertal girls demonstrated a higher sensitivity to peer rejection compared to performance related stress (Stroud, Papandonatos, D'Angelo, Brush & Lloyd-Richardson, 2017). The heightened sensitivity to socially related events has also been explored from a neuroanatomical perspective. Nelson et al. (2005) describe the functional and anatomical reorganization that takes place during puberty in the regions that make up the affective node. This node is densely innervated by gonadal steroid receptors, indicating its potential for resulting intensified emotional responsiveness to social stimuli, and socially related events accordingly. One of the proposed consequences of dysregulation of this region, one part of what Nelson et al refers to as the “social information processing network”, is the triggering of mood and anxiety disorders during this period (Nelson et al., 2005). This heightened emotional potency

contributes to amplified sensitivity to negative interpersonal events. There has been ample support for these relations, with rejection by peers or romantic partners found to be strongly associated with behavioral and psychological difficulties during the adolescent period (Gould, Greenberg, Velting, & Shaffer, 2003). Simultaneously, this is a time when familial and parental relationships become less prominent and relationship with peers gains significance (Steinberg, 2001). The major impact of social experiences on youth physical activity has also been noted. Studies exploring social factors related to physical activity engagement have demonstrated that decreased social support from friends was more strongly associated to decreases in activity compared to declines in parental support (Dishman, Dowda, McIver, Saunders & Pate, 2017). Striking declines in physical activity during adolescence has repeatedly been demonstrated in the literature and become a primary health concern (Dumith, 2011). However, declines appear to also be more strongly related to pubertal phase compared to chronological age (Metcalf, Hosking, Jeffery, Henley & Wilkin, 2015). While overall engagement starts to diminish around age 12 and it appears to begin slightly earlier and at a more rapid pace in girls (Caspersen et al., 2000; Duncan 2007). As a result, focusing on social interactions during puberty gains importance.

Furthermore, the majority of youth within the U.S. also transition from elementary school into middle school around this period. The supplementary stress incurred cannot be overlooked as it presents them with notable challenges pertaining to expectations, priorities, teaching approach, social climate, romantic relationships and in some cases moving to a new establishment (Rudolph, Lambert, Clark, & Kurlakowsky,

2001). Dishman et al. (2017) compared groups of boys and girls who maintained physical activity with adolescents whose activity lessened and explored associated factors. Their results showed that those who had become less active reported feeling that their priorities had changed resulting from the academic demands, had felt pressured by others to be physically active and more importantly to perform at a certain level and feeling discouraged by supervising adults. Some even articulated discontinuing certain activities they enjoyed because of perceived lack of competence expressed by others (Bélanger et al., 2011). In other words, the social climate surrounding adolescents is another significant influential variable on physical activity engagement.

### **2.3 Role of Physical Activity, Social Support, Positive Peer Relationships and Climate on Mental Health**

Consistent findings have been demonstrated in the literature highlighting the positive impact of physical activity on several physical and mental health outcomes (Penedo & Dahn, 2005). Among those outcomes, physical activity and sports participation were particularly found to be independently negatively correlated with internalizing disorders (McMahon et al. 2017; Zarrett et al., 2009). Numerous studies have shown direct effects of physical activity on both physical and mental health as outlined in a review conducted by Strong et al. (2005). While most effects of physical activity on depression have been found to be moderate in strength, the available evidence indicates that effects were more robust in groups that displayed clinical levels of depression (Bailey, Hetrick, Rosenbaum, Purcell & Parker, 2018; Biddle et al., 2018). Lubans et al., (2016) conducted a systematic review in order to propose a conceptual

model of the mechanisms that had been put forth in the literature explaining the effect of physical activity in the youth on cognitive and mental health. Three main hypotheses were derived: 1) neurobiological, 2) psychosocial and 3) behavioral. Studies investigating possible neurophysiological mechanisms through which physical activity alleviates internalizing features have gathered evidence in support of several hypotheses including the: endocannabinoid, monoamine, epigenetic, neuroplasticity, prefrontal lateralization, thermogenic and homeostatic hypotheses (Chan et al., 2018 and Motta, 2018). Another interesting finding to mention is that studies investigating the effects of physical activity on internalizing disorder have found notable variability depending on the mode of physical activity; however, most studies included aerobic types of exercise (Bailey et al., 2018; Strong et al., 2005). While each hypothesis provides valuable insight regarding potential underlying neurophysiological processes, they are outside the scope of the current study (see Chan et al., 2018 and Motta, 2018 for further information).

Conversely, psychosocial hypotheses of the beneficial effects of physical activity on mood have also been proposed including the distraction and stress-buffering hypotheses (Motta, 2018) as well as several social cognitive theories such as the social cognitive theory (Young, Plotnikoff, Collins, Callister & Morgan, 2014), self-determination theory (Christiansen, Lund-Cramer, Brondeel, Smedegaard, Holt & Skovgaard, 2018). The distraction and stress-buffering hypotheses pertain to the more immediate internal processes ongoing during and after exercise where distraction from negative stimuli can lead to mood enhancement (Motta, McWilliams, Schwartz &

Cavera, 2012). Regrettably, many authors involved in reviews of published studies pertaining to exercise and wellbeing in the youth, have expressed serious concern regarding both the quality and dearth of research on physical activity interventions and their impact on mental health in adolescents. Consequently, very few solid conclusions can be drawn from those reviews and many analyses are unable to be performed due to the lack of sufficient studies to be compared and high variability in methodology (Bailey et al., 2018; Biddle & Asare, 2011). Though outlining the particular mechanisms, magnitude of impact and sequence, through which physical activity influences psychological health will necessitate further research, it appears consistent that engagement in physical activity is beneficial for mental health and looks to be even more important in the presence of internalizing features. Nevertheless, engagement in physical activity also takes place within a social context; and as such, social aspects also need to be considered, whether they influence engagement directly (e.g. encouragement) or indirectly (e.g. societal pressure). This paper focuses on the more proximal social influences that can both be targeted through physical activity interventions and potentially have more lasting effects as opposed to temporary relief.

While the adolescent brain becomes more sensitive to social cues and undergoes re-orientation, puberty engenders a heightened vulnerability to the social climate (Andersen, 2003; Nelson et al., 2005). As adolescents strive for individuation and become less enmeshed in the family unit, peer relations gain significant salience (Steinberg, 2001). Those interpersonal relationships with peers, accrue influence on adolescent attitudes, activities and emotional wellbeing (Brown & Larson, 2009). Within

the more immediate ecological system, positive peer relationships have been associated with wellbeing as they influence social and motivational processes (Wentzel, Donlan & Morrison, 2012). In addition, those positive relationships have also been shown to influence physical activity engagement; where physical activity engagement behaviors of peer, as well as their help and support, leads to an adolescent's own increased physical activity. Yet, the direction of the effect of positive peer relationship on physical activity has also been observed in the reverse; physical activity carried out in mastery motivational climates have also been found to strengthen and improve peer relationships as well (Smith, 2003). Studies have established that perceived social support can play a crucial protective role in the development of psychopathology (Rueger, Malecki, Pyun, Aycock & Coyle, 2016). In their meta-analysis, Rueger et al., (2016) looked at two models that aimed to explicate the role of social support. The general benefits model of social support and the stress-buffering model of social support. The former, proposed that social support leads to an increased sense of wellbeing, self-worth, purpose and positive affect. The stress-buffering model observes social support as acting as shield against the negative effects of stress. The authors note that some have criticized the latter model as it required the presence of an acute stressor in order for a buffering effect to be able to take place and propose that this may explain why there is currently more support for the general benefits model of social support in the literature (Rueger et al, 2016). However, they also point out that when factors such as low-socioeconomic status is conceptualized as a chronic stressor, the

stress-buffering hypothesis regains merit and social support does become a significant factor (Malecki, & Demaray, 2006).

One noteworthy finding in the literature, underlined the association between reductions in physical activity and declines in social support (Raudsepp & Viira, 2008; Duncan et al., 2007). Again, partaking in activities occurs within a context, where climate plays another factor interacting with involvement. Evidence supports that peer-created motivational climate can impact engagement in both directions. When the climate encourages improvement, mastery, effort and relatedness; the impact was positive as opposed to valuing performance, competition and ability (Mellano & Smith, 2017). McMahon et al. (2017) compared the wellbeing of teenagers engaged in a team sport, individual sports or fitness activity and found that those involved in a team sport exhibited higher overall wellbeing; and, particularly in girls, partaking in a team sport lead to greater benefits than individual sport or fitness activity. Another aspect of climate that has been linked with increased physical activity and wellbeing is that of inclusion (Aldridge et al., 2016; Seymour, Reid & Bloom, 2009). Inclusion is conceptualized as actions through which one aims to elicit a sense of belonging in others which increases feelings of connectedness. Several theories have proposed the crucial need for belongingness and social cognitive theories have further highlighted that motivation is highly associated with feelings of relatedness. Hence, feeling included within a group increases one's motivation to engage in the activities of the group, and helps promote a sense of wellbeing (Roffey, 2013; Spruit et al., 2016). Overall, physical activity benefits on wellbeing appear to be

moderated by social factors such as social support from friends, positive peer relationships and inclusive climate.

#### **2.4 Role of After-school Programs**

Adolescents are expected to reach specific academic benchmarks to successfully graduate and enter adulthood, yet, much more needs to be learned in order to foster positive youth development (Davis & Farbman, 2002; Zarrett & Eccles, 2006). Aside from the obvious lack of time available during school hours to offer opportunities to cultivate academic and non-academic skills; the riskiest time during the day are the hours immediately after school ends, particularly if they are unsupervised (Riggs & Greenberg, 2004). Adolescents were found to be at higher risk for depression, substance use, lower academic grades, and other risky behaviors (Richardson, Radziszewska, Dent & Flay, 1993; Mahoney, Vandell, Simpkin & Zarrett, 2009; Zarrett et al., 2009). As after-school programs have gained tremendous support over time; many types of programs were developed with various aims, outcomes and efficacy. As a result, it is important to gauge the suitability of a program in meeting the needs identified. In their meta-analysis, Durlak, Weissberg, and Pachan (2010), found positive and significant effects of after-school programs on participating youth when compared to control groups. Effects were observed on social behaviors, self-perceptions, grades and achievement scores. In parallel, there was a significant decrease in problem behaviors. After-school programs which target physical activity in adolescents have demonstrated positive effects on internalizing and externalizing problems, as well as self-concept (Spruit, Assink, Van Vugt, Van der Put & Stams, 2016). Furthermore, the benefits of after-school programs

have been found to be particularly salient for underserved populations (Miller, 2001). Zarrett et al., (2015) found that social and motivational contextual correlates such as positive peer relationships and inclusiveness were associated with youth physical activity engagement in particularly under resourced physical activity afterschool programs. While there is evidence that afterschool programs have the potential to provide a favorable context to influence physical activity engagement and social climate features, little is known about the potential protective role those climate features could play in relation to internalizing problems. In other words, understanding whether intentionally addressing social climate features within an afterschool physical activity program can either act as a protective mechanism or have greater diminishing effects on present internalizing features could guide the design of future afterschool programs.

Given that time and resources are always limited; choosing or designing an afterschool program that is cost-effective and evidence-based is paramount. On a population level, genetics accounts for only 30% of the variance on mortality, where modifiable (and more pragmatic) features such as behavioral patterns and social circumstances have been shown to contribute to 40% and 15% of the variance, respectively (Schroeder, 2007). Meanwhile, mortality risk has been associated with a complex and synergistic combination of factors including low socioeconomic status, racial minority status, neighborhood economic status as well as income inequality. In their recent study, Kimmel, Fwu, Abbott, Ratner and Eggers (2016), found that African American men who endure income inequality, low socioeconomic status and live in poor neighborhoods, incur the highest mortality rate. Although the reasons for this increased

risk are beyond the scope of this article, understanding who is faced with the highest risk helps prioritize and guide where interventions need to be implemented. On the matter of resource allocation, targeting behavior change has also been found to have ripple effects on various domains of quality of life as well as physical and mental health outcomes; and therefore, appears to be one of the more promising approaches to endorse (Wilson, 2005). Hence, efforts should be directed towards improving access/reach by implementing interventions in under resourced neighborhoods and for underserved populations (e.g., low income, minority status). Furthermore, interventions carried out within those programs need to identify and target key behavioral and social factors in order to provide the most cost-effective strategy to positively influence several domains of quality of life.

## **2.5 Mechanisms of Action**

Health behaviors and wellbeing have been identified as complex areas of research as a broad range of variables are at play and have a different impact depending on the context in which they occur (Bauman, Sallis, Dzewaltowski & Owen, 2002; Biddle et al., 2018). Several meta-analyses and literature reviews have been conducted with the intention of finding better models to explain mechanisms underlying mental and physical health to be applied to the development of efficacious interventions to address the growing health concerns (Bailey et al., 2018). Although several variables shape developmental pathways, intervening at some levels remains challenging. Hence, focusing on areas which, on one hand, are more amenable to change and, on the other, could have positive ripple effects on several health outcomes needs to be a primary

goal. There is consistent evidence supporting a direct mechanism between moderate-to-vigorous physical activity and wellbeing. Other mechanisms that have received substantial attention have linked high-quality peer relationships, perceived social support and positive climate to wellbeing. However, given that most physical activity interventions take place within a social setting and climate, it would be informative to gain a better understanding of the possible moderating effects of these socio-environmental variables on physical activity and investigate the direction and ways in which they affect mental health.

## **2.6 Purpose of the Present Study**

This study was compiled following the results found from a randomized controlled feasibility trial implementing an intervention in afterschool programs to increase youth physical activity through targeting social affiliation goals and a positive social-motivational physical activity climate. Results from the Connect Through Positive Leisure Activities for Youth (P.L.A.Y.) trial (Zarrett, PI) demonstrated that compared to wait-list control sites, those that received the intervention displayed significant changes in several targeted domains post intervention. Controlling for site, gender and body mass index (BMI), positive improvements were noted for moderate-to-vigorous physical activity, and for targeted mechanisms including social support, positive peer interactions, and inclusive climate. All of those same variables have previously been associated with wellbeing; therefore, this presented a good opportunity to invest their impact on internalizing features although it was not the primary aim of this RCT.

The purpose of this paper is to examine the non-targeted effects of this intervention by investigating the roles of physical activity, social support, positive peer interactions and inclusive climate, on changes in internalizing problems. Based on previous research and theories that have demonstrated independent protective and prospective effects of those variables on mental health, the first aim was to examine intervention effects on internalizing features. It is expected that the intervention group will demonstrate a significant decrease in internalizing problems from baseline to post measurements compared to the control group. The second aim is to examine each of the posited individual mechanisms involved in the effects of the intervention on internalizing. Understanding the role and differential impact of various components, will be beneficial in tailoring any intervention utilizing physical activity to diminish internalizing processes. The second set of hypotheses formulated, state that improvements in social support, peer climate, positive peer interactions, inclusive climate and engagement in moderate-to-vigorous physical activity, each significantly contribute to a reduction in internalizing scores. Lastly, the third aim tests the interaction of physical activity with each social mechanism (i.e., social support, peer climate, positive peer interactions and inclusive climate) on internalizing symptomology. It is expected that each social mechanism will interact with physical activity to either enhance or minimize its impact on internalizing. Specifically, increased levels of physical activity is expected to have greater effects on reducing internalizing symptomology when social factors are also high, but reduced impact on internalizing when social factors are minimally present. Since the design used for this study was a randomized

control trial, assumptions of this model include that intervention and control samples did not differ by demographic composition, intervention sites received comparable doses of the intervention and that wait-list groups were not exposed to other interventions or external variables that could impact the measures evaluated. Efforts were made to ensure those assumptions were met through rigorous process evaluation and additionally verified in preliminary analyses.

## **Chapter 3**

### **Method**

#### **3.1 Participants**

The current study is based on data collected from the Connect through Positive Leisure Activities for Youth (P.L.A.Y.; Zarrett, PI) intervention, a randomized controlled feasibility pilot study implemented within middle schools serving underserved youth. The objective of the intervention was to increase physical activity through improving the social-motivational climate of the after school program setting. The original study was carried out between September 2014 and March 2017. In each phase, two schools were selected and randomly assigned as wait-list control or intervention site for a total of 3 control and 3 intervention schools. Recruitment criteria was at the site level, and included: only mid-sized after school programs (enrollment between 30-70) that offered a recreational and/or physical activity component to the program, focused broadly on positive youth development rather than specialized skills (sports, arts, etc.), catered to an underserved population of youth (defined by 50% or more of their students receiving free/fee reduced lunch) and had a population comprised of 50% or more students who are of minority status. All of the students enrolled in recruited afterschool programs could participate in the Connect through P.L.A.Y program. However, in order to participate in the data collection part of the study students needed to fulfill a set of inclusion criteria. Those criteria included: 1) be currently enrolled in the afterschool

program, 2) be present for baseline and post-intervention data collection, 3) have parental consent to participate, and 4) have provided assent for participation in data collection. Individuals were excluded from the study if they: 1) suffered from a medical condition that restricted physical activity, 2) had experienced developmental delays that would influence their ability to complete youth surveys. A total of 238 adolescents in grades 6 through 8 provided parental consent and agreed to partake in the study. Post-randomization, 14 participants were dropped from the study due to disenrollment in the afterschool program or sporadic attendance. The remaining sample of 224 students were included in the larger study. The current study was comprised of 138 cases (mean age = 12.18 years); 57 students had not completed the measure of interest for the current study at baseline, and, 29 students had missing data at post-measurement. Cases that were dropped due to missing post-intervention data on the main outcome variable were compared to those retained for analyses to examine potential differences on independent variables of interest. Of the final sample, 58 students were in the wait-list control condition and 80 in the intervention condition. About 55% of the sample was female. The majority of the sample self-identified as Black (74%), 14.5% identified as White, 5% as multiracial and 3.6% as Latino, only one person self-identified as Asian/Pacific Islander and three individuals as other (see Table 1 for group details).

### **3.2 Measures**

**Internalizing features.** Subscales of the Strengths and Difficulties Questionnaire (SDQ) were used to measure internalizing features. The SDQ is a 25-item screening questionnaire of psychological attributes designed to be administered to 3-16 year old

individuals. The items are divided among 5 subscales, each comprised of 5 items and include a) emotional symptoms, b) conduct problems, c) hyperactivity and inattention, d) peer relationship problems and e) prosocial behavior. The responses range from 0 (not true), to 2 (certainly true). It was developed as part of the Development and Well-Being Assessment package (Goodman, Ford, Richards, Gatward & Meltzer, 2000) with the aim of providing 1) questionnaires and interviews that could distinguish between clinical and community populations (Goodman, Meltzer & Bailey, 1998), 2) include strengths as well as weaknesses and 3) provide briefer measures (Stolk, Kaplan & Szwarc, 2017). Over the years, several versions were developed and tested including parent, teacher and self-report versions; it has also been translated into 80 different languages and are freely accessible online (Stolk, Kaplan & Szwarc, 2017).

The SDQ was chosen as a measure for the current study as evidence points to its utility in measuring internalizing and externalizing problems in general populations samples (Goodman, Lamping & Ploubidis, 2010). Based on Institutional Review Board ethical recommendations pertaining to the sensitivity of the content, this particular scale was amended to include an additional response (i.e., uncomfortable answering) that allowed participants to choose not to answer; as, this was not a clinical study and mental health was not a primary outcome. Out of the overall sample (N = 224), 167 students completed this measure. Since the aim of the current study was to evaluate the levels of internalizing features endorsed by participants, an aggregate score of the emotional symptoms and peer relationships problems subscales (see Appendix A) was computed to obtain an internalizing symptoms subscale as recommended by Goodman

at al. (2010). Previous research has demonstrated that the aggregate internalizing problems scale has acceptable internal consistency ( $\alpha = 0.66$ ) in youth samples, and could be particularly advantageous when tending to small sample sizes and minority groups (Goodman et al., 2010). In the current study, Cronbach's  $\alpha$  for the internalizing SDQ subscale was 0.827 at baseline and 0.823 post-intervention; indicating good internal consistency.

**Physical activity.** While there are several ways to measure physical activity, studies have shown that self-report measures; particularly measures based on memory recall are of variable accuracy when compared to objective measures of physical activity (Shephard, 2003; Troiano et al., 2008; Prince et al., 2008). The use of omni-directional accelerometers has been identified as a primary way to collect objective data on participants' physical activity levels. Thus, this study utilized omni-directional accelerometers to assess activity levels for a duration of 7 consecutive days at both baseline and post-intervention; which was determined to be a good time period to provide reliable estimates with intra-class reliability coefficients ranging between  $R = 0.76$  and  $R = 0.87$  (Trost, Pate, Freedson, Sallis & Taylor, 2000). A subsample of participants in each school wore the accelerometers. The devices were attached to a belt which participants wore at the hip. The device continuously records motion into 15 second intervals (epochs) through a piezoelectric sensor (John & Freedson, 2012). Motion is quantified in terms of counts; where activity levels are determined depending on the number of counts per 4 epochs ( $4 * 15$  seconds = 1 minute) and activity count thresholds (cut-points) developed for youth (Puyau, Adolph, Vohra, Zakeri & Butte,

2004): sedentary (0-99 counts), light (100-1499), moderate (1500-6499) and vigorous (> 6500) activity. According to the U.S. Department of Health and Human services, the 2018 physical activity recommendations for adolescents suggest at least 60 minutes per day of moderate-to-vigorous physical activity. Therefore, moderate and vigorous physical activity were combined; counts above 1500 per minute were categorized as moderate-to-vigorous physical activity (MVPA).

The devices were calibrated to record information into 4 intervals of 6 hours each and initialized to start collecting data at midnight, resulting in a maximum total of 42 successive intervals measured. Data from the devices was extracted and processed using the Actiware version 6.0.8. The raw data was then exported into the Statistical Analysis System (SAS) versions 9.4, for data reduction and management. This process was repeated both pre and post intervention. In order to identify possible times when participants may not have been wearing their belts, non-wear was defined by having 60 minutes in a row of 0 counts per minute. Data usability was defined using validity cut-offs established in previous research and included that participant had have worn the accelerometer for at least 10 hours of consecutive wear-time per day (Cain & Geremia, 2011) for at least 3 days (Mitchell et al., 2013; Troiano et al., 2008). For data that met the wear criteria multiple imputation was carried out to deal with any remaining missing data using the mice R package (Van Buuren & Groothuis-Oudshoorn, 2010). From the original sample (N = 224), 17% of participants at baseline and 36% post-intervention did not reach satisfactory compliance thresholds for wear time and were coded as missing.

To note physical activity was a primary outcome of the randomized control study, however, other variables included in the current study were not imputed.

**Social support.** To measure self-reported changes in social support between pre and post-intervention, a social support scale for exercise was adapted from the Social Support for Exercise Habits Scale developed by Sallis, Grossman, Pinski, Patterson and Nader (1987). The initial scale administered included 2 parts, each comprised of 10 items; the first part was for family support and second was for friend support. Each item is rated on a 5-point scale (0 = Not comfortable answering, 1 = never, 5 very often). To shorten the questionnaire packet provided to the participants, items were dropped following the first phase of the intervention; the items that did not impact the internal consistency of the scale were removed. Items 3, 4, 8 and 10 were kept (see Appendix A). The current study solely included the items related to friend support in the analysis given the intervention was not aimed at influencing familial support. The Cronbach  $\alpha$  coefficients of the final social support from friends scale showed good internal consistency; at baseline  $\alpha$  was 0.843 and 0.813 post-intervention.

**Self-reported climate.** One of the aims of the intervention was to positively influence peer climate by emphasizing positive reinforcements and modeling behaviors such as: valuing others and saying positive things to them, praising effort, helping one another, working together, demonstrating care and acceptance of peers. To measure the impact of the intervention on individual perceptions of peer climate, the Peer Motivational Climate in Youth Sport Questionnaire (PeerMCYSQ; developed and validated by Ntoumanis and Vazou, 2005) was used. The Full Questionnaire includes 5

subscales: improvement, relatedness/autonomy support, effort, intra-team competition and intra-team conflict (Ntoumanis, Taylor & Thøgersen-Ntoumani, 2012). For the purpose of brevity only 4 subscales were used in the current study; the intra-team conflict subscale was dropped as it was developed more specifically in the context of team sports. The final scale administered in the current study included 27 self-reported items and responses were indicated on a 5-point scale (0 = Not comfortable answering, 1 = completely false, 5 = completely true; 8 items are reverse scored). The internal consistency of the 27 item scale used in this study was very good, Cronbach's  $\alpha$  was 0.877 at baseline and 0.890 post-intervention.

**Observed climate.** Understanding individual perceptions of climate change resulting from the intervention provides only partial information, and, the use of self-reports measures, particularly in adolescent samples has been highly criticized (Fan et al., 2006). Hence, to measure overall objective changes in climate pertaining to inclusiveness and positive peer interactions, 2 social indicators of the Motivational Climate Observation Tool for Physical Activity (MCOT-PA) were used. This tool was originally included in the larger randomized control study (Zarrett et al., under review), to measure changes from baseline to post in targeted social and motivational factors shown to support physical activity in the after school program simultaneously with youth physical activity levels. The MCOT-PA was previously developed and validated by the PI (Zarrett, Sorensen & Skiles 2012; 2013; Zarrett et al., 2015) as a supplement to the System for Observing Children's Activity and Relationships during Play (SOCARP) and a modified version of the System for Observing Fitness Instruction Time (SOFIT)

(McKenzie, 2002; McKenzie, 2006). Together SOCARP and the MCOT-PA supplement provide objective simultaneous observational data on youth social and motivational experiences while assessing their physical activity levels, their environments, and ways in which individuals interact with one another within the after school setting.

Specifically, The MCOT-PA assesses social-motivational factors that are divided into 9 staff interaction (e.g. encourages child) and 7 climate components: inclusion, engagement, structured/unstructured autonomy, positive peer interactions, clarity of rules and bullying. Inter-rater reliability of the scale was found to be very high with a coefficient of  $r = 0.98$  (Zarrett et. al, 2013; Zarrett et al., 2015). The intervention team members, of the current study, were trained on the implementation of the MCOT-PA and participated in workshops to ensure inter-rater reliability. Team members were then disseminated in the schools to record observations. Participants were given ID numbers which were printed on label and affixed to the participants' backs. Based on observation protocols, teams of 2 coders went to each school and made continuous observation of successive 2 minute long scans; observers listened to a recording to kept track of time. They attended 5 program days over a 2-week period to capture a more comprehensive account of the activities taking place at each afterschool program at baseline, midpoint, post and follow-up (Coleman et al., 2008; Mckenzie, 2005; Zarrett et al., 2015). For the purpose of the current study, two critical social factors of the MCOT-PA were utilized in the analysis: 1) the observed inclusivity of the after school climate (e.g. all youth are encouraged to participate in the activities offered; each students' contributions to the activities are valued; no youth are discouraged from participating)

and observed positive peer interactions (e.g. youth help each other, work together as a team, encourage and/or praise one another, etc.).

### **3.3 Procedure**

The Connect through P.L.A.Y feasibility trial is a 10-week program offered for 1.5 hours, 3 times per week. Baseline measurements were collected two-weeks prior to the start of intervention implementation and post-intervention and physical activity measures were collected 12 weeks later. Process evaluators assessed fidelity once a week and program readiness assessments that assessed adoptability/acceptability of the intervention were completed by the after-school program staff at baseline and post-intervention.

The intervention was designed to target several social components of the after-school programs that promote student engagement in the physical activity curriculum, such as positive interpersonal interactions between students and among staff and students, inclusive, engaging physical activity opportunities to foster cooperation and collaboration, program structure and physical environment (e.g., equipment allocation; small group-based games and activities). Essential elements of the intervention were derived from motivational theory including self-determination theory (Ryan & Deci, 2000) and achievement goal theory (Maehr & Zusho, 2009) and previous observational (Zarrett et al., 2015) and qualitative studies (Zarrett, et al., 2013) conducted by the PI on the social- motivational factors within after school programming that support youth PA. The identified elements included: 1) moral, emotional and social goal oriented support

and skill development, 2) collaborative and cooperative play, 3) equal treatment and access, and 4) inclusivity and engagement.

The curriculum included a 30-minute “Get-to-Know-You” small group session where students engaged in activities to foster friendship building skills, the development of intra and interpersonal assets to build and support friendships and group cohesion, as well as connectedness with staff through physical activity. Youth were encouraged to share ideas, personal stories, activity preferences, and new activity ideas (favorite activity to teach your peers); through fun team building and ice breaker activities.

The second part included 60-minutes of physical activity designed to promote positive social experiences and affiliations which were centered on the components identified in the prior small group sessions. The games offered were intended to be novel, inclusive and emphasize team work. Furthermore, the intervention aimed to promote a positive and supportive climate to provide a favorable environment to bolster youth motivation for physical activity.

The intervention implementation team and school staff attended a 3-day training with a Physical Education consultant to learn about how to enact the games in ways to achieve the essential elements targeted by the program. A curriculum manual was provided to each with recommended activity schedules, a detailed guide for each game, and set-up instructions. For the first two days of each week, three games were offered and students could rotate from one activity to the other. The third day of each week was designated as ‘choice day’ where the three activities offered were chosen by the students via a majority preference rating.

The intervention was derived based on Self-Determination Theory and Achievement Goal Theory; which highlights the basic needs for competence, autonomy and relatedness. The curriculum was designed to address those needs by providing students with a choice in the activity they engaged in, focusing on mastery, and providing opportunities for positive social interactions through support, praise and encouragements from peers and staff. Enjoyment, competence and belonging were prioritized as opposed to performance, competition and individuation; which has been suggested to increase intrinsic motivation and hence lead to more sustainable behavior change (for more detailed information on the development of the intervention please see Zarrett et al., under review).

### **3.4 Analytical Procedure**

Preliminary analyses were conducted in order to identify potential differences at baseline between individual schools as well as between control and intervention sites (dummy coded) by key sample characteristics. Chi square tests were carried out on sample demographic variables to ensure control and intervention sites were comparable post-randomization on gender, age and race, a t-test was used to look at differences on BMI. One-way analyses of variance (ANOVA) were used to look at differences between schools and experimental phases at baseline on SDQ internalizing scores. Additionally, t-tests were conducted to assess for equality of means between control and intervention groups at baseline on study variables including: SDQ internalizing scores, social support from friends, peer climate, observed positive peer interactions, inclusive climate and moderate-to-vigorous physical activity. The same

variables were used to test for gender differences. A one-way ANOVA was run to look for associated differences on the study variables related to BMI. To note, no tests were carried out to test for differences correlated with race as the sample was intended to be primarily African American and groups formed by other races were significantly smaller in size to allow meaningful conclusions.

While multi-level modeling is the gold standard when analyzing nested data, the number of groups and participants included in the current study was insufficient to warrant the use of this statistical approach (Hox, 1998; Maas & Hox, 2005). Therefore, to account for the nested nature of the data, differences in variability between sites (schools) was controlled for in all analytic models. Furthermore, differences by gender were also controlled for in all of the regression models as both the literature and previous studies have demonstrated gender differences on some of the variables explored in this study such as physical activity (Caspersen et al., 2000) and internalizing disorders (Van Voorhees et al., 2008).

To test the first hypothesis of this study, which stipulates that the adolescents partaking in the Connect Through P.L.A.Y trial will experience a significantly greater decrease in internalizing symptoms compared to youth in the wait-list control group from baseline to post-intervention, a linear regression was performed with post-intervention SDQ internalizing scores as the dependent variable, baseline SDQ internalizing scores as the main independent variable and the dummy variable identifying schools as intervention or control sites.

The second aim of this study was to explore the underlying mechanisms embedded in the intervention that potentially influence internalizing features. The next set of analyses were formulated following the significant changes identified by Zarrett et al. (under review) where the intervention was shown to lead to changes in social support, peer climate, positive peer interactions, inclusive climate and moderate-to-vigorous physical activity. Hence, to establish a possible relationship between each of those mechanisms and their non-targeted effect on internalizing features, simple mechanisms were investigated by exploring associations between changes in each singular mechanisms and  $\Delta$ SDQ. Change variables were created by subtracting post-intervention scores from baseline scores for each mechanism,  $\Delta$ MVPA for change in moderate-to vigorous physical activity,  $\Delta$ SS for change in social support for physical activity,  $\Delta$ PC for change in peer climate,  $\Delta$ PP for change in observed positive peer relationships and  $\Delta$ IC for observed inclusive climate.

While testing for direct main effects of individual mechanisms helps clarify parts of the puzzle, the intervention was particularly designed as a step in addressing an existing gap identified in the literature on after-school school programs, as evidence pointed towards the benefits of socially motivating contexts in increasing physical activity engagement. A recent review of school based interventions by Rafferty, R., Breslin, G., Brennan, D., & Hassan, D. (2016) have noted the dire need for empirical studies to assess both physical activity and wellbeing simultaneously as previous studies had measured one or the other but very few had done both; and, those that did, had reported mixed findings. Furthermore, Bauman et al. (2002) describe the complexity of

physical activity behavior having been associated with more than 10 variables that can act as predictors, mediators and moderators depending on the situation. Consequently, to gain further knowledge about the mechanisms of action, and whether some variables did act as moderators, further analyses were conducted. As the intervention aimed to increase physical activity through targeting social factors, analyses were conducted to examine whether some of those mechanisms explained more variance by moderating the effects of physical activity. Therefore, four interaction models were performed between  $\Delta$ MVPA and  $\Delta$ SS,  $\Delta$ PC,  $\Delta$ PP and  $\Delta$ IC on the same outcome measure  $\Delta$ SDQ, while controlling for differences by school and gender.

## Chapter 4

### Results

#### 4.1 Preliminary Analyses

Preliminary analyses evaluating baseline differences between individual schools demonstrated comparable baseline SDQ internalizing scores [ $F(5,161) = .392, p = .854$ ]. Chi square tests between control and intervention sites did not reveal significant group composition differences on gender, age or race (see table 4.1). The t-test comparing sites on BMI did not reveal significant differences between control and intervention sites at baseline [ $t(223) = -.439, p = .661$ ]. Additional t-tests evaluating baseline differences of baseline SDQ and all intervention mechanisms showed no significant differences between control and intervention sites (see table 4.2). However, t-tests assessing for gender differences on all study variables at baseline indicated significant differences. Males engaged in significantly more moderate-to-vigorous physical activity, reported having greater social support for physical activity from friends and were observed to experience a more inclusive climate for physical activity in after school programs. Females, on the other hand, were observed to experience more positive peer interactions when engaging in physical activity in after school programs (see table 4.3). These results further supported the need to include gender in subsequent models. The one-way ANOVA exploring baseline differences by BMI did not reveal any significant differences (see table 4.4).

## 4.2 Analyses

**4.2.1 Effect of the Connect Through P.L.A.Y. intervention on internalizing symptomatology.** The aim of this study was to investigate the non-targeted effects of an after-school physical activity based intervention integrated into pre-existing programs. The first hypothesis, was derived based on previous research which has shown that physical activity and perceived social support are negatively associated with internalizing disorders. Hence, it was expected that the youth receiving the physical activity intervention would have significantly greater decreases in internalizing symptomatology compared to youth in the wait-list control from baseline to post-intervention. In support of this hypothesis, the linear regression results indicated that being in the Connect intervention, as compared to the wait-list control, was associated with a greater decrease in internalizing symptomatology,  $\beta = -.163$ ,  $p = .027$ ; while the variance explained by the model was 28.7% ( $R^2 = .31$ ,  $F(4,133) = 14.782$ ,  $p < .000$ ).

**4.2.2 Simple and moderating mechanisms of the intervention contributing to changes in internalizing symptomatology.** In order to investigate the potential direct main effects and moderating effects of changes in the targeted mechanisms proposed on relatable changes in internalizing symptomatology, a new variable was computed;  $\Delta$ SDQ was obtained by subtracting post-test SDQ scores from baseline SDQ scores where a positive change indicates a decrease in internalizing features endorsed. In the current study,  $\Delta$ SDQ from baseline to post ranged between -2.45 and 2.67 ( $M = -.041$ ,  $SD = .95$ ). No significant main effects were found in any of the five linear regressions

testing the direct main effects of change in each of the individual mechanisms on change in SDQ scores (see table 4.5).

#### **4.2.3 Interaction effects with change in moderate-to-vigorous physical activity.**

Additional regression models controlling for gender and school were performed in order to investigate the interaction effects of change in physical activity with change in each social mechanism, on change in SDQ. Out of the four social mechanisms hypothesized to moderate the impact of physical activity on internalizing symptomology, change in observed inclusive climate was the only social factor shown to moderate the relations between youth physical activity and internalizing ( $\beta = .025$ ,  $p = 0.046$ ,  $F(5, 92) = 1.537$ ,  $p = .186$ ,  $R^2 = .077$ ). In the group of participants who engaged in more physical activity than the sample mean, a 1 unit increase in inclusive climate was correlated to a positive .612 unit difference in  $\Delta$ SDQ ( $CI_{95} = -.002, 1.226$ ). In the group who participated in less activity than the mean, a 1 unit increase in  $\Delta$ IC was also associated with a positive .296 unit difference in  $\Delta$ SDQ ( $CI_{95} = -.755, 1.347$ ) (see figure 4.1). In other words, all individuals benefited from experiencing an inclusive climate; however, participating in above average physical activity seems to predict a stronger positive impact on mental health. On the other hand, perceived social support, peer climate and observed positive peer interactions were not found to significantly interact with change in physical activity in predicting a change in youth internalizing.

Table 4.1  
*Sample Demographics by Site*

	Intervention		Wait-list control		$\chi^2$	<i>p</i>
	<i>n</i>	%	<i>n</i>	%		
Overall Sample	80	58	58	42		
Gender					0.509	0.476
Female	42	52.5	34	58.6		
Male	38	47.5	24	41.4		
Race					0.266	0.136
African American/Black	60	75.0	41	70.7		
White	12	15	8	13.8		
Hispanic	0	0.0	5	8.6		
Asian/Pacific Islander	1	1.3	0	0.0		
Other	1	1.3	2	3.4		
Multiracial	5	6.3	2	3.4		
Missing	1	1.3	0	0.0		
Age					0.228	0.305
10	1	1.3	0	0.0		
11	21	26.3	14	24.1		
12	29	36.3	29	50		
13	20	25	9	15.5		
14	9	11.3	4	6.9		
15	0	0.0	1	1.7		
16	0	0.0	0	0.0		
17	0	0.0	1	1.7		

*Chi-square Test; p < 0.05*

Table 4.2  
*T-tests for Equality of Means of Study Variables by Group at Baseline*

	Control		Intervention		<i>t-test</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
SDQ Internalizing Scores	3.37	0.94	3.36	0.97	0.09	0.930
Social Support from friends Scale	3.11	1.09	3.14	1.03	-0.20	0.840
Peer Climate Scale	3.17	0.59	3.56	6.49	-0.57	0.570
Observed Positive Peer Interactions	0.31	0.64	0.29	0.48	0.19	0.850
Observed Inclusive Climate	0.19	0.30	0.10	0.23	2.00	0.050
Moderate-to-vigorous Physical Activity	44.97	25.28	42.39	27.45	0.72	0.470

Table 4.3

*T-tests for Equality of Means of Study Variables by Gender at Baseline*

	Male		Female		<i>t-test</i>	<i>p</i>
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>		
SDQ Internalizing Scores	3.23	0.94	3.47	0.97	-1.60	0.114
Social Support From Friends Scale	3.29	1.02	3.00	1.07	2.08	0.039*
Peer Climate Scale	3.07	0.51	3.07	0.59	-0.04	0.965
Observed Positive Peer Interactions	0.20	0.33	0.38	0.64	-2.11	0.036*
Observed Inclusive Climate	0.17	0.30	0.09	0.21	2.00	0.048*
Moderate-to-vigorous Physical Activity	56.19	29.47	33.03	18.57	7.10	0.000***

\*  $p < 0.05$ \*\*\*  $p < 0.001$ 

Table 4.4

*One-Way Analyses of Variance of Study Variables by BMI*

		<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
SDQ Internalizing Scores	Between Groups	0.31	2	0.15	0.17	0.847
	Within Groups	152.25	164	0.93		
Social Support From Friends Scale	Between Groups	0.38	2	0.19	0.17	0.843
	Within Groups	246.96	220	1.12		
Peer Climate Scale	Between Groups	1.18	2	0.59	1.94	0.146
	Within Groups	67.52	222	0.30		
Observed Positive Peer Interactions	Between Groups	1.77	2	0.88	0.14	0.873
	Within Groups	1016.51	156	6.52		
Observed Inclusive Climate	Between Groups	4.63	2	2.31	0.45	0.640
	Within Groups	805.37	156	5.16		
Moderate-to-vigorous Physical Activity	Between Groups	2510.91	2	1255.46	1.79	0.169
	Within Groups	155287.33	222	699.49		

Table 4.5

*One-Way Analysis of Variance of Intervention Components on Change in Scores of the Strengths and Difficulties Questionnaire ( $\Delta$ SDQ), controlling for school and biological sex.*

		<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>p</i>
Social Support From Friends Scale	Regression	3.73	3	1.24	1.40	0.245
	Residual	109.80	124	0.89		
Peer Climate Scale	Regression	1.40	3	0.47	0.46	0.708
	Residual	106.64	106	1.01		
Observed Positive Peer Interactions	Regression	0.45	3	0.15	0.15	0.930
	Residual	94.20	94	1.00		
Observed Inclusive Climate	Regression	3.36	3	1.12	1.15	0.332
	Residual	91.29	94	0.97		

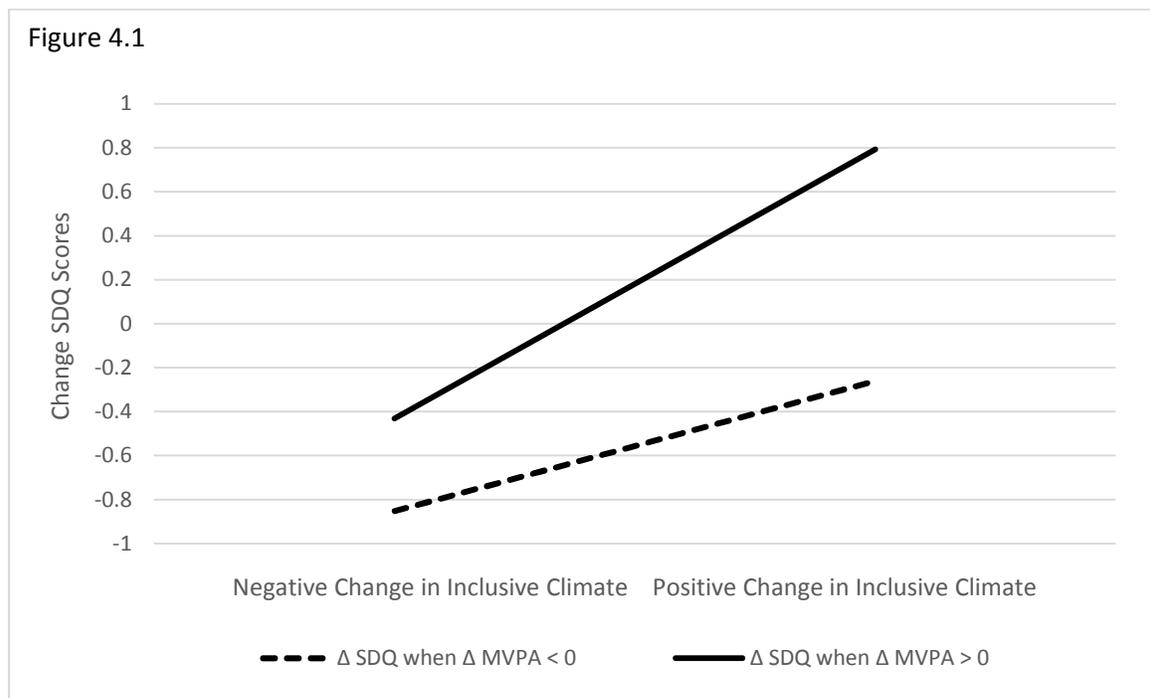


Figure 4.1 Interaction Between Change in Inclusive Climate and Change in Moderate-to-vigorous Physical Activity on Change in Internalizing Symptoms (SDQ).

## **Chapter 5**

### **Discussion**

The first aim of this study was to evaluate the non-targeted effect of a social-motivational physical activity intervention on internalizing symptoms. Connect Through P.L.A.Y., was a feasibility pilot study that found intervention effects on increasing moderate-to-vigorous physical activity, and targeted social mechanisms, including perceived social support from friends, positive peer interactions and inclusive climate. Significant favorable changes in physical activity engagement and targeted social mechanisms were expected to also improve youth wellbeing/mental health. As predicted, findings of the current study demonstrated that the intervention had a significant, albeit small effect on internalizing features as measured by the internalizing subscale of the Strengths and Difficulties Questionnaire (Goodman, Lamping & Ploubidis, 2010), while controlling for gender, school site and baseline scores. The small effect size aligns with results found from previous intervention studies using physical activity to positively influence internalizing symptoms (Bailey et al., 2018; Biddle et al., 2018). Furthermore, this study was based on a small subsample and investigated a non-primary outcome of the larger randomized controlled pilot study; hence, this finding is encouraging as it indicates potential for further exploration particularly in underserved populations mostly comprised of youth of minority status.

While there is substantial evidence showing the positive effects of physical activity on mental health, previous research has been heavily criticized for the scarcity and unsatisfactory quality of published works that include adolescent participants. Some of the criticisms include high variability in measures used, lack of objective measures of physical activity, lack of control groups to assess true effects, and lack of details of the interventions such as length, intensity, frequency and duration (Brown, Pearson, Braithwaite, Brown & Biddle, 2013). A recent review conducted by Rafferty, Breslin, Brennan and Hassan (2016) notes that they were the first to review the effectiveness of school-based physical activity interventions on activity levels and wellbeing of youth simultaneously. They explain that most previous research on the effects of school-based interventions on wellbeing had reported mixed findings and did not specifically measure physical activity concurrently. Furthermore, they refer to a review by Ahn and Fedewa (2011), which demonstrated that physical activity interventions that had been carried out in school settings, particularly after school as, had led to the largest effect sizes on mental health outcomes. After the selection process, 11 studies were retained; while some solely targeted physical activity, others included physical activity as part of a multicomponent intervention but none of the studies retained incorporated social and motivational components as part of their multicomponent interventions. Only two studies found improvements in wellbeing and it was suggested that those changes were found in samples who initially had lower levels of wellbeing (e.g. overweight/obese samples). This resonates with previous studies that had found greater interventions effects of physical activity on depression in those who displayed clinical levels of

depression at baseline (Bailey et al, 2018). Yet, studies that had engendered significant increases in physical activity in the intervention groups did not report significant changes in wellbeing. Overall, their results indicate that interventions consisting of multiple components, engendered greater effects on physical activity, which aligns with findings from the Connect through P.L.A.Y multicomponent intervention. However, one should point out that this review included studies that targeted youth aged between 6 and 12 years, which makes interpretations additionally complex as it includes both children and adolescents.

In an effort to address the dearth of evidence surrounding the effects of multicomponent physical activity school-based interventions on adolescent wellbeing, this study chose to investigate the mechanisms underlying the Connect Though P.L.A.Y. intervention effects. Notable strengths of the Connect intervention is its multicomponent approach and randomized controlled trial intervention design. This enabled comparison of the intervention to a control group. The intervention aimed to increase both physical activity as well as social climate factors, hence the direct impact of physical activity and key physical activity based social mechanisms, and the moderating effects of these mechanisms on the relation between physical activity and mental health could be examined. The study utilized objective measures of physical activity (accelerometers) and included both self-report and objective measures of social climate factors targeted by the intervention. Self-report measures were used to assess individual perceptions of internal experiences such as internalizing symptoms, positive peer climate and social support. However, since the use of self-report measures in

adolescent samples has been criticized (Fan et al., 2006), and some social aspects can be measured objectively as they are demonstrated behaviorally; measuring changes in those social behaviors can provide valuable information to indicate overall climate change. Hence, subscales of an objective measure of social climate was additionally used to assess changes in inclusiveness and positive peer interactions. Accelerometers were used to measure physical activity as they have been shown to be more accurate than self-report measures (Shephard, 2003; Troiano et al., 2008; Prince et al., 2008). The primary target population of the trial was underserved African American youth aged 11 to 13 years old, as it is a population that not only incurs the highest risk for inactivity and mental and physical health problems but has also been the most understudied population in this domain.

To investigate proposed mechanisms influencing internalizing symptomatology, the current study aimed to test the potential direct and indirect impacts of changes in physical activity, perceived social support, peer interactions and climate. Surprisingly, no direct main effects were found for changes in physical activity engagement, perceived social support, peer climate, observed positive peer interactions or observed inclusive climate on change in internalizing features. None of the examined mechanisms appeared to operate alone to impact internalizing symptoms.

Consequently, a second set of analyses was performed to examine the moderating effects of changes in social climate mechanisms on physical activity, with the understanding that it is likely an interaction of increases in physical activity, with improvements in critical social mechanisms, that enhances wellbeing. The hypotheses

were driven by social cognitive theories which highlight that individuals' sense of wellbeing and motivation to engage in physical activity will increase when they are immersed in a motivational climate where they are praised for effort rather than achievement, feel connected to their peers, observe their peers engaging in activities and are encouraged by their peers to join the activity. Hence, partaking in an intervention which successfully increased physical activity, social support, peer interactions and climate, (Zarrett et al., under review), from which the subsample for this study was obtained, was expected to influence the experience of the youth involved in the intervention and, lead to decreased internalizing features compared to youth engaged in the control group. Furthermore, it was also anticipated that the changes in social mechanisms would boost the positive effects of the physical activity on internalizing symptoms where those who experienced higher social support, more positive peer climate, more inclusive climate and more positive peer interactions, during the activity would display even greater decreases in internalizing symptomatology. The interactions between perceived social support, peer climate and observed positive peer interactions with physical activity, were not supported by the available data.

Nevertheless, the interaction between observed inclusive climate and physical activity was found to be significantly associated with positive changes in internalizing features. Though this finding is interpreted with caution, further exploration suggested that individuals who engaged in above average moderate-to-vigorous physical activity within an increasingly inclusive setting experienced greater reductions in internalizing symptoms. While previous studies have found a positive association between activity

intensity and magnitude of effects on depression and anxiety (Parfitt, Pavey, & Rowlands, 2009), it appears that this impact may depend, at least in part on the degree to which the physical activity setting is inclusive.

Although the Connect Through P.L.A.Y. intervention lead to significant increases in moderate-to-vigorous physical activity, perceived social support, observed positive peer interactions, and observed inclusive climate (Zarrett et al., under review); changes in each of these individual mechanisms, by themselves, were not found to significantly influence internalizing symptomatology. Out of the social mechanisms hypothesized to interact with physical activity in leading to a positive change in internalizing symptoms, analyses revealed a significant, albeit small interaction effect, between change in observed inclusive climate and change in physical activity on change in internalizing features. One possible explanation for this finding could be that the feeling of belonging derived from inclusiveness may be more salient to individuals, compared to other variables such as perceived social support, and hence may have had a larger influence on engagement and wellbeing (Prevo, Stessen, Kremers, Wassenberg & Jansen, 2018). Inclusiveness has been shown to be an important factor within social cognitive theories as it is a human fundamental need (Leonardelli, Pickett & Brewer, 2010), that has also been linked to relatedness and belonging. Studies have demonstrated a positive association between increased relatedness and motivation to engage in physical activity in adolescents (Barkoukis, Hagger, Lambropoulos & Tsorbatzoudis, 2010; Wallhead, Garn & Vidoni, 2013). Observed inclusiveness is a component that was measured objectively using the MCOT-PA, which was specifically developed to assess youth

experiences of social and motivational factors within a physical activity context. Inclusiveness appears to play a role in supporting the impact of physical activity on mental health, with regards to the length of the intervention, it could be that inclusiveness may play an important primary role in engaging individuals in the intervention and that other social factors such as social support may have secondary roles such as maintaining engagement and motivation for physical activity (Craggs, Corder, Van Sluijs & Griffin, 2011; Mendonça, Cheng, Mélo & de Farias Júnior, 2014), while feeling supported and reinforced, but that those mechanisms may take longer to have an effect on internalizing symptoms. Along the same perspective, some internalizing features may be more amenable to change than others, studies investigating the symptom reduction have shown that some symptoms take longer to resolve while some individuals will continue to experience symptoms despite pharmacological and psychological treatments (Thapar, Collishaw, Pine & Thapar, 2012). In other words, inclusiveness may have led to some improvements in internalizing features in particular domains but other areas may need more than 10 weeks to be positively altered, if they can be altered by the intervention at all. Although other proposed social mechanisms were not found to predict changes in internalizing symptoms in the current study, the fact that the intervention as a whole, did significantly influence internalizing mental health components points to the need for further research to be conducted to take a closer look at the underlying mechanisms contributing to this change, considering longer mechanisms of action, identifying

potential additional mechanisms and perhaps investigate their impact on particular areas of functioning rather than a category of features.

Several other suppositions can be made regarding the lack of support for these hypothesized mechanisms leading to intervention effects. Some have suggested that dose could be an element, where the same dose of the intervention can be sufficient for increasing some aspects but not all (Calfas & Taylor, 1994); it could be that longer interventions may have larger effect sizes and enable the exploration of more minute changes in mechanisms. Attempts undertaken to identify an exhaustive list of correlates, moderators and mediators of physical activity behaviors have described it to be highly complex. Some variables were also shown to have the potential to act as a moderator at one point in time, a mediator at another and to influence behavior. Additionally, evidence indicates that some relationships are bi-directional, pathways in behavioral research are rarely singular and causality is difficult to establish. Furthermore, more than 15 variables have been associated with physical activity engagement alone and no single theory currently exists encompassing all of these variables; the feasibility of such a theory is also questionable (Bauman et al., 2002). Therefore, when investigating additional social mechanisms, future studies may benefit from utilizing different analytical methods such as cluster or profile analyses which could provide information about having a combination of factors present and their impact on internalizing features.

Other variables at play that were not included in the current study may also have contributed to the observed intervention effect. For example, studies evaluating the

benefits of afterschool programs have found that the provision of structured activities for the youth during hours outside of school is associated with several indicators of positive youth development and wellbeing (Little et al., 2008; Reisner et al., 2007). Furthermore, interacting with nonkin adults has been shown to provide a notable source of support for adolescents and to promote resilience (Roffman, Pagano & Hirsch, 2001). The intervention included both structured activities and emphasized increased opportunities for the youth to interact with the after school program staff who were trained on the games implemented, as well as the individuals from the research team. The combination of these factors could have contributed to the observed intervention effects that were not measured in the current study. Studies have found that perceived social support is also a multifaceted concept; where girls appear to be more sensitive to emotional and appraisal support compared to boys (Laird, Fawkner, Kelly, McNamee & Niven, 2016; Tennant et al., 2015). Sources of support is also essential as peers have been shown to be influential but parents and school staff have also been found to provide different types of support. Studies that have increased support for physical activity from multiple sources have been found to be more effective (Hohepa, Scragg, Schofield, Kolt & Schaaf, 2007). While the current study focused on social support for physical activity from friends, it appears to fall short in capturing sufficient nuances of social support; future studies may benefit from simultaneously measuring perceptions, source and impact on physical activity behaviors and internalizing disorders to help further tailor interventions accordingly. Girls have also been shown to need a higher dose (more days) of physical activity to benefit from effects on wellbeing and that while

boys improved on depression, anxiety and wellbeing measures, girls only improved on wellbeing (McMahon et al., 2017).

Others have outlined that while there is substantial evidence of intervention effects on wellbeing in adults, such effects have not been consistently demonstrated in the youth (Rafferty et al., 2016). It has also been suggested that different levels of internalizing symptomatology respond differently to interventions (Bailey et al., 2018; Biddle et al., 2018). However, the sample included in this study was not a clinical sample and the sample size did not allow for sufficient power to detect effects in subsample analyses of those in upper and lower quartiles. This limits the ability to examine possible differences between different groups where those with extreme scores may derive benefits differentially (Bailey et al., 2018; Rafferty et al., 2016). Additional sample related aspects to consider pertain to variations by youth characteristics. This study aimed to address gaps in the literature by targeting an understudied population of African American adolescents who are of low socioeconomic status, and who live in under-resourced areas. Low socioeconomic status, under-resourced neighborhoods, and minority status are all factors that have been associated with chronic stress; these added factors could in themselves be moderating the effects of the intervention mechanisms (Malecki & Demaray, 2006).

Gender is another important factor that deserves attention as previous research has demonstrated that it influences behavior with regards to physical activity engagement, social support as well as peer relationships, and has also been associated with differential rates of incidence of internalizing disorder in adolescents. Adolescent girls

have been shown to have lower daily physical activity accrual, and sharper decreases in physical activity during adolescence than boys (Caspersen et al., 2000; Duncan 2007). These physical activity trends were supported in the current study with girls lower in physical activity than boys, and less of an increase in physical activity as compared to boys in the intervention arm. Surprisingly, contrary to the prevalent literature highlighting the greater susceptibility for internalizing symptoms in adolescent girls compared to adolescent boys (Bitsko et al., 2018; Twenge et al., 2018), in the sample examined, no gender differences were found on the internalizing subscale of the Strength and Difficulties Questionnaire (Goodman & Goodman, 2009). Recent neurobiological prospective studies on the impact of early life stress concluded that there was a strong gender based vulnerability; where girls were significantly more likely to develop both depression and anxiety up to 14 years post exposure to early life stressors (Burghy et al., 2012). In addition, Martel (2013), describes the intricate interaction between genetic, environmental and biological factors that are hypothesized to render adolescent girls more vulnerable to internalizing disorders; hypotheses outlined explain the role of evolutionary selection, oxytocin, hormonal changes during puberty, gene expression and hypothalamic-pituitary-adrenal axis response to exposure to stress. These findings become particularly concerning with recent systematic review studies indicating that although overall mental health has not worsened in children and adolescents over the years, internalizing problems have increased in adolescent girls. The “uncomfortable answering” response option in the survey data makes it difficult to make clear suppositions as to why girls did not significantly endorse internalizing

symptoms significantly more than boys beyond basic conclusions concerning nonresponse bias where those who may have been experiencing more severe symptoms may have been the ones who were more likely to feel uncomfortable answering internalizing survey data. Contemporary evidence suggests that previously mentioned youth characteristics such as minority status, socioeconomic status and race/ethnicity, can contribute to increased exposure to stressors (Bradley & Corwyn 2002; Chou et al., 2012), and in addition to gender, should also be considered in future research.

### **5.1 Limitations**

Since this study was designed as a secondary analysis of previously collected data, the available sample of individuals who had completed information on all of the variables included in this study was restricted. While missing data for physical activity was dealt with using multiple imputation, missing survey data was not as it was not a primary target of the larger randomized control pilot study. Following IRB recommendation, given that this was a non-clinical study and included adolescent participants, the Strength and Difficulties Questionnaire (Goodman & Goodman, 2009) was amended; a response item was added, giving participants the possibility not to answer items they did not feel comfortable answering. However, this strategy comes with its drawbacks as it influences response rates. In addition, the social desirability bias and response sensitivity bias have also been reported to play a role when administering self-report questionnaires in social behavioral sciences to adolescent populations (Fan et al., 2006). As a result, it is likely that internalizing symptoms are underestimated in

the study sample. With regards to missing accelerometer data, several hypotheses have been put forth surrounding compliancy, the most common were forgetfulness to put it back on after a shower or in the morning and discomfort or inconvenience (Troiano et al., 2008). Other studies investigating factors relevant to the sample examined in this study have found that participants of lower socioeconomic status and who were non-White tended to be less compliant (Wells et al., 2013). However, missing data was remediated using multiple imputation when sufficient valid days were obtained which enabled the preservation of most of the sample. Another factor that also led to missing data was the absence of students during measurement phases where some students who had provided baseline data were not present during the post-measurement phase. Due to the purpose of this research both baseline and post-intervention measures were needed for analysis. Since the aim of this study was to investigate the effect of the intervention on internalizing symptoms, participants who had missing survey data were dropped. This limited the power to detect effects, increasing the likelihood of type II errors and the ability to conduct more extensive analyses.

Other factors to bear in mind while interpreting the results of this study include forms of bias that emerge as a result of the design. For example, participants in the intervention group may have exhibited benefits due to the presence of external individuals in their setting and not solely from the intervention itself; while, the wait-list control sites did not interact with team members beyond the measurement process (Bailey et al., 2018). While wearing an accelerometer may have led to some performance bias, the fact that both intervention and control groups wore devices at

baseline and post-intervention measurement phases assumes that it would not confound results (Mansournia, Higgins, Sterne & Hernán, 2017). However, statistical bias cannot be overlooked due to missing survey data. Even though imputation, which was the method selected in the current study, is considered as one of the more rigorous approaches recommended for handling missing accelerometry data; pitfalls have been observed in relation to the proportion of missing data, intermittence period, cut-off points and observation period (Catellier et al., 2005). With regards to non-response bias, it is more difficult to tell whether those who did fill-out all of the survey measures and were compliant with accelerometers, were different from those who did not.

Limitations also exist pertaining to the generalizability of the results. The intention of this study was to focus on underserved African American adolescents in the United States, which makes the sample very particular regarding both socioeconomic status and racial/ethnic background. Therefore, results may not be applicable to populations of different demographic characteristics or be meaningful in other cultures. Furthermore, all the schools participating in the study were selected from the State of South Carolina; while schools in other states may present students with variable support, environments and opportunities resulting from differential state laws and provisions.

## **5.2 Conclusions and Future Directions**

Overall, despite the limitations incurred as a result of the small available sample size and diminished power; this study did find effects of the Connect through P.L.A.Y intervention on internalizing symptoms. These findings contribute to the literature on

physical activity interventions that also target social factors in improving the mental health of underserved African American adolescents in the United States who have been shown to incur higher risks compared to other adolescent populations.

In addition, this study went beyond the investigation of mechanisms that were particular to this intervention to address broader mechanisms at play in improving wellbeing. Hence, instead of focusing on specific components of the intervention, change variables were used to explore the effects of variables that can moderate the impact of physical activity on wellbeing. Although there was insufficient evidence to support most of the hypothesized mechanisms underlying the intervention effects; this study sheds light on the need to further investigate such mechanisms to improve the effectiveness of interventions. Tailoring interventions to target specific key mechanisms has been shown to be more cost-effective and lead to positive ripple effects in other domains of functioning and wellbeing. In addition, future studies should aim to target and evaluate different types and sources of social support as both variables have been shown to influence physical activity behaviors (Laird et al., 2016; Tennant et al., 2015). Efforts need to be made to utilize measures that allow for comparisons to be made regarding intervention effects, while observing the relationship between dose, frequency and intensity on effects can also be informative in future intervention designs. Gender also deserves particular attention in the design process, as, studies have shown that girls and boys both need and derive differential benefits from various types of activities. Hence, the setting and types of physical activities provided should be adjusted depending on the targeted outcome (McMahon et al., 2017).

Future studies would benefit from considering youth characteristics when designing interventions as they appear to potentially be moderating factors on their own, such as gender, socioeconomic status, minority status, and other factors not measured in this study such as culture, beliefs, motivations, etc. Similarly, targeting a more discrete age range such as early adolescence as opposed to including younger or older youth could benefit its design to be more developmentally suitable and relevant; in addition it allows for more meaningful comparison with other interventions targeting similar age groups and identify interventions that may be more effective for different phases of development. In addition, including larger sample sizes and assessing intervention outcomes at multiple points in time would enable more rigorous statistical analyses to be performed such as cluster analyses, mediation as well as moderation to look at the more complex roles that particular components might play at different points in time as suggested by (Bauman et al., 2002). Furthermore, while the Connect through P.L.A.Y intervention utilized a multicomponent approach, the current study did not examine the additive impact of targeting parental support, school and staff support as well as values for physical activity and mental health, which all have been shown to provide additional benefits to the success of afterschool interventions (Gortmaker et al., 2012; Thornton et al., 2017). Research on adolescent physical and mental health needs to be prioritized as targeting key factors has been shown have ripple effects in several domains, may help prevent the development of more serious pathologies and has been associated with long-term wellbeing. While this study focused on measuring internalizing symptomatology, utilizing a more encompassing definition of health and increasing

mental and physical wellbeing as opposed to preventing physiological and psychological pathology may present more benefit in the long run (Haworth, Carter, Eley & Plomin, 2017). In conclusion, developing high-quality sustainable interventions that target key social and behavioral mechanisms is a cost-effective approach to support positive youth development and wellbeing, efforts should be geared towards identifying those mechanisms and tailoring them to targeted sample youth characteristics while addressing contextual factors.

## References

- Achenbach, T. M., & Edelbrock, C. S. (1978). The classification of child psychopathology: a review and analysis of empirical efforts. *Psychological bulletin*, *85*(6), 1275.
- Ahn, S., & Fedewa, A. L. (2011). A meta-analysis of the relationship between children's physical activity and mental health. *Journal of pediatric psychology*, *36*(4), 385-397.
- Aldridge, J. M., Fraser, B. J., Fozdar, F., Ala'i, K., Earnest, J., & Afari, E. (2016). Students' perceptions of school climate as determinants of wellbeing, resilience and identity. *Improving Schools*, *19*(1), 5-26.
- Andersen, S. L. (2003). Trajectories of brain development: point of vulnerability or window of opportunity? *Neuroscience & Biobehavioral Reviews*, *27*(1-2), 3-18.
- Anderson, E. R., & Mayes, L. C. (2010). Race/ethnicity and internalizing disorders in youth: A review. *Clinical Psychology Review*, *30*(3), 338-348.
- Bailey, A. P., Hetrick, S. E., Rosenbaum, S., Purcell, R., & Parker, A. G. (2018). Treating depression with physical activity in adolescents and young adults: a systematic review and meta-analysis of randomized controlled trials. *Psychological medicine*, *48*(7), 1068-1083.
- Barkoukis, V., Hagger, M. S., Lambropoulos, G., & Tsoarbatzoudis, H. (2010). Extending the trans-contextual model in physical education and leisure-time contexts:

- Examining the role of basic psychological need satisfaction. *British Journal of Educational Psychology*, 80(4), 647-670.
- Bassett, D. R., John, D., Conger, S. A., Fitzhugh, E. C., & Coe, D. P. (2015). Trends in physical activity and sedentary behaviors of United States youth. *Journal of physical activity and health*, 12(8), 1102-1111.
- Bauman, A. E., Sallis, J. F., Dzewaltowski, D. A., & Owen, N. (2002). Toward a better understanding of the influences on physical activity: the role of determinants, correlates, causal variables, mediators, moderators, and confounders. *American journal of preventive medicine*, 23(2), 5-14.
- Bélanger, M., Casey, M., Cormier, M., Filion, A. L., Martin, G., Aubut, S., Chouinard, P., Savoie, S.P., & Beauchamp, J. (2011). Maintenance and decline of physical activity during adolescence: insights from a qualitative study. *International Journal of Behavioral Nutrition and Physical Activity*, 8(1), 117.
- Biddle, S. J., & Asare, M. (2011). Physical activity and mental health in children and adolescents: a review of reviews. *British journal of sports medicine*, 45(11), 886-895.
- Biddle, S. J., Ciaccioni, S., Thomas, G., & Vergeer, I. (2018). Physical activity and mental health in children and adolescents: An updated review of reviews and an analysis of causality. *Psychology of Sport and Exercise*.
- Bitsko, R. H., Holbrook, J. R., Ghandour, R. M., Blumberg, S. J., Visser, S. N., Perou, R., & Walkup, J. T. (2018). Epidemiology and Impact of Health Care Provider–

- Diagnosed Anxiety and Depression Among US Children. *Journal of Developmental & Behavioral Pediatrics*, 39(5), 395-403.
- Bradley, R. H., & Corwyn, R. F. (2002). Socioeconomic status and child development. *Annual review of psychology*, 53(1), 371-399.
- Brown, B. B., & Larson, J. (2009). Peer relationships in adolescence. *Handbook of adolescent psychology*.
- Brown, H. E., Pearson, N., Braithwaite, R. E., Brown, W. J., & Biddle, S. J. (2013). Physical activity interventions and depression in children and adolescents. *Sports medicine*, 43(3), 195-206.
- Burghy, C. A., Stodola, D. E., Ruttle, P. L., Molloy, E. K., Armstrong, J. M., Oler, J. A., Fox, M.E., Hayes, A.S., Kalin, N.H., Essex, M.J., & Davidson, R. J. (2012). Developmental pathways to amygdala-prefrontal function and internalizing symptoms in adolescence. *Nature neuroscience*, 15(12), 1736.
- Cain, K. L., Gavand, K. A., Conway, T. L., Saelens, B. E., Frank, L. D., Kerr, J., King, A.C., Schipperijn, J., & Sallis, J. F. (2015). Accelerometer Compliance Rates And Sample Demographics. *Medicine & Science in Sports & Exercise*, 47(5S), 109-110.
- Cain, K. L., & Geremia, C. M. (2011). Accelerometer data collection and scoring manual. Accessed Dec.
- Calfas, K. J., & Taylor, W. C. (1994). Effects of physical activity on psychological variables in adolescents. *Pediatric exercise science*, 6(4), 406-423.
- Casey, B. J., Jones, R. M., & Hare, T. A. (2008). The adolescent brain. *Annals of the New York Academy of Sciences*, 1124(1), 111-126.

- Caspersen, C. J., Pereira, M. A., & Curran, K. M. (2000). Changes in physical activity patterns in the United States, by sex and cross-sectional age. *Medicine & Science in Sports & Exercise*, 32(9), 1601-1609.
- Catellier, D. J., Hannan, P. J., Murray, D. M., Addy, C. L., Conway, T. L., Yang, S., & Rice, J. C. (2005). Imputation of missing data when measuring physical activity by accelerometry. *Medicine and science in sports and exercise*, 37(11 Suppl), S555.
- Chan, J. S., Liu, G., Liang, D., Deng, K., Wu, J., & Yan, J. H. (2018). Special Issue—Therapeutic Benefits of Physical Activity for Mood: A Systematic Review on the Effects of Exercise Intensity, Duration, and Modality. *The Journal of psychology*, 1-24.
- Chavira, D. A., Garland, A. F., Daley, S., & Hough, R. (2008). The impact of medical comorbidity on mental health and functional health outcomes among children with anxiety disorders. *Journal of developmental and behavioral pediatrics: JDBP*, 29(5), 394.
- Chou, T., Asnaani, A., & Hofmann, S. G. (2012). Perception of racial discrimination and psychopathology across three US ethnic minority groups. *Cultural Diversity and Ethnic Minority Psychology*, 18(1), 74.
- Cicchetti, D., & Toth, S. L. (1991). A developmental perspective on internalizing and externalizing disorders. *Internalizing and externalizing expressions of dysfunction*, 2, 1-19.
- Christiansen, L. B., Lund-Cramer, P., Brondeel, R., Smedegaard, S., Holt, A. D., & Skovgaard, T. (2018). Improving children's physical self-perception through a

- school-based physical activity intervention: The Move for Well-being in School study. *Mental Health and Physical Activity*, 14, 31-38.
- Cicchetti, D., & Toth, S. L. (2009). The past achievements and future promises of developmental psychopathology: The coming of age of a discipline. *Journal of Child Psychology and Psychiatry*, 50(1-2), 16-25.
- Coleman, K. J., Geller, K. S., Rosenkranz, R. R., & Dzewaltowski, D. A. (2008). Physical activity and healthy eating in the after-school environment. *Journal of School Health*, 78(12), 633-640.
- Colman, I., Zeng, Y., McMartin, S. E., Naicker, K., Atallahjan, A., Weeks, M., Senthilselvan, A., & Galambos, N. L. (2014). Protective factors against depression during the transition from adolescence to adulthood: findings from a national Canadian cohort. *Preventive medicine*, 65, 28-32.
- Costello, E. J., & Maughan, B. (2015). Annual research review: optimal outcomes of child and adolescent mental illness. *Journal of Child Psychology and Psychiatry*, 56(3), 324-341.
- Craggs, C., Corder, K., Van Sluijs, E. M., & Griffin, S. J. (2011). Determinants of change in physical activity in children and adolescents: a systematic review. *American journal of preventive medicine*, 40(6), 645-658.
- Currie, C., Zanotti, C., Morgan, A., Currie, D., De Looze, M., Roberts, C., Samdal, O., Smith, O.R., & Barnekow, V. (2009). Social determinants of health and well-being among young people. *Health Behaviour in School-aged Children (HBSC) study: international report from the, 2010*, 271.

- Dahl, R. E. (2004). Adolescent brain development: a period of vulnerabilities and opportunities. Keynote address. *Annals of the New York Academy of Sciences, 1021*(1), 1-22.
- Davis, J., & Farbman, D. A. (2002). Schools alone are not enough: After-school programs and education reform in Boston. *New Directions for Student Leadership, 2002*(94), 65-88.
- Dishman, R. K., Dowda, M., Mclver, K. L., Saunders, R. P., & Pate, R. R. (2017). Naturally-occurring changes in social-cognitive factors modify change in physical activity during early adolescence. *PloS one, 12*(2), e0172040.
- Dumith, S. C., Gigante, D. P., Domingues, M. R., & Kohl III, H. W. (2011). Physical activity change during adolescence: a systematic review and a pooled analysis. *International journal of epidemiology, 40*(3), 685-698.
- Dumont, M., & Provost, M. A. (1999). Resilience in adolescents: Protective role of social support, coping strategies, self-esteem, and social activities on experience of stress and depression. *Journal of youth and adolescence, 28*(3), 343-363.
- Duncan, S. C., Duncan, T. E., Strycker, L. A., & Chaumeton, N. R. (2007). A cohort-sequential latent growth model of physical activity from ages 12 to 17 years. *Annals of Behavioral Medicine, 33*(1), 80-89.
- Durlak, J. A., & Weissberg, R. P. (2007). The Impact of After-School Programs that Promote Personal and Social Skills. *Collaborative for academic, social, and emotional learning (NJ1)*.

- Durlak, J. A., Weissberg, R. P., & Pachan, M. (2010). A meta-analysis of after-school programs that seek to promote personal and social skills in children and adolescents. *American journal of community psychology, 45*(3-4), 294-309.
- Fan, X., Miller, B. C., Park, K. E., Winward, B. W., Christensen, M., Grotevant, H. D., & Tai, R. H. (2006). An exploratory study about inaccuracy and invalidity in adolescent self-report surveys. *Field Methods, 18*(3), 223-244.
- Farre, A., & Rapley, T. (2017). The New Old (and Old New) Medical Model: Four Decades Navigating the Biomedical and Psychosocial Understandings of Health and Illness. In *Healthcare* (Vol. 5, No. 4, p. 88). Multidisciplinary Digital Publishing Institute.
- Gould, M. S., Greenberg, T. E. D., Velting, D. M., & Shaffer, D. (2003). Youth suicide risk and preventive interventions: a review of the past 10 years. *Journal of the American Academy of Child & Adolescent Psychiatry, 42*(4), 386-405.
- Goodman, R., Ford, T., Richards, H., Gatward, R., & Meltzer, H. (2000). The Development and Well-Being Assessment: description and initial validation of an integrated assessment of child and adolescent psychopathology. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 41*(5), 645-655.
- Goodman, A., & Goodman, R. (2009). Strengths and difficulties questionnaire as a dimensional measure of child mental health. *Journal of the American Academy of Child & Adolescent Psychiatry, 48*(4), 400-403.
- Goodman, A., Lamping, D. L., & Ploubidis, G. B. (2010). When to use broader internalizing and externalizing subscales instead of the hypothesized five

- subscales on the Strengths and Difficulties Questionnaire (SDQ): data from British parents, teachers and children. *Journal of abnormal child psychology*, 38(8), 1179-1191.
- Goodman, R., Meltzer, H., & Bailey, V. (1998). The Strengths and Difficulties Questionnaire: A pilot study on the validity of the self-report version. *European child & adolescent psychiatry*, 7(3), 125-130.
- Gortmaker, S. L., Lee, R. M., Mozaffarian, R. S., Sobol, A. M., Nelson, T. F., Roth, B. A., & Wiecha, J. L. (2012). Effect of an after-school intervention on increases in children's physical activity. *Medicine & Science in Sports & Exercise*, 44(3), 450-457.
- Halfon, N., & Hochstein, M. (2002). Life course health development: an integrated framework for developing health, policy, and research. *The Milbank Quarterly*, 80(3), 433-479.
- Halfon, N., Larson, K., & Slusser, W. (2013). Associations between obesity and comorbid mental health, developmental, and physical health conditions in a nationally representative sample of US children aged 10 to 17. *Academic pediatrics*, 13(1), 6-13.
- Haworth, C. M., Carter, K., Eley, T. C., & Plomin, R. (2017). Understanding the genetic and environmental specificity and overlap between well-being and internalizing symptoms in adolescence. *Developmental science*, 20(2), e12376.

- Hogue, C. M., Fry, M. D., & Fry, A. C. (2017). The differential impact of motivational climate on adolescents' psychological and physiological stress responses. *Psychology of Sport and Exercise, 30*, 118-127.
- Hohepa, M., Scragg, R., Schofield, G., Kolt, G. S., & Schaaf, D. (2007). Social support for youth physical activity: Importance of siblings, parents, friends and school support across a segmented school day. *International Journal of Behavioral Nutrition and Physical Activity, 4*(1), 54.
- Hox, J. (1998). Multilevel modeling: When and why. In *Classification, data analysis, and data highways* (pp. 147-154). Springer, Berlin, Heidelberg.
- John, D., & Freedson, P. (2012). ActiGraph and Actical physical activity monitors: a peek under the hood. *Medicine and science in sports and exercise, 44*(1 Suppl 1), S86.
- Klasen, F., Otto, C., Kriston, L., Patalay, P., Schlack, R., Ravens-Sieberer, U., & Bella Study Group. (2015). Risk and protective factors for the development of depressive symptoms in children and adolescents: results of the longitudinal BELLA study. *European child & adolescent psychiatry, 24*(6), 695-703.
- Kimmel, P. L., Fwu, C. W., Abbott, K. C., Ratner, J., & Eggers, P. W. (2016). Racial disparities in poverty account for mortality differences in US Medicare beneficiaries. *SSM-population health, 2*, 123-129.
- Kraemer, H. C., & Blasey, C. M. (2004). Centering in regression analyses: a strategy to prevent errors in statistical inference. *International journal of methods in psychiatric research, 13*(3), 141-151.

- Kriemler, S., Meyer, U., Martin, E., Van Sluijs, E. M., Andersen, L. B., & Martin, B. W. (2011). Effect of school-based interventions on physical activity and fitness in children and adolescents: a review of reviews and systematic update. *British journal of sports medicine, 45*(11), 923-930.
- Laird, Y., Fawkner, S., Kelly, P., McNamee, L., & Niven, A. (2016). The role of social support on physical activity behaviour in adolescent girls: a systematic review and meta-analysis. *International Journal of Behavioral Nutrition and Physical Activity, 13*(1), 79.
- Leonardelli, G. J., Pickett, C. L., & Brewer, M. B. (2010). Optimal distinctiveness theory: A framework for social identity, social cognition, and intergroup relations. In *Advances in experimental social psychology* (Vol. 43, pp. 63-113). Academic Press.
- Liem, E. T., Sauer, P. J., Oldehinkel, A. J., & Stolk, R. P. (2008). Association between depressive symptoms in childhood and adolescence and overweight in later life: review of the recent literature. *Archives of pediatrics & adolescent medicine, 162*(10), 981-988.
- Little, P., Wimer, C., & Weiss, H. B. (2008). After school programs in the 21st century: Their potential and what it takes to achieve it. *Issues and opportunities in out-of-school time evaluation, 10*(1-12).
- Lobstein, T., Jackson-Leach, R., Moodie, M. L., Hall, K. D., Gortmaker, S. L., Swinburn, B. A., James, W.P.T., Wang, Y., & McPherson, K. (2015). Child and adolescent obesity: part of a bigger picture. *The Lancet, 385*(9986), 2510-2520.

- Liu, J., Chen, X., & Lewis, G. (2011). Childhood internalizing behavior: analysis and implications. *Journal of psychiatric and mental health nursing, 18*(10), 884-894.
- Lubans, D., Richards, J., Hillman, C., Faulkner, G., Beauchamp, M., Nilsson, M., Kelly, P., Smith, J., Raine, L., & Biddle, S. (2016). Physical activity for cognitive and mental health in youth: a systematic review of mechanisms. *Pediatrics, 138*(3), e20161642.
- Maas, C. J., & Hox, J. J. (2005). Sufficient sample sizes for multilevel modeling. *Methodology, 1*(3), 86-92.
- Malecki, C. K., & Demaray, M. K. (2006). Social support as a buffer in the relationship between socioeconomic status and academic performance. *School Psychology Quarterly, 21*(4), 375.
- Mansournia, M. A., Higgins, J. P., Sterne, J. A., & Hernán, M. A. (2017). Biases in randomized trials: a conversation between trialists and epidemiologists. *Epidemiology (Cambridge, Mass.), 28*(1), 54.
- Martel, M. M. (2013). Sexual selection and sex differences in the prevalence of childhood externalizing and adolescent internalizing disorders. *Psychological bulletin, 139*(6), 1221.
- McKenzie, T. L. (2006). SOPLAY system for observing play and leisure activity in youth, description and procedures manual. *San Diego, CA: Universidad Estatal de San Diego.*
- McKenzie, T. L. (2002). System for observing play and leisure activity in youth (SOPLAY). *San Diego: San Diego State University.*

- McKenzie, T. L., Marshall, S. J., Sallis, J. F., & Conway, T. L. (2000). Leisure-time physical activity in school environments: an observational study using SOPLAY. *Preventive medicine, 30*(1), 70-77.
- McMahon, E. M., Corcoran, P., O'Regan, G., Keeley, H., Cannon, M., Carli, V., Wasserman, C., Hadlaczky, G., Sarchiapone, M., Apter, A. & Balazs, J. (2017). Physical activity in European adolescents and associations with anxiety, depression and well-being. *European child & adolescent psychiatry, 26*(1), 111-122.
- Mellano, K. T., & Smith, A. L. (2017). Peer-created motivational climate and motivation of adolescent soccer players. *Journal of Exercise, Movement, and Sport, 49*(1), 110.
- Mendonça, G., Cheng, L. A., Mélo, E. N., & de Farias Júnior, J. C. (2014). Physical activity and social support in adolescents: a systematic review. *Health education research, 29*(5), 822-839.
- Metcalf, B. S., Hosking, J., Jeffery, A. N., Henley, W. E., & Wilkin, T. (2015). Exploring the adolescent fall in physical activity: a 10-yr cohort study (EarlyBird 41).
- Miller, B. M. (2001). The promise of after-school programs. *Educational Leadership, 58*(7), 6-12.
- Mitchell, J. A., Pate, R. R., España-Romero, V., O'Neill, J. R., Dowda, M., & Nader, P. R. (2013). Moderate-To-vigorous physical activity is associated with decreases in body mass index from ages 9 to 15 years. *Obesity, 21*(3), E280-E286.

- Mojtabai, R., Olfson, M., & Han, B. (2016). National trends in the prevalence and treatment of depression in adolescents and young adults. *Pediatrics*, e20161878.
- Motta, R. (2018). The role of exercise in reducing PTSD, and negative emotional states. In *Psychology of Health-Biopsychosocial Approach*. IntechOpen.
- Motta, R. W., McWilliams, M. E., Schwartz, J. T., & Cavera, R. S. (2012). The role of exercise in reducing childhood and adolescent PTSD, anxiety, and depression. *Journal of Applied School Psychology*, 28(3), 224-238.
- Nelson, E. E., Leibenluft, E., McClure, E. B., & Pine, D. S. (2005). The social re-orientation of adolescence: a neuroscience perspective on the process and its relation to psychopathology. *Psychological medicine*, 35(2), 163-174.
- Ntoumanis, Nikos, Ian M. Taylor, and Cecilie Thøgersen-Ntoumani. "A longitudinal examination of coach and peer motivational climates in youth sport: Implications for moral attitudes, well-being, and behavioral investment." *Developmental Psychology* 48, no. 1 (2012): 213.
- Ntoumanis, N., & Vazou, S. (2005). Peer motivational climate in youth sport: Measurement development and validation. *Journal of Sport and Exercise Psychology*, 27(4), 432-455.
- O'Connor, K. L., Dolphin, L., Fitzgerald, A., & Dooley, B. (2016). Modeling problem behaviors in a nationally representative sample of adolescents. *Journal of adolescence*, 50, 6-15.

- Parfitt, G., Pavey, T., & Rowlands, A. V. (2009). Children's physical activity and psychological health: the relevance of intensity. *Acta Paediatrica*, *98*(6), 1037-1043.
- Peer, S. C. I. (2006). Peer relationships, child development, and adjustment: A developmental psychopathology perspective. *Developmental psychopathology, Theory and method*, *1*, 419.
- Penedo, F. J., & Dahn, J. R. (2005). Exercise and well-being: a review of mental and physical health benefits associated with physical activity. *Current opinion in psychiatry*, *18*(2), 189-193.
- Prevo, L., Stessen, K., Kremers, S., Wassenberg, M., & Jansen, M. (2018). Shining light inside the tunnel: using photovoice as a strategy to define the needs for health promotion among families of low socioeconomic status. *International journal of qualitative studies on health and well-being*, *13*(1), 1542909.
- Prince, S. A., Adamo, K. B., Hamel, M. E., Hardt, J., Gorber, S. C., & Tremblay, M. (2008). A comparison of direct versus self-report measures for assessing physical activity in adults: a systematic review. *International Journal of Behavioral Nutrition and Physical Activity*, *5*(1), 56.
- Puyau, M. R., Adolph, A. L., Vohra, F. A., Zakeri, I., & Butte, N. F. (2004). Prediction of activity energy expenditure using accelerometers in children. *Medicine & Science in Sports & Exercise*, *36*(9), 1625-1631.

- Rafferty, R., Breslin, G., Brennan, D., & Hassan, D. (2016). A systematic review of school-based physical activity interventions on children's wellbeing. *International review of sport and exercise psychology, 9*(1), 215-230.
- Raudsepp, L., & Viira, R. (2008). Changes in physical activity in adolescent girls: a latent growth modelling approach. *Acta Paediatrica, 97*(5), 647-652.
- Reisner, E. R., Vandell, D. L., Pechman, E. M., Pierce, K. M., Brown, B. B., & Bolt, D. (2007). Charting the Benefits of High-Quality After-School Program Experiences: Evidence from New Research on Improving After-School Opportunities for Disadvantaged Youth. *Policy Studies Associates, Inc.*
- Richardson, J. L., Radziszewska, B., Dent, C. W., & Flay, B. R. (1993). Relationship between after-school care of adolescents and substance use, risk taking, depressed mood, and academic achievement. *Pediatrics, 92*(1), 32-38.
- Riggs, N. R., & Greenberg, M. T. (2004). After-school youth development programs: A developmental-ecological model of current research. *Clinical Child and Family Psychology Review, 7*(3), 177-190.
- Roffey, S. (2013). Inclusive and exclusive belonging: The impact on individual and community wellbeing. *Educational and Child Psychology, 30*(1), 38-49.
- Roffman, J. G., Pagano, M. E., & Hirsch, B. J. (2001). Youth functioning and experiences in inner-city after-school programs among age, gender, and race groups. *Journal of Child and Family Studies, 10*(1), 85-100.

- Rudolph, K. D., Lambert, S. F., Clark, A. G., & Kurlakowsky, K. D. (2001). Negotiating the transition to middle school: the role of self-regulatory processes. *Child development, 72*(3), 929-946.
- Rueger, S. Y., Malecki, C. K., Pyun, Y., Aycocock, C., & Coyle, S. (2016). A meta-analytic review of the association between perceived social support and depression in childhood and adolescence. *Psychological Bulletin, 142*(10), 1017.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American psychologist, 55*(1), 68.
- Schroeder, S. A. (2007). We can do better—improving the health of the American people. *New England Journal of Medicine, 357*(12), 1221-1228.
- Seymour, H., Reid, G., & Bloom, G. A. (2009). Friendship in inclusive physical education. *Adapted Physical Activity Quarterly, 26*(3), 201-219.
- Shephard, R. J. (2003). Limits to the measurement of habitual physical activity by questionnaires. *British journal of sports medicine, 37*(3), 197-206.
- Smith, A. L. (2003). Peer relationships in physical activity contexts: A road less traveled in youth sport and exercise psychology research. *Psychology of sport and Exercise, 4*(1), 25-39.
- Spruit, A., Assink, M., van Vugt, E., van der Put, C., & Stams, G. J. (2016). The effects of physical activity interventions on psychosocial outcomes in adolescents: A meta-analytic review. *Clinical psychology review, 45*, 56-71.

- Steinberg, L. (2001). We know some things: Parent–adolescent relationships in retrospect and prospect. *Journal of research on adolescence, 11*(1), 1-19.
- Stolk, Y., Kaplan, I., & Szwarc, J. (2017). Review of the strengths and difficulties questionnaire translated into languages spoken by children and adolescents of refugee background. *International journal of methods in psychiatric research, 26*(4), e1568.
- Strong, W. B., Malina, R. M., Blimkie, C. J., Daniels, S. R., Dishman, R. K., Gutin, B., Hergenroeder, A.C., Must, A., Nixon, P.A., Pivarnik, J.M, & Rowland, T. (2005). Evidence based physical activity for school-age youth. *The Journal of pediatrics, 146*(6), 732-737.
- Stroud, L. R., Papandonatos, G. D., D'Angelo, C. M., Brush, B., & Lloyd-Richardson, E. E. (2017). Sex differences in biological response to peer rejection and performance challenge across development: A pilot study. *Physiology & behavior, 169*, 224-233.
- Tennant, J. E., Demaray, M. K., Malecki, C. K., Terry, M. N., Clary, M., & Elzinga, N. (2015). Students' ratings of teacher support and academic and social–emotional well-being. *School psychology quarterly, 30*(4), 494.
- Thapar, A., Collishaw, S., Pine, D. S., & Thapar, A. K. (2012). Depression in adolescence. *The Lancet, 379*(9820), 1056-1067.
- Thornton, C. M., Cain, K. L., Conway, T. L., Kerr, J., Saelens, B. E., Frank, L. D., Glanz, K., & Sallis, J. F. (2017). Relation of adolescents' physical activity to after-school recreation environment. *Journal of physical activity and health, 14*(5), 382-388.

- Troiano, R. P., Berrigan, D., Dodd, K. W., Masse, L. C., Tilert, T., & McDowell, M. (2008). Physical activity in the United States measured by accelerometer. *Medicine and science in sports and exercise*, *40*(1), 181.
- Troiano, R. P., McClain, J. J., Brychta, R. J., & Chen, K. Y. (2014). Evolution of accelerometer methods for physical activity research. *Br J Sports Med*, *48*(13), 1019-1023.
- Trost, S. G., Pate, R. R., Freedson, P. S., Sallis, J. F., & Taylor, W. C. (2000). Using objective physical activity measures with youth: how many days of monitoring are needed?. *Medicine & Science in Sports & Exercise*, *32*(2), 426.
- Twenge, J. M., Joiner, T. E., Rogers, M. L., & Martin, G. N. (2018). Increases in depressive symptoms, suicide-related outcomes, and suicide rates among US adolescents after 2010 and links to increased new media screen time. *Clinical Psychological Science*, *6*(1), 3-17.
- U.S. Department of Health and Human Services. (2018). Physical activity guidelines for Americans, 2<sup>nd</sup> Edition. Retrieved from <http://www.health.gov/paguidelines/guidelines/default.aspx>.
- Van Buuren, S., & Groothuis-Oudshoorn, K. (2010). Mice: Multivariate imputation by chained equations in R. *Journal of statistical software*, 1-68.
- Van de Pavert, I., Sunderland, M., Luijten, M., Slade, T., & Teesson, M. (2017). The general relationship between internalizing psychopathology and chronic physical health conditions: a population-based study. *Social psychiatry and psychiatric epidemiology*, *52*(10), 1257-1265.

- Van Voorhees, B. W., Paunesku, D., Kuwabara, S. A., Basu, A., Gollan, J., Hankin, B. L., Melkonian, S. & Reinecke, M. (2008). Protective and vulnerability factors predicting new-onset depressive episode in a representative of US adolescents. *Journal of Adolescent Health, 42*(6), 605-616.
- Wallhead, T. L., Garn, A. C., & Vidoni, C. (2013). Sport Education and social goals in physical education: relationships with enjoyment, relatedness, and leisure-time physical activity. *Physical Education and Sport Pedagogy, 18*(4), 427-441.
- Wells, S. L., Kipping, R. R., Jago, R., Brown, J., Hucker, D., Blackett, A., & Lawlor, D. A. (2013). Characteristics associated with requested and required accelerometer wear in children. *BMJ open, 3*(8), e003402.
- Wilson, D. K. (2015). Behavior matters: The relevance, impact, and reach of behavioral medicine. *Annals of behavioral medicine, 49*(1), 40-48.
- Wentzel, K. R., Donlan, A., & Morrison, D. (2012). Peer relationships and social motivational processes. In A. M. Ryan & G. W. Ladd (Eds.), *Adolescence and education. Peer relationships and adjustment at school* (pp. 79-105). Charlotte, NC, US: IAP Information Age Publishing.
- Wright, A. G., Krueger, R. F., Hobbs, M. J., Markon, K. E., Eaton, N. R., & Slade, T. (2013). The structure of psychopathology: toward an expanded quantitative empirical model. *Journal of Abnormal Psychology, 122*(1), 281.
- Wu, P., Hoven, C. W., Bird, H. R., Moore, R. E., Cohen, P., Alegria, M., Dulcan, M. K, Goodman, S. H, Horwitz, S. M., Lichtman, J. H & Narrow, W. E. (1999). Depressive and disruptive disorders and mental health service utilization in children and

- adolescents. *Journal of the American Academy of Child & Adolescent Psychiatry*, 38(9), 1081-1090.
- Young, M. D., Plotnikoff, R. C., Collins, C. E., Callister, R., & Morgan, P. J. (2014). Social cognitive theory and physical activity: A systematic review and meta-analysis. *Obesity Reviews*, 15(12), 983-995.
- Zarrett, N., & Eccles, J. (2006). The passage to adulthood: Challenges of late adolescence. *New directions for youth development*, 2006(111), 13-28.
- Zarrett, N., Fay, K., Li, Y., Carrano, J., Phelps, E., & Lerner, R. M. (2009). More than child's play: Variable-and pattern-centered approaches for examining effects of sports participation on youth development. *Developmental psychology*, 45(2), 368.
- Zarrett, N., Sorensen, C., & Skiles, B. (2013). Environmental and social-motivational contextual factors related to youth physical activity: systematic observations of summer day camps. *International Journal of Behavioral Nutrition and Physical Activity*, 10(1), 63.
- Zarrett, N., Sorensen, C., & Cook, B. S. (2015). Physical and social-motivational contextual correlates of youth physical activity in underresourced afterschool programs. *Health Education & Behavior*, 42(4), 518-529.

## Appendix A: Measures

### Strengths and Difficulties Questionnaire (SDQ) (Internalizing Subscales)

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

***Please choose which the most correct statement about you is.***

#### 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 |

### Social Support for Exercise Habits Scale

1 = Never          2 = Rarely          3 = A few times          4 = Often          5 = Very Often

***Rate how often your friends have said or done what is described during the past month.***

- |  |   |   |   |   |   |
|--|---|---|---|---|---|
| 1. During the past month my friends reminded me to be active (to “go outside and play”)                | 1 | 2 | 3 | 4 | 5 |
| 2. During the past month my friends encouraged me to be physically active                              | 1 | 2 | 3 | 4 | 5 |
| 3. During the past month my friends asked me for ideas on how they can get more active?                | 1 | 2 | 3 | 4 | 5 |
| 4. During the past month my friends talked about how much they like to do physical activities/exercise | 1 | 2 | 3 | 4 | 5 |

### Peer Motivational Climate in Youth Sport Questionnaire (PeerMCYSQ)

1 = Completely False 2 = False much of the time 3 = Sometimes true, sometimes false  
4 = True much of the time 5 = Completely true

#### ***During the after school program***

1. most students encourage each other to improve 1 2 3 4 5
2. most students teach each other new things 1 2 3 4 5
3. most students give helpful advice to each other on how to improve after mistakes 1 2 3 4 5
4. most students work together to improve the skills they don't do well 1 2 3 4 5
5. most students help each other improve 1 2 3 4 5
6. most students offer to help others learn new skills 1 2 3 4 5
7. most students feel like the other students allow them to be themselves and play whatever activities they would like to play 1 2 3 4 5
8. most students find positive things to say to everyone 1 2 3 4 5
9. most students try to get to know all the other students in the program 1 2 3 4 5
10. most students feel comfortable with all other students in the program 1 2 3 4 5
11. most students care about everyone's opinion 1 2 3 4 5
12. most students make all other students in the program feel important or valued 1 2 3 4 5
13. most students make all other students in the program feel accepted 1 2 3 4 5
14. most students set a good example for trying their hardest and being the best they can be 1 2 3 4 5
15. most students praise students who try hard 1 2 3 4 5
16. most students are pleased when the other students try hard 1 2 3 4 5
17. most students feel free to express their opinion to other students 1 2 3 4 5
18. most students encourage other students in the program to try their hardest 1 2 3 4 5
19. most students encourage other students in the program to keep trying after they make a mistake 1 2 3 4 5
20. most students try to do better than the other students at the physical activities 1 2 3 4 5
21. most students look pleased when they do better than the other students in the program 1 2 3 4 5
22. most students want to play with only those students who are best at the activity/sport 1 2 3 4 5
23. most students only praise the students who are the best at the activity 1 2 3 4 5
24. most students care most about the opinions of the students who do the best at the activities 1 2 3 4 5
25. most students think that good teammates are those who perform a task successfully 1 2 3 4 5
26. most students feel pressure to play like the most capable players in the program 1 2 3 4 5
27. most students want to be with the most successful teammates 1 2 3 4 5

### Motivational Climate Observation Tool for Physical Activity (MCOT-PA)

Date \_\_\_\_\_ Program \_\_\_\_\_ Observer \_\_\_\_\_ Time start \_\_\_\_\_ Time end \_\_\_\_\_  
 Temp/Weather \_\_\_\_\_/\_\_\_\_\_

Interval	Student Activity	Group Size	Peer Interaction	Staff Interaction	Area/Zone, Activity
----------	------------------	------------	------------------	-------------------	---------------------

ID #	# Staff	Equipment: Y N	Time start	Time end	
1	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	Area: _____
2	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
3	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
4	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
5	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	Activity: _____
6	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	

Climate Cr AuS AuU He MA In C DpP DpC # program staff # program staff engaging

ID #	# Staff	Equipment: Y N	Time start	Time end	
1	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	Area: _____
2	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
3	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
4	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
5	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	Activity: _____
6	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	

Climate Cr AuS AuU He MA In C DpP DpC # program staff # program staff engaging

ID #	# Staff	Equipment: Y N	Time start	Time end	
1	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	Area: _____
2	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
3	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
4	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
5	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	Activity: _____
6	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	

Climate Cr AuS AuU He MA In C DpP DpC # program staff # program staff engaging

ID #	# Staff	Equipment: Y N	Time start	Time end	
1	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	Area: _____
2	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
3	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
4	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	
5	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	Activity: _____
6	1 2 3 4 5	A S M L	N Pb Pv Nb Nv I	I ii ip O D M T Ob	

Climate Cr AuS AuU He MA In C DpP DpC # program staff # program staff engaging

## Motivational Climate Observation Tool for Physical Activity Codes (MCOT-PA)

### Activity Level

1	Lying	
2	Sitting	<ul style="list-style-type: none"> <li>If sitting or transitioning from lie to sit</li> </ul>
3	Standing	<ul style="list-style-type: none"> <li>On all fours, kneeling, transitions to stand</li> </ul>
4	Walking	<ul style="list-style-type: none"> <li>Dribbling, moving slowly</li> </ul>
5	Very Active	<ul style="list-style-type: none"> <li>Running, jogging, fast movement, anything more than ordinary walking</li> </ul>

### Group Size

A	Alone	<ul style="list-style-type: none"> <li>Group size is whole group playing game (all teams)</li> <li>Include staff IF participating</li> </ul>
S	Small (2-4)	
M	Medium (5-9)	
L	Large (10+)	

### Peer Interactions

N	No interaction	<ul style="list-style-type: none"> <li>Just playing the game</li> <li>Does not speak/interact directly</li> </ul>
PB	Positive behaviors	<ul style="list-style-type: none"> <li>Helps peers, spotting, retrieves equipment</li> <li>High fives, links arms, holds hands</li> </ul>
PB	Positive verbal	<ul style="list-style-type: none"> <li>Praises peer, thanks, thumbs up, claps, provides instruction</li> </ul>
NB	Negative behaviors	<ul style="list-style-type: none"> <li>Do not include typical game behaviors (defending, blocking, tagging)</li> <li>Hitting, shoving, bumping, threatening</li> <li>Intentionally plays game wrong, takes equipment from others</li> </ul>
NV	Negative verbal	<ul style="list-style-type: none"> <li>Name calling, teasing, cursing, sarcasm, gesturing, refusing</li> </ul>
I	Ignores	<ul style="list-style-type: none"> <li>Non-action, child ignores negative interaction by peer</li> </ul>

### Staff Interactions

I	Promotes PA	<ul style="list-style-type: none"> <li>Begin, go ahead, roll the ball, chase them</li> </ul>
ii	Increases PA	<ul style="list-style-type: none"> <li>Go, go, go; hustle; try to do it 15 times</li> </ul>
ip	Praises PA	<ul style="list-style-type: none"> <li>Great job; good communication</li> </ul>
O	Promotes out-of-program PA	<ul style="list-style-type: none"> <li>Go home and play this with your friends,</li> <li>Remember to practice at home</li> </ul>
D	Demonstrates	<ul style="list-style-type: none"> <li>Staff is engaged and playing with the kids</li> </ul>
Ob	Observes	<ul style="list-style-type: none"> <li>Staff watches but does not interact/speak</li> </ul>
M	Manages PA	<ul style="list-style-type: none"> <li>Organizes team, instructions</li> <li>Related to game, put the balls back</li> </ul>
T	Other-task	<ul style="list-style-type: none"> <li>Disengaged, talking to parents, texting</li> </ul>
None		<ul style="list-style-type: none"> <li>There is engagement with the students but it is not PA related, management not related to the game</li> </ul>

### Climate

<b>Cr</b>	<b>Clarity of rules</b>	<ul style="list-style-type: none"> <li>• PA expectations and rules are understood</li> </ul>
<b>AuS</b>	<b>Structured autonomy</b>	<ul style="list-style-type: none"> <li>• If the students are given choice of 2+ organized activities</li> </ul>
<b>AuU</b>	<b>Unstructured autonomy</b>	<ul style="list-style-type: none"> <li>• Unguided freeplay</li> </ul>
<b>He</b>	<b>High engagement</b>	<ul style="list-style-type: none"> <li>• Fun, not too easy or too difficult</li> <li>• Students are laughing, smiling, not bored</li> </ul>
<b>Ma</b>	<b>Mastery-focused</b>	<ul style="list-style-type: none"> <li>• Activity focuses on mastering skills not winning, shooting or throwing drills</li> </ul>
<b>In</b>	<b>Inclusion</b>	<ul style="list-style-type: none"> <li>• Activities are cooperative, teamwork</li> <li>• No kids sitting out by choice or exclusion</li> </ul>
<b>C</b>	<b>Competitive</b>	<ul style="list-style-type: none"> <li>• Kids are acting competitively</li> <li>• Regardless of if game is intended to be competitive</li> </ul>
<b>DP-p</b>	<b>Punitive discipline</b>	<ul style="list-style-type: none"> <li>• Punishment, running lap</li> <li>• Staff stops play</li> </ul>
<b>DP-c</b>	<b>Constructive discipline</b>	<ul style="list-style-type: none"> <li>• Allows play to continue, switches teams</li> <li>• Encourages better behavior</li> </ul>