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Impact of Exercise on Depression and Anxiety in Adolescents with Complex Trauma Living in Residential Treatment Centers

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Walden University
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Abstract

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MS, Walden University, 2015

BS, Bemidji State University, 2006

Dissertation Submitted in Partial Fulfillment

of the Requirements for the Degree of

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Abstract

Depression and anxiety disorders are two of the most frequently reported mental health problems for adolescents entering Residential Treatment Centers (RTCs). Many adolescents in RTCs also have a higher rate of traumatic experiences than their peers. Traumatized children frequently develop mental illness disorders of depression and anxiety. Based on the theoretical foundations provided by attachment theory and social cognitive theory, this pilot study, using secondary data, observed the relationship between exercise participation, depression, trauma, and anxiety for 11 youth in an upper Midwest RTC. Adolescents with higher initial depression and anxiety scores tended to exercise less during RTC than those with lower scores. Depression ($r = -.34$, $n = 11$, $p = .31$), anxiety ($r = -.34$, $n = 11$, $p = .31$), and trauma ($r = -.08$, $n = 11$, $p = .83$) levels were negatively correlated with exercise participation, although results were not statistically significant. The pilot study also investigated the effects of exercise on depression and anxiety change scores for youth in RTC. However, exercise levels had no significant effect on depression and anxiety change scores for adolescents. The results of this pilot study provide insight into a larger-scale study of same variables in the future. Positive social change implications include at the individual level for adolescents and their families, as well as at the program level, where low-cost and efficacious exercise intervention can provide improvements in programming while adhering to budget guidelines.

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Dedication

During my time in graduate school, my family has been through an immense number of changes and has supported me through the journey. Each member in my family has made immense sacrifices to allow me to fulfill my dream of earning a PhD. This dissertation is dedicated to my husband, Jason, for his undying support. This work is also dedicated to each of my children, Nevaeh, Madeline, Lillin, Addison, Sophia, Benjamin, and Joseph. Thank you for always believing in me.

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Table of Contents

List of Tables v

List of Figures vi

Chapter 1: Introduction to the Study 1

Introduction 1

Background of the Study 2

Adolescent Depression and Anxiety 2

Childhood Trauma 3

Exercise 3

Problem Statement 4

Purpose of the Study 5

Research Questions 6

Theoretical Orientation 8

Nature of the Study 9

Definitions 10

Assumptions 11

Scope and Delimitations 12

Limitations 12

Significance 12

Summary and Transition 13

Chapter 2: Literature Review 15

Introduction 15

Search Strategy 17
Theoretical Foundation 18
Attachment Theory 18
Social Cognitive Theory 19
Literature Review Related to Key Concepts 21
Exercise 21
Complex Trauma 23
Residential Treatment Centers (RTCs) 27
Adolescent Depression 31
Adolescent Anxiety 32
Complex Trauma, Depression, and Anxiety 33
Exercise and Depression 36
Exercise and Anxiety 39
Exercise in RTCs 42
Summary 44
Chapter 3: Research Method 46
Introduction 46
Purpose of the Study 46
Research Design and Rational 47
Methodology 48
Population Description 48
Power Analysis 49

Procedures for Participation and Data Collection 49
Instrumentation and Operationalization 51
Patient Health Questionnaire (PHQ-9) 51
Generalized Anxiety Disorder 7-Item (GAD-7) 54
Child and Adolescent Trauma Screen (CATS) 56
Data Analysis 58
Research Questions 59
Threats to Validity 61
External Validity 61
Internal Validity 63
Data Analysis Validity 67
Ethical Procedures 68
Summary 69
Chapter 4: Results 70
Introduction 70
Research Questions 72
Data Collection 74
Results 75
Evaluation of Assumptions for Correlation Analysis 75
Results for Research Question 1 75
Results for Research Question 2 77
Results for Research Question 3 78

Evaluation of Assumptions for Repeated Measures ANOVA 79
Results for Research Question 4 80
Results for Research Question 5 82
Summary 84
Chapter 5: Discussion, Conclusions, and Recommendations 86
Discussion 86
Summary of Research 86
Interpretation of Findings 88
Theoretical Foundation 88
Correlational Research Findings 89
Repeated Measures ANOVA Research Questions Findings 91
Limitations 93
Recommendations 94
Research 94
Applying to the Field of Psychology 95
Implications 96
Social Change 96
Conclusion 97
References 99
Appendix A: Data Key 123

List of Tables

Table 1 *Descriptive Statistics for Initial Depression Scores and Subsequent Exercise in RTC* 76

Table 2 *Correlation Values for Initial Depression Scores and Exercise* 76

Table 3 *Descriptive Statistics for Initial Anxiety Score and Subsequent Exercise in RTC* 78

Table 4 *Correlation Values for Initial Anxiety Scores and Exercise* 78

Table 5 *Descriptive statistics for Trauma Scores and Subsequent Exercise in RTC* 79

Table 6 *Correlation Values for Trauma Scores and Exercise* 79

List of Figures

Figure 1 *Line Chart Indicating Depression Change Score Between Groups* 82

Figure 2 *Line Chart Indicating Anxiety Change Score Between Groups* 84

Chapter 1: Introduction to the Study

Introduction

Each year, 12% of youth in the United States reside in out-of-home placements that include residential treatment facilities, residential treatment centers (RTCs), inpatient hospitalizations, and other forms of transitional living programs (U.S. Department of Health and Human Services [HHS], 2019). RTCs offer structured programming, therapy, and social skills components with 24-hour supervision for youth with emotional and/or behavioral concerns (Coll et al., 2019). Depression, anxiety, and behavioral disorders are the most common mental health diagnoses among adolescents in RTCs (Fragkaki et al., 2019). Research suggests that complex trauma stemming from childhood is often the underlying cause of emotional and behavioral concerns among adolescents entering RTCs (Boel-Studt, 2017b; Steinke & Derrick, 2018). Research regarding adolescent populations indicates that exercise is an effective intervention in reducing depression and anxiety (Arat & Wong, 2017; Kleppang et al, 2018; McDowell et al., 2017).

However, research regarding adolescent populations in RTC is much less available. Exercise effects on mental health and trauma have not been extensively researched among adolescents in RTCs, with only a handful of pilot studies available on this subject (Bruce et al., 2019; D'Andrea et al., 2013; Lederman et al., 2017). Within this study, I investigated how exercise may provide mental health benefits for adolescents in RTCs, as well as created replicable research for a larger scale study.

Information provided in this chapter includes background, purpose, and problem statement for this study, as well as outlining research questions and hypotheses,

theoretical foundation, nature of the study, definitions of key terms, assumptions, delimitations, limitations, and significance of the study.

Background of the Study

RTCs provide 24-hour care and structure for children and adolescents with significant impairments involving affective and behavioral concerns (Boel-Studt, 2017a; Lynch et al., 2017). RTCs provide residential living environments, schooling, social skills, and mental health services for adolescents who cannot thrive in less-restrictive community settings (Lynch et al., 2017).

Although exercise has been extensively studied as an efficacious intervention for reducing mental health symptoms of anxiety and depression in adolescents, only a small amount of research has explored this topic within RTCs.

Adolescent Depression and Anxiety

Depression and anxiety disorders are the most common mental health disorders for adolescent populations and constitute a significant health concern in the United States. Among adolescents ages 12-17, 32% have experienced a major depressive episode and/or anxiety disorder (National Institute of Mental Health [NIMH], 2017). These numbers have continued to rise over the previous decade among adolescents more rapidly than any other age group (Weinberger et al., 2018). Anxiety and depression among adolescents remain largely undiagnosed and untreated, creating significant concerns for this age group (Lu, 2019). These disorders are also primary symptoms of childhood trauma. (Baker et al., 2018; Gamache Martin et al., 2016; Kisiel et al., 2017; Raknes et

al., 2017). As the most common mental health concerns for adolescents, depression and anxiety have been widely explored in relation to childhood trauma.

Childhood Trauma

Certain types of traumas have been shown to impact development throughout childhood and adolescence (John et al., 2019). When a child experiences multiple, chronic, and prolonged traumatic events within their caregiving system, the potential for negative outcomes in adulthood increase (John et al., 2019). These complex trauma experiences often result in impacted childhood development in several areas including emotional regulation, behavioral control, and healthy self-esteem (John et al., 2019). Emotional and behavioral dysregulation problems are common among adolescents who have experienced complex trauma in their childhood (Gamache Martin et al., 2016; Kisiel et al., 2017; Turner et al., 2017). Adolescents with a history of trauma experiences are more likely to develop mental health symptoms and to end up in restrictive placements, such as RTCs, than their non-traumatized peers (Boel-Studt, 2017b).

Exercise

Exercise comes in many forms and is a low-cost alternative or addition to other treatments, such as therapy and medication, for the treatment of mental health symptoms (Kleppang et al., 2018; McDowell et al., 2017; Rethorst, 2019). Exercise can be differentiated from physical activity in that exercise is “planned, organized, and repetitive movements that are done specifically to improve or maintain physical fitness” (Centers for Disease Control and Prevention [CDC], 2017). Exercise among adolescents has been recognized for its many health benefits, including reductions in anxiety and depression

(Arat & Wong, 2017; Bailey et al., n.d.). Exercise has also been shown to reduce the symptoms of trauma-related diagnoses, increasing emotional and behavioral regulation among adolescents (He et al., 2018). However, positive effects of exercise programming have only been studied in adolescent RTC populations in more recent years (Bruce et al., 2019; Lederman et al., 2017; McIlvain et al., 2015; More et al., 2018; Rawson et al., 2015). Many studies regarding exercise in RTCs are in the pilot stages and long-term exercise studies in RTCs are still forthcoming.

Many trauma-informed services are costly to implement in residential settings, often requiring a high degree of specialization in their approach (Cohen et al., 2016). Exercise programming, which can be implemented with little cost or specialized employee training within RTCs, has remained widely uninvestigated in terms of positive mental health benefits. This pilot study was conducted to assist in planning a larger-scale study on exercise effects in RTC with variables of trauma, depression, and anxiety. The data analysis focused on impact of exercise participation on depression and anxiety for youth with trauma histories in RTC, including effects of mental health symptoms on exercise participation.

Problem Statement

Most of the literature around trauma focuses on adult reporting and healthcare service seeking, though many mental health disorders associated with trauma develop during adolescence (Adams et al., 2016; Selwyn et al., 2019). 92% of adolescents in RTCs have experienced multiple types of traumas including physical, sexual, or emotional abuse; domestic violence; traumatic loss; and school or community violence

(Briggs et al., 2012). Further, depression and anxiety disorders are two of the most frequently reported mental health problems for adolescents entering RTCs (Boel-Studt, 2017b; Cohen et al., 2016).

Adolescents with trauma histories often experience extensive developmental impacts in many areas of functioning as compared to their peers. Research investigating effects of exercise on depression, anxiety, and trauma in adults have indicated positive outcomes (Arat & Wong, 2017; de Moor et al., 2006; Kleppang et al., 2018; McDowell et al., 2017). However, there is less research investigating exercise as an intervention for adolescents with childhood trauma, depression, and/or anxiety concerns. (McWilliams et al., 2011; Motta et al., 2012). Even fewer studies assess the benefits of exercise for adolescents in RTCs. Current research is needed that provides insight into exercise benefits for adolescents in RTCs.

Purpose of the Study

This quantitative pilot study was used to explore the relationship between exercise participation in RTCs, depression, anxiety, and trauma while laying the foundation for a larger scale replicated study in the future. Assessing the association between these variables led to information regarding relationships and effects of exercise. This pilot study guides determination of an appropriate sample size required for a full-scale assessment of the impact of exercise on levels of depression and anxiety for adolescents in RTCs.

The pilot study involved using three measures: Patient Health Questionnaire (PHQ 9), a self-report measure of depression; the Generalized Anxiety Disorder

Assessment (GAD-7), a self-report measure of anxiety; and the Child and Adolescent Trauma Screen (CATS), a self-report measure of trauma. During RTC programming, each adolescent was offered exercise participation opportunities 2 times per week and total participation by each adolescent was subsequently tracked between their first PHQ-9 or GAD-7 score and their final PHQ-9 or GAD-7 score. In order to explore relationships between these variables in more depth, the PHQ-9 and GAD-7 were used approximately every 4-5 weeks to assess for levels of depression and anxiety, respectively. Two types of statistical analyses were used. Correlation and repeated measures analysis of variance (ANOVA) were performed with the variables of depression, anxiety, trauma, and exercise participation, in order to answer the following research questions.

Research Questions

RQ1: Is there a correlation between initial depression scores and amount of exercise participation for adolescents in RTCs?

$H_0 1$: There is no correlation between initial depression scores and amount of exercise for adolescents in RTCs.

$H_a 1$: There is a correlation between initial depression scores and amount of exercise for adolescents in RTCs.

RQ2: Is there a correlation between initial anxiety scores and amount of exercise participation for adolescents in RTCs?

$H_0 2$: There is no correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

H_a2: There is a correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

RQ3: Is there a correlation between initial trauma scores and amount of exercise participation for adolescents in RTCs?

$H_0 3$: There is no correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

H_a3: There is a correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

RQ4. Is there a statistically significant change in depression score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

$H_0 4$: There is no statistically significant change in depression score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

H_a4: There is a statistically significant change in depression score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

RQ5. Is there a statistically significant change in anxiety score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

H_05: There is no statistically significant change in anxiety score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

H_a5: There is a statistically significant change in anxiety score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

Theoretical Orientation

The dependent variables of trauma, depression, and anxiety identified in this pilot study were chosen based on two separate theories of development, attachment theory as developed by John Bowlby (1977), and social cognitive theory as developed by Alfred Bandura (1989). These theories will be briefly discussed here and in more depth in chapter 2.

In attachment theory, Bowlby identified that attachment develops in infancy; driven by dependence on others to meet needs for survival. Attachment bonds become reinforced by the type of engagement an infant receives from caregivers in their life and the amount of needs that are met (Bowlby, 1977). Children who experience chaotic and unpredictable interactions with caregivers, and whose needs are only partially or inconsistently met, tend to develop disrupted and insecure attachments to others (Saakvitne, 2017). Disrupted and insecure attachments lead to over sensitized nervous systems, and poorly defined self-capacities, such as recognizing and managing emotions, experience of self-worth, and positive connections with others (Gamache Martic et al., 2016; Kisiel et al., 2017; John et al., 2018; Saakvitne, 2017). These impairments are

characteristic of most adolescents when entering RTCs, providing a clear connection between caregiver environments and development of depression, anxiety, and trauma symptoms for this adolescent population.

Self-efficacy is also a critical component to explore when discussing mental health concerns and the impact of interventions. As children age, self-efficacy begins to develop. Bandura (1989) defined self-efficacy as the "perceived capability to manage one's functioning and manage environmental demands" (p. 1175). A child's self-efficacy is impacted by traumatic experiences, especially those within the caregiving system. Healthy self-efficacy development is critical for people to be able to grow and heal past their traumatic experiences.

Nature of the Study

This quantitative study used archival data retrieved from adolescents aged 13-17 who were placed in an upper Midwest RTC for a variety of reasons. The study used both a correlational approach and repeated measures ANOVA to answer research questions posed. Adolescents were offered the opportunity to participate in exercise at least 2 times per week while in RTC, and if they chose to participate at least once per week, participation was counted. Due to the variability in length of stay for adolescents in RTC, exercise participation was tracked following the initial data collection (PHQ-9, GAD-7) until the last collection of depression and anxiety symptom scores (PHQ-9; GAD-7).

For research questions 1-3, initial depression, anxiety, and trauma symptom scores were used in correlation to exercise participation between initial and final data collection. A repeated measures ANOVA was used to assess impact of independent

variable exercise participation on dependent variables depression and anxiety. The data collection instruments used in the study were Child and Adolescent Trauma Screen (CATS) (Sachser et al., 2017), Patient Health Questionnaire (PHQ-9) (Kroenke et al., 2001) and Generalized Anxiety Disorder 7-item (GAD-7) (Spitzer et al., 2006). Detailed methodology is discussed further in Chapter 3.

Definitions

Affective Dysregulation: Having trouble with emotional regulation, difficulty describing feelings and emotions, and difficulty communicating wishes and desires to others (Cook et al., 2003).

Anxiety: An emotional state associated with feelings of apprehension, imminent danger, or disappointment. Physical symptoms of anxiety include tense muscles, rapid heartbeat, and rapid breathing. Anxiety is future-oriented, focusing on defusing a threat (American Psychiatric Association [APA], 2013).

Childhood Trauma: An experience of an extreme stressor that exceeds a person's ability to cope. These stressful events then create an actual or perceived threat that activates an extreme stress response in many children and adults (John et al., 2018).

Complex Trauma: Repeated or extended exposure to trauma that involves direct harm or neglect from caregivers; occurs during early childhood; and creates a severe threat that may impact child development (Ford & Courtois, 2009; John et al., 2018).

Depression: A negative emotional state that includes a range of emotions, including unhappiness, discontent, sadness, pessimism, and despondency. A depressive state interferes with daily life and includes changes in appetite, sleeping patterns, lack of

motivation, concentration difficulties, and social isolation. Depression is often a symptom of other mental health disorders (APA, 2013).

Exercise: Exercise is planned, organized, and repetitive movements that are done specifically to improve or maintain physical fitness (CDC, 2017).

Residential Treatment Centers (RTCs): RTCs are facilities that offer mental health services to children and adolescents under the age of 18. Services are time-limited, include 24-hour supervision, and include programming to improve social and living skills. RTCs are also called residential treatment facilities or therapeutic residential centers. Within this study, all above names facilities that offer services defined are grouped under the name "RTCs."

Assumptions

There are several assumptions underlying this current study. The first assumption was that the CATS tool was adequate to identify adolescents in RTCs with trauma histories and related symptoms. Additionally, it was assumed that the PHQ-9 and the GAD-7 accurately measured the respective mental health symptoms as designed. Further assumptions included participants' willingness to provide honest symptom reporting on the PHQ-9, CATS, and GAD-7. It was also assumed that archival data collection had been gathered accurately according to the respective data points and parameters of the study. The final assumption was that the residential population demographics in this study were similar to other residential populations studied within the research.

Scope and Delimitations

The archival design of this pilot study did not allow for condition control or manipulation of variables (depression, anxiety, trauma, exercise). The projected sample size was low, around 15-20 cases were expected. All cases included in the data key (Appendix A) had specific data points collected, including initial depression, anxiety, and traumas scores; final depression and anxiety scores; and amount of exercise participation. However, due to inclusion and exclusion criteria, only 11 cases were able to be analyzed. The findings in the pilot study are not generalizable to non-clinical populations. The results are representative of the participants involved in the specific RTC programming at the upper Midwest RTC.

Limitations

This study was limited to data collected from an upper Midwest RTC facility that provided services to adolescents between the ages of 13 and 17 between November 1, 2020, and March 31, 2021. The adolescent census in the facility during that time frame was low due to COVID-19 restrictions. This ultimately led to fewer adolescents being available to participate in exercise, as well as fewer data points being collected as a result. Another limitation of this study was that the questionnaires are self-reported, which may lead to bias in reporting by adolescents.

Significance

This pilot study aimed at providing information regarding exercise as a potential low-cost transformative intervention for adolescents with trauma histories and mental health concerns, such as anxiety and depression. The study results add to the current

literature and provide guidance on additional gaps in research regarding trauma, adolescents, and exercise that future research could explore.

While research regarding effects of trauma in adulthood have been well established, understanding effects of trauma in adolescents has not. Adolescents entering RTCs often have complex trauma histories, along with depression, anxiety, and behavioral disorders (Briggs et al., 2012). Some research suggests that adolescents with significant trauma histories are more likely to engage in programming than those with less trauma (Steinke & Derrick, 2018). Effective and cost-efficient interventions for these adolescents are few and far between.

Summary and Transition

Adolescents who have trauma experiences come from various backgrounds, yet often share similar experiences of chaotic caregiver relationships. Trauma experiences, particularly those that are repetitive and complex, often have a significant negative impact on a variety of developmental areas including affective regulation, behavioral regulation, and healthy self-efficacy development. Provision of efficacious and cost-effective programming designed to reduce impact of complex trauma experiences for adolescents in RTC has implications for both adolescents and society at large. Extant literature lacks an exploration in cost-effective treatments targeting trauma among this adolescent population. By exploring the impact of exercise participation for adolescents in RTC, I was able to provide research aiming to fill the research gap.

Chapter 2 provides a comprehensive overview of literature pertaining to adolescents with childhood trauma, adolescent depression, adolescent anxiety, exercise

effects on mental health, as well as how these variables relate to adolescents in RTC. The chapter also explored how exercise may assist in reducing anxiety and depression associated with trauma.

Chapter 2: Literature Review

Introduction

Childhood trauma is considered a public health epidemic due to the lasting effects on children's emotional and physical wellbeing, as well as the hidden costs to society that are incurred across a lifetime (Felitti et al., 1998). Epidemiological studies have unearthed disturbing correlations between childhood trauma and adolescent risk behavior, health status, and mental health problems (Adams et al., 2016; Ford et al., 2010).

Age at the first traumatic experience, frequency of the traumatic events, as well as the degree to which a child's caregiver was involved in the traumatic experience(s), have all been linked to the more pervasive and detrimental trauma reactions of hypervigilance and emotional dysregulation seen in some victims (Ford & Delker, 2018). The psychological impacts of these significant and extensive traumatic experiences are expressed by with self-regulation difficulties, raised levels of aggression; attention and dissociation problems, physical ailments, conflicts within interpersonal relationships, as well as deficits in self-efficacy (D'Andrea et al., 2012).

When adolescents are subjected to pervasive and repetitive traumatic experiences as young children, they often become unable to thrive in traditional family settings or foster homes and require more restrictive care settings, such as those provided by RTCs (Kisiel et al., 2017). Most adolescents living in RTCs have experienced varying forms of traumatic experiences in their childhood, making the importance of trauma-informed care significant.

Previous literature has established clear relationships between trauma experiences and diagnoses of depression and anxiety for both adolescents and adults (Dauber et al., 2015; Luoni et al., 2018; Rossiter et al., 2015). Additionally, there is a growing body of research identifying RTCs as largely being comprised of adolescents with complex trauma (D'Andrea et al., 2013; Denison et al., 2018). However, the relationship between adolescents in RTCs with complex trauma and effects of exercise on depression and anxiety symptoms has not yet been clearly established with the literature.

Advancing research in this area is helpful for all levels of professionals and staff involved in care and placement for adolescents in RTCs for a myriad of reasons, including staff-based tailored exercise program with minimal training costs or time investments; adoption of exercise programs to maximize resources currently available in facilities under flexible approaches; and cost-effectiveness for RTCs with efficient exercise programs implementation.

The literature review for this chapter is divided into several sections. The first part of the section discusses the theoretical foundation relevant to this study. Following is an overview of each of the variables discussed in the study, as well as subsections of how these variables related to one another. Finally, a discussion regarding current literature on exercise programming outcomes was provided. The justification for analyzing the impact of exercise on depression and anxiety symptoms for adolescents in RTC with trauma histories is provided within the literature review.

Search Strategy

The search strategy was comprised of a comprehensive review of the literature conducted via computer searches of several online databases within the Walden University library. Databases included: Academic Search Complete, MEDLINE with Full Text, PsycARTICLES, PsycBOOKS, Psychology Databases Combined Search, Sage Journals, ScienceDirect, SocIndex, and Google Scholar. Search terms included: adolescence, adolescent(s), affect (dys)regulation, anxiety and any variant, attachment, attachment disruption, abuse, behavioral (dys)regulation, child(ren), childhood, complex trauma, depression and any variant, developmental trauma, developmental stages, emotional (dys)regulation, exercise, mental health symptoms, mental illness, neglect, physical activity, physical exercise, polyvictimization, poly-victimization, residential facilities, residential programming, residential treatment centers, teenagers, and trauma. Reviewed research spanned from 1989 to 2019 for theoretical framework and theory information. Research regarding complex trauma included searches of time frames beginning in 1990 and forward to the current time. Adolescent and complex trauma research is primarily based within the timeframe of 2000-2020, with a small body of research related to complex trauma and effects on adolescents prior to that timeframe. Emphasis was placed on research published between the years 2015-2021 to ground the review in the most current and relevant studies available. Citations prior to the 2015-2021 timeframe reflect a lack of more recently expanded or updated research for those concepts.

Theoretical Foundation

Attachment Theory

Children begin to form strong affectional bonds with their caregivers almost immediately following birth. Caregivers' reactions toward being able and willing to respond to children's needs for basic safety, food, and other needs impacts development of attachment to others (Bowlby, 1977). Attachment disruption, due to lack of healthy caregiving and repetitive trauma, has a significant impact on development throughout childhood and adolescence (John et al., 2018).

Understanding the potential long lasting and wide array of trauma impact hinges on the additional understanding of attachment theory as developed by John Bowlby (1977). Attachment theory postulates that early patterns of attachment can significantly affect the way a person processes environmental information, thus influencing the way a person interprets and understands their own world and the events that occur within it. Almost immediately following birth, children begin to form strong affectional bonds to their caregivers. The reactions of caregivers toward being able/willing to respond to an infant, and later, a child's needs for basic safety, food, and other needs, impacts that child's development of attachment to others (Bowlby, 1977).

In terms of trauma, a child who experiences multiple and chronic traumatic events, most specifically at the hands of their caregivers, develop insecure and unhealthy attachment which prohibits a healthy development of affective responses and ability to regulate their own thoughts and emotions in response to experienced stressors. These traumatic experiences have been shown to have an extensive effect on brain

development, and also reduces a person's capacity to integrate sensory, emotional, and cognitive information into a cohesive whole (van der Kolk, 2005). Research has linked attachment disruption to the development of internalizing and externalizing disorders by adolescence (Steinke & Derrick, 2018). Attachment has also been studied in context of adolescents in RTCs, suggesting a significant link between disrupted attachment and problem behaviors (Drewes, 2015; Ford et al., 2009; Purvis et al., 2014). Attachment theory provides the lens through which we can view the detrimental effects of complex trauma and the impact it has on overall healthy development of attachment, self-efficacy, and mental health in adolescence.

Relationship of Attachment Theory to this study

As the data being reviewed was collected from adolescents who are in RTCs, which indicates displacement from nuclear family experiences, there is also an assumption within this study that at least some portions of these displaced adolescents have had complex trauma. This assumption is supported by prevailing research (Boel-Studt, 2017a; Boel-Studt, 2017b; Steinke & Derrick, 2018; Torgersen, 2018). This study built upon attachment theory providing further insight into adolescents placed in RTCs, struggling with depression and anxiety that might be related to trauma experiences.

Social Cognitive Theory

Social Cognitive Theory, defined by Alfred Bandura in 1989, discusses the concept of self-efficacy as one's belief in their personal abilities to generate and sustain change in their environment, that they have identified as needed or desired. Bandura suggests that the development of self-efficacy begins at an early age and is shaped by

experiences and environment (Bandura, 1989). The concept of self-efficacy in relation to the ability to overcome traumatic experiences is discussed as the "perceived capability to manage one's personal functioning and manage environmental demands following trauma" (Benight & Bandura, 2004). As a child develops secure attachment to their caregivers and environment, they develop feelings of being understood, which then leads to higher self-efficacy in their decision-making abilities as well as increases their confidence in seeking others within their environment to help them meet their needs in situations that are unfamiliar with. Conversely, when a child's experiences do not contribute to secure attachment with caregivers or their environment, they are less able to develop trust in their own abilities to manage adverse events, or stressors, which then may lead to the development of maladaptive responses to subsequent stress experienced later in life (van der Kolk, 2005; Weindl & Lueger-Schuster, 2018) as well as beliefs that they cannot control or influence their own emotional responses (Ford & Delker, 2018).

Relationship of Social Cognitive Theory to this study

Researchers have studied self-efficacy in a variety of contexts that are relevant to the current study. Levels of self-efficacy have been shown to have reciprocal relationships with exercise, in that higher levels of self-efficacy tend to lead to engagement in exercise as well as exercise leading to increased levels of self-efficacy (Cortis et al., 2017; Malik et al., 2020). For adolescents, self-efficacy has also been studied in relation to depression, with findings suggesting that higher levels of self-efficacy contribute to lower levels of depression (Guerra et al., 2018; Ngo et al., 2020). In relation to anxiety symptoms, self-efficacy has also been shown to play a role for

adolescents, specifically adolescents who have experienced negative life events (Asselmann et al., 2017; Raknes et al., 2017). Finally, self-efficacy has also been shown to play a role in the development of trauma-related symptoms for adolescents who have experienced trauma (Asselmann et al., 2017; Guerra et al., 2018). The development of self-efficacy begins at an early age and is shaped by many childhood experiences. In this study, with its focus on the clinical adolescent population, self-efficacy likely impacts engagement in exercise programming.

Literature Review Related to Key Concepts

Exercise

Exercise is a specific form of physical activity that is planned, organized, and consists of repetitive movements that are done specifically to improve or maintain physical fitness (CDC, 2017). Exercise can consist of any number of activities including sports, gym workouts, school activities, and individual physical activity sessions. Almost any activity that gets a body moving can be shaped into an exercise routine and often produces positive benefits (Panza et al., 2019).

Exercise serves a variety of purposes, including maintaining or increasing physical health, promoting positive mental health, and facilitating positive well-being (Bélair et al., 2018; He et al., 2018; McDowell et al., 2019; Panza et al., 2019). Exercise has been studied extensively among the adolescent population in combination with many other research areas, including sleep habits (Burns et al., 2020), mental health (Bélair et al., 2018) physical health (Burns et al., 2020), self-efficacy (Dishman et al., 2019; Nock et al., 2016), and peer connectedness (Kleppang et al., 2018).

Adolescents exercise in a variety of ways, with organized sports being one of the most common forms of exercise during the high school years (Kleppang et al., 2018). Engagement in exercise and physical activity overall also appears to decline from childhood to adolescence (Dishman et al., 2019). As exercise participation decreases, other concerns rise, including weight gain (Burns et al., 2020; Carter et al., 2016) and mental health problems (He et al., 2018; McDowell et al., 2019).

Exercise comes in many forms and is a low-cost alternative or addition to other treatments, such as therapy and medication, for the treatment of mental health symptoms. Exercise can be used to promote health and well-being, reduce mental health concerns, and increase energy (Kleppang et al., 2018; McDowell et al., 2017; Rethorst, 2019). Exercise effects on depression and anxiety are discussed thoroughly in the literature review.

Exercise and self-efficacy

Although not specifically assessed within this current study, it is important to briefly discuss the role of exercise in self-efficacy development for adolescents, specifically those with trauma histories. Research by Dishman et al. (2019) have linked declines in exercise to declines in self-efficacy over adolescence for both boys and girls from 5th-11th grade (N=187). As levels of self-efficacy decline for adolescents, so does their participation in exercise/physical activity. This indicates concerns for adolescent populations that are not gaining the health benefits of regular exercise. Additional research by Lu et al. (2014) indicates that higher levels of self-efficacy had a large moderating effect on participation in physical activity for adolescent males as well as a

partial moderating effect on participation for adolescent females. This suggests that self-efficacy serves a reciprocal role in exercise for adolescents, both on willingness to participate, and the development of healthy self-efficacy by way of regular exercise.

Complex Trauma

The experience of a stressful event from a perceived or real threat can produce biological and affective responses that exceeds a person's ability to cope. These stressful events then activate an extreme stress response in many children and adults (John et al., 2018; van der Kolk, 2005). Childhood experiences of various types of traumas are quite common in the general population, and 33% of clinical populations have a history of childhood trauma (Luoni et al., 2018). Individuals experiencing multiple and prolonged traumatic events from within their caregiving system, or complex trauma, are more likely than individuals who do not have these experiences to develop more pronounced and long-term psychological symptoms (Luoni et al., 2018; Rossiter et al., 2015).

Developmental Impact

Research suggests that complex trauma experiences are impactful on a child's development in several ways, largely because the events co-occur with significant brain development (Cook et al., 2003). Children depend on their primary caregiving system for safety and stability to promote healthy development (John et al., 2018). When children are exposed to complex trauma experiences during key developmental times, there is a higher likelihood of impact to developmental areas of attachment, biology, affect regulation, dissociation, behavioral control, cognition, and self-concept (Cook et al.,

2003). Discussion of the relevant areas of developmental impact is necessary to the discussion of adolescent placement in residential services.

Attachment Development

Attachment bonds begin to develop almost immediately upon birth between a child and their caregivers. Within this domain, authors Cook et al., (2003) identifies the following difficulties that are present for adolescents with complex trauma: uncertainty about how to reliably predict events in their experiences; problems with boundaries; distrust and suspiciousness; social isolation; interpersonal difficulties; difficulties adjusting to others' emotional states; difficulties with perspective taking; and difficulties reaching out to others for support. Based on the theoretical groundwork laid by John Bowlby (1977) on attachment bonds between caregivers and children, authors Cook et al., (2003) have built upon this work to frame the effects of complex trauma experiences on the development of disorganized attachment styles for affected adolescents. Children who experience maltreatment from their caregivers are often left without other supportive and stable adult caregiving relationships with which to develop trusting bonds (Rahim, 2014). Lack of supportive and stable relationships, coupled with these childhood traumatic experiences received from one's own caregivers, impact development of healthy attachment bonds with others.

Affective Regulation

Affect regulation, or the ability of an individual to regulate their emotions to meet the demands of their environment, is another domain affected by the experience of complex trauma in childhood. Specifically, adolescents with complex trauma show

difficulty in affective/emotional regulation, difficulty describing feelings and internal mood states, as well as difficulty being able to communicate personal wishes and desires to others (Cook et al., 2003). The ability to identify and describe one's own feelings and internal mood states is learned through social interactions with caregivers. Consistent response patterns are required for a young child to develop a framework of response types to begin identifying their own internal arousal states. Caregiver responses that are inconsistent in terms of behavioral and affective responses do not help children develop a consistent framework for identifying and organizing their own internal states. As complex trauma impairs a child's ability to identify their own internal states, this similarly impacts ability to express emotions and regulate their own internal states and is linked to deficits that children experience with self-soothing abilities (Cook et al., 2003). The effects of complex traumatic experiences often last through adolescence and into adulthood.

Behavioral Control

Adolescents with complex trauma often experience a high amount of impairment relating to behavioral control. Adolescents often have observable difficulties in the following areas: regulation of impulsivity, self-destructive behaviors, aggression toward others, compulsive self-soothing behaviors, sleep disturbance, eating disorders, problems with substance use/abuse, excessive compliance, oppositional behaviors, difficulty understanding and/or complying with rules, as well as use of reenactment of trauma with day-to-day behavior or in play (Cook et al., 2003). As compared to their peers, children who have been traumatized display more over- and under-controlled behavior patterns.

Over-controlled behavior often appears as resistance to change in schedules, inflexible behavior patterns, and compulsive compliances to adult requests (Cook et al., 2003). Under-controlled behaviors often include heightened impulsive and reckless behaviors such as aggression, self-injury, or substance use (D'Andrea et al., 2012). The overt behavioral dysregulation displayed by adolescents with complex trauma histories is often hard to recognize as specifically due to trauma, resulting in disproportionately high amounts of these adolescents being placed in restrictive RTC settings. In research by Harr et al., (2013), they found that of 457 adolescents' ages 13-18 years old that were entering RTCs, at least half of the sample had experienced 3 or more personal traumas. These same adolescents also had more risk behaviors such as academic problems, peer violence, substance use, use of weapons, juvenile delinquency, and cruelty to animals (Harr et al., 2013). Impairment in behavioral control in adolescence appears to be closely linked to the experience of complex trauma in childhood.

Self-Efficacy

As discussed within the theoretical orientation, Bandura's (1989) work on self-efficacy and development of identity has laid the groundwork for understanding the impacts of trauma on development of a secure, stable, and integrated sense of identity. The seminal work of Cook et al., (2003) on defining complex trauma and its effects on development provides an in-depth look at how self-efficacy is affected by complex trauma. For children and adolescents exposed to frequent and/or repetitive experiences of rejection and harm from their caregivers, self-efficacy does not develop on a health trajectory (Cook et al., 2003). The authors assert that repetitive experiences of harm from

caregivers, coupled with the failure to develop other competency areas, are likely to lead to a sense of self that is ineffective, helpless, deficient, or unlovable. Consistent and positive responses to a child's needs in early life are a necessary component to cultivating positive self-concept, where a child can begin to see themselves as worthy and competent (Cook et al., 2003; Green & Myrick, 2014; Turner et al., 2017). The attachment disruption that occurs in these chaotic and neglectful relationships often produces adolescents that have low expectations for their own futures (Thompson et al., 2012).

Even into adulthood, research suggests that self-efficacy development continues to be limited for those with complex trauma histories. McCormack and Thomson (2017), found that adults with underlying trauma consistently reported overarching themes of "not good enough," struggles with self-doubt, and adherence to negative mental health stigmas which delayed help-seeking behaviors. Although self-efficacy is not directly researched within this current study, it is nonetheless an important consideration when discussing exercise participation for adolescents in RTCs.

Residential Treatment Centers (RTCs)

In 2017, there were 674,000 substantiated cases of abuse or neglect nationwide for America's children and 442,995 children and adolescents living in out of home placements, which include RTCs (Child Welfare League of America [CWLA], 2019). Some RTCs focus on living skills, others on substance use, while still other RTCs focus on the provision of mental health as part of their care model (Lynch et al., 2017). RTCs are defined by the Minnesota Department of Health and Human Services (MN DHS), as facilities that provide 24-hour supervision with therapeutic services for adolescents up to

age 18, and require adolescents to have mental health diagnoses of Severe Emotional Disturbance (SED) where substance use problems are not the primary concern (MN DHS, 2019). RTCs are not sought after as a first line of defense for adolescents that have been removed from the homes but rather as a longer-term solution for adolescents who are not thriving in less restrictive placements, such as foster care (Lynch et al., 2017). RTCs offer a wide array of services for children and adolescents, including education programming, short-term and long-term living programs, social skills, as well as therapeutic support that includes individual, family, and group programming.

Mental Health

Many children do not receive a mental health assessment until they enter the child welfare system (CWLA, 2019). Adolescents entering RTC often have varied histories of out-of-home placements, trauma histories, as well as behavioral and affective dysregulation concerns that make them unable to thrive in less restrictive care settings (CWLA, 2019; Lynch et al., 2017). Large group sample studies of adolescents receiving some form of child welfare care indicate that 46% - 70% have experienced complex trauma (Briggs et al., 2012; Kisiel et al., 2017). Additional research indicates that adolescents in RTCs have 3 or more mental health diagnoses on average, with behavioral diagnoses (conduct disorder or oppositional defiant disorder) and affective diagnoses (depression, anxiety), being the most common (Izmirian et al., 2019). If these children and adolescents cannot thrive in less restrictive environments, RTCs become an important part of treatment and care.

Trauma Prevalence

In a large clinical sample of adolescents in RTCs (n = 525), Briggs et al. (2012) reported that as many as 92% have experienced multiple types of traumas, including physical, sexual, or emotional abuse; domestic violence; traumatic loss; school or community violence; and/or an impaired caregiver. The researchers also noted that as the number of traumatic experiences rose, so did impairment in areas of academic, behavioral, or attachment problems; running away, substance use, or self-harm behaviors; suicidality; and criminal activity. The impairment caused by trauma often leads to misdiagnoses or underestimation of the role it has in the manifestations of behaviors (Boel-Studt, 2017b; Zelechoski et al., 2013). Adolescents with trauma histories are also in more concentrated numbers when in RTCs. Staff at RTCs may also experience limitations in ability to respond appropriately to traumatized adolescents, which is primarily true when there has not been a trauma-informed approach implemented, along with appropriate staff training, within the RTC (Zelechoski et al., 2013).

Despite the identified barriers adolescents with complex trauma experience within RTCs, there is some research that offers evidence that they continue to attempt connections even in restrictive care settings. Steinke and Derrick (2018) revealed in their study that despite large amounts of adverse childhood experiences for male adolescents in RTCs, they also displayed a high level of engagement in treatment services. Interestingly, adolescents with higher levels of trauma were more engaged in services than adolescents with lower levels of trauma (Steinke & Derrick, 2018). Findings of this nature suggest

that adolescents with complex trauma backgrounds in RTCs may also respond positively to specific treatment interventions that are intended to improve outcomes for them.

Length of Stay

An important factor to consider when discussing adolescents in RTC and outcomes is length of stay. Research is sparse regarding the impact of length of stay in an RTC on overall mental health outcomes, as well as being primarily focused on immediate outcomes and improvements for adolescents. However, there are a few longitudinal studies that have provided evidence that the longer an adolescent resides in an RTC, the better the overall outcome regardless of programming provided (Lino et al., 2016; Strickler et al., 2016; Turner & Deane, 2016).

In one such study, Strickler et al (2016) sampled 716 adolescents over a one-year period following a stay in RTC. The authors found that there were functional improvements for adolescents that could be observed for as long as 6 months after their stay in RTC. In another study regarding Portuguese adolescents ages 12-18 years old, Lino et al. (2016), found that length of stay in an RTC had a positive effect for boys on their ability to trust and develop attachments and healthy communication with their peers. Surprisingly, for girls in RTC, this same effect is not found, and no relationship was found between length of stay and ability to communicate, trust, and attach with other peers. The researchers also found that adolescents who present with more cognitive dysregulation during their stay did not seem to be able to increase their abilities to attach, trust, and communicate with their peers during their stay (Lino et al., 2016).

In focusing on specific types of treatment provided to adolescents in RTCs, Boel-Studt (2017a) found that children and adolescents, ages 5-17 years old, who are provided with trauma-informed treatment, have fewer seclusion room incidents and shortened stays overall. In a separate study regarding 70 adolescents in RTC with anxiety and/or depressive disorders, the researchers found that length of stay had a significant impact on overall symptom reduction for both disorders in males and females (Schneider et al., 2018). These findings suggests that trauma-focused treatments may provide increased benefit than other treatments. In a thorough search of various databases, there were only a few recent studies regarding the impact of length of stay on overall changes for adolescents.

Adolescent Depression

Depression is one of the most common mental health concerns today, affecting 13% of adolescents each year (NIMH, 2017). Symptoms of adolescent depression include feelings of sadness, depressed or irritable mood; loss of interest or pleasure in activities a person previously enjoyed; changes in appetite or weight loss/gain that is unrelated to dieting; trouble sleeping or the opposite, sleeping too much; loss of energy or increases in fatigue; feelings of worthlessness or guilt; difficulty thinking or concentrating; thoughts of death or suicide (APA, 2013). These feelings must have been present for at least the previous two weeks to warrant a diagnosis. Adolescent depression has been well-studied in relation to several variables, including family systems (Poole et al., 2017), hereditary traits (Lebowitz & Ahn, 2017), social adversity (Björkenstam et al., 2017; Lu, 2019; Weinberger et al., 2018), and trauma (Gershon et al., 2018). Depression in adolescence

has been linked to higher rates of suicide (Schlagbaum, 2020; Twenge et al., 2019), risk-taking behaviors, substance use (Bai et al., 2018; Roberts et al., 2018), decreases in exercise/physical activity (Bailey et al., n.d.; Bélair et al., 2018; McDowell et al., 2017), as well as declines in physical health (Jamnik & DiLalla, 2019; Zhu et al., 2019). A more in-depth discussion regarding adolescent depression and exercise is presented later within this literature review.

Adolescent Anxiety

Anxiety disorders are also a common concern among adolescents. Around 30% of adolescents aged 13-18 report anxiety problems that affect their mental health (NIMH, 2017). Anxiety is an emotional state associated with feelings of apprehension, imminent danger, or disappointment. Physical symptoms associated with anxiety include tense muscles, rapid heartbeat, and rapid breathing. Anxiety is future-oriented focusing on diffusing a threat (APA, 2013). Generalized Anxiety Disorder (GAD) is the most diagnosed anxiety disorder (NIMH, 2017). A diagnosis of GAD must meet the following criteria: excessive anxiety and worry occurring more days than not for the previous six months; individual finds it difficult to control the worry. In addition, three or more of the following symptoms must be present: restlessness or feeling keyed up or on edge; being easily fatigued; difficulty concentrating or mind going blank; irritability; muscle tension; and sleep disturbance (difficulty falling/staying asleep, restless, or unsatisfying sleep) (APA, 2013).

The prevalence of anxiety among adolescents is significant, with research suggesting a high number of contributing factors that increase risk of anxiety among

adolescents, such as trauma (Kisiel et al., 2017; Lee et al., 2020, Miloyan et al., 2018) cultural heritage (Kim et al., 2019), low self-efficacy (Raknes et al., 2017), perceived strengths (Kisiel et al., 2017), and traumatic or negative life events in childhood (Raknes et al., 2017). Anxiety was studied as a variable in the current research with its relation to exercise for adolescents in an RTC.

Complex Trauma, Depression, and Anxiety

The dysregulation that results from complex traumatic experiences in childhood appears to also increase the risk for additional development of depression and anxiety disorders in adolescents. D'Andrea et al., (2012) have identified that as many as 40% of adolescents with identified complex trauma histories also meet criteria for a mood, anxiety, or disruptive behavior diagnosis. Other research indicates comparable results, such that adolescents with complex trauma histories tend to exhibit higher impairment than those with single trauma histories (Briggs et al. 2012; Harr et al., 2013; Luoni et al., 2018).

In their research, Gamache Martin et al. (2016), also identified that adolescents who experienced physical violence and emotional violence from their caregivers were more likely to have moderate to severe major depressive disorders than adolescents who experienced other types of traumas, or as the researchers defined it "experienced betrayal." The frequency of betrayal, or incidents of trauma, experienced by adolescents is linked to higher rates and intensity levels of mood disorders (Gamache Martin et al., 2016). Interestingly, authors Luoni et al., (2018) have found that the type of complex trauma suffered does not necessarily change the outcome of psychiatric diagnoses,

suggesting that all types of abuse, such as sexual abuse, neglect, and general maltreatment, can have similar deleterious effects on mental health. The duration and frequency experienced, as well as the intimate nature of the trauma, has a farther-reaching impact on development and is more important than the category of trauma that was experienced.

Children who have experienced complex trauma also are at increased risk of anxiety and depression disorders in adulthood. In their study, authors McDonald et al. (2014), found that higher amount of trauma that was reported by young adults, ages 18-19 years old, was also highly correlated with higher levels of impairment in areas of emotional regulation, physical problems (headaches, general illness), and self-harming behaviors. In other, research, women who have difficulties with emotional regulation report higher levels of depression, posttraumatic stress disorder symptoms, general health concerns, as well as higher amounts of adverse childhood events than women with more health emotional regulation (Cloitre et al., 2019). For adult women, emotional regulation abilities have a significant impact on reported psychological and physical problems.

Although studied among larger populations of adolescents and adults, research on complex trauma effects on mental health, and specifically depression and anxiety, for adolescents already in RTCs, remain few. Of the studies that are currently available, many are considered outdated by current standards, occurring prior to the last five years. As such, a brief overview of findings from older research is warranted here.

Conner et al. (2002) reviewed treatment outcomes for 87 adolescents who were discharged from an RTC as well as assessing history of abuse and internalizing

symptoms at entry into the RTC. The authors found that obtaining trauma history and internalizing symptoms at entry to RTC is critical to treatment implementation for adolescents. Additionally, less vulnerable children were more likely to receive the greatest benefit from RTCs over more vulnerable adolescents (Conner et al., 2002). In 2011, Murphy and Siv involved a case study regarding the effectiveness of Mode Deactivation Therapy (MDT) for twenty adolescent male patients in RTC who had physically or sexually aggressive behaviors, as well as conduct and/or personality dysfunction. In their study, depressive symptoms, suicidal ideation, and aggressive behaviors were monitored for adolescents receiving treatment as usual (TAU) and MDT. After one year of treatment, the adolescents who received MDT showed decreases in aggression, physical restraints, depressive symptoms, and suicidal ideation over those who received the TAU (Murphy & Siv, 2011).

More recent research regarding the impact of trauma on behavior and mental health for adolescents entering RTCs provides insight into the significant and lasting impact trauma has for adolescents. Brack et al. (2012) evaluated the relationship between gender, abuse history, and clinical change in an RTC for 1,303 youth aged 9-19 years old with emotional and behavioral problems. At intake, the females in the study scored higher on pathology concerns in 9 out of 12 measures used. Abuse history was also collected at intake for these adolescents and adolescents. Adolescents who had experienced abuse indicated more aggression, anxiety, and mood/depressive concerns than adolescents who had not experienced abuse. Even after a full year of treatment,

adolescents with abuse histories continued to experience higher rates of anxiety, affective and behavioral problems, and eating disorders (Brack et al., 2012).

Harr et al. (2013) provides insight into the amount of trauma many youths experience prior to entering RTCs. In their study, 457 male and female adolescents aged 13-18 years old were assessed for types of traumas they had experienced as various risk behaviors (academic concerns, animal cruelty, fighting with peers, use of harmful weapons, juvenile delinquency, and substance use). Of the 457 adolescents, around half had experienced at least 3 or more various traumas (loss of parent, sexual assault, physical abuse, sexual abuse, verbal abuse, or witnessing violence). Adolescents who had experienced higher amounts of trauma also had higher amounts of suicide attempts and risk behaviors compared to adolescents exposed to less trauma overall. The authors additionally found that family-specific traumas had the largest impact on adolescent risk behaviors overall (Harr et al., 2013). Additional research in this sparse area regarding adolescents in RTCs was explored in relation to exercise participation.

Exercise and Depression

The positive effects of physical activity on overall mental health and well-being have been well substantiated within the literature across all age groups (Arat & Wong, 2017; Cortis et al., 2017; Panza et al., 2019; Snedden et al., 2019). There continues to be a large body of research available discussing exercise in relation to many of the variables within this study, including depression (Arat & Wong, 2017; Bailey et al., n.d.; Kangas et al., 2015), anxiety (Arat & Wong, 2017; Saeed et al., 2019), and trauma (Sanders, 2018).

Exercise and physical activity remain one of the most accessible and low-cost interventions to improving mental health for almost every population.

Regular exercise has been explored in relationship to depression in several ways, including as an intervention strategy to reduce depression (Bailey et al., n.d.; McDowell et al., 2017) as well as a correlating factor for lower depression symptoms (Arat & Wong, 2017). In several studies across the world in non-clinical populations, adolescents who participate in regular exercise, organized sports, or other forms of physical activity also exhibit lower levels of depressive symptoms than peers who do not exercise as frequently.

For example, in a large-scale population study of 11,655 adolescent students in Norway, Kleppang et al. (2018) found that adolescents who participated in regular exercise also had lower odds of depressive symptoms. Interestingly, these researchers found that when other confounding variables were controlled for, it was adolescents who participated in organized sports that exhibited statistically significantly lower depressive symptoms than adolescents who participated in other forms of exercise, suggesting that social interaction during exercise may also play a role in symptom reduction (Kleppang et al., 2018). Other studies mirror similar findings. In a large study of adolescents, ages 12-18 years old, McDowell et al., (2017) revealed that those who engage in moderate to high amounts of physical activity (60 minutes) at least 3-7 days per week also reported lower amounts of anxiety and depressive symptoms, where adolescents who report engaging in physical activity the least (0-2 times per week) reporting the highest levels of anxiety and depressive symptoms (McDowell et al., 2017).

Other large-scale studies provide findings that indicate depression and exercise, or physical activity are closely linked. Zhu et al. (2019) studied physical activity, depression, anxiety, sleep, and screen-time factors among 20,708 adolescents ages 12-17. Adolescents who did not participate in physical activity during the week were twice as likely to experience anxiety and depression than peers who participated in daily physical activity or exercise (Zhu et al., 2019). The positive effects of exercise on reducing depressive symptoms have also been confirmed within large scale meta-analyses. For instance, Bailey et al., (n.d.) cross-referenced seventeen randomized trials and 771 participants in various studies and assessed the effectiveness of exercise on depression reduction. In their examination of multiple studies, the authors maintained that there is a large effect of exercise on depression symptoms across studies with standardized mean difference (SMD) of -0.82, showing an inverse relationship between regular exercise and depressive symptoms across trials of adolescents and young adults ages 12-25 years old (Bailey et al., n.d.).

Not all research regarding exercise and depression shows conclusive positive evidence, however. In a 6-year longitudinal study of adolescent females ages 11-15 years old, Jerstad et al., (2010) identified that physical activity reduces risk for subsequent depression episodes for adolescent females as physical activity appears to increase self-efficacy, social interactions, and engagement levels. Interestingly, this study also revealed an inverse relationship in that as young females already experience depression, they are also less likely to engage in physical activity, thereby reducing their engagement in social interactions and self-efficacy building activities (Jerstad et al., 2010). In more recent

research by Arat and Wong (2017) that examined a large-scale sample of 23,372 adolescents ages 11-17 across six middle income countries. Higher levels of physical activity are not conclusively linked to lower levels of depression. Overall, the researchers found that there was a generally low level of exercise participation across this age group as well as a low level of depression, with no significant differences between adolescents who exercised more frequently (Arat & Wong, 2017).

The research regarding exercise and impact on depression symptoms in adolescents is staggering. Not all research confirms exercise to be a "cure all" for depression, and many studies indicate that other factors associated with exercise, such as social interaction, should be considered (Kleppang at al., 2018). These studies notwithstanding, there remain a significantly strong empirical link suggesting exercise reduces depression in adolescent populations.

Exercise and Anxiety

Research focusing specifically on the variables of exercise and anxiety, such as generalized anxiety disorder, are far fewer than that of exercise and depression. Much of the research available focuses on global adolescent population groups, rather than within the United States (Bailey et al., n.d.; Bélair et al., 2018; Kleppang et al., 2018; McDowell et al., 2017). Although there is a lack of significant focus on American adolescents within the most recent research of anxiety and exercise, several studies merit discussion in this aspect due to the similarities in adolescent population demographics.

In 2018, Bélair et al., (2018) examined effects of sedentary and physical activity among 9,702 adolescents aged 14-15 years old. Findings suggest that physically inactive

adolescents were 1.88 times more likely to have moderate to severe anxiety symptoms as opposed to peers who were not physically active. Additionally, both physically inactive (less than one day per week) and sedentary lifestyles in adolescence appear to significantly increase the odds of developing anxiety. Many studies regarding adolescent exercise and mental health focus on the two most predominant mental health problems that adolescents face today, depression and anxiety (Arat & Wong, 2017; Bélair et al., 2018; He et al., 2018), presenting a strong case for examining the variables of depression and anxiety together in relation to exercise.

Arat and Wong (2017) examined the relationship between physical activity and mental health in an epidemiological study of 23,372 adolescents ages 11-17 years old across six middle-income countries using archival data. The authors looked specifically at adolescent engagement in at least 60 minutes of walking or biking per week and several mental health factors that may have affected the participants over the previous 12 months: loneliness, anxiety, depression, suicidal ideation, and suicide attempts. Across the six countries, the authors noted a low prevalence of exercise within this age group and additionally found that adolescents who engaged in at least 60 minutes of exercise per week reported lower rates of anxiety in the previous 12 months than their counterparts who did not engage in at least once weekly exercise (Arat & Wong, 2017). Interestingly, the authors also found a low prevalence rate of both weekly exercise and mental health in all the middle-income countries examined.

Other research specifically focused on Canadian adolescents also indicates similar relationships between exercise and adolescent anxiety symptoms. For example, authors

Bélair et al. (2018) used archival data from the National Longitudinal Survey of Children and Adolescents (NLSCY) to examine the relationship between anxiety, depression, physical activity, and sedentary behavior. Using data gathered for 9,702 participants, aged 14-15-years old, the authors found that adolescents who are sedentary are 1.69 times more likely to experience symptoms of moderate to severe anxiety than their physically active peers (Bélair et al., 2018). Additional research performed by Gunnell et al., (2016) among the Canadian adolescent population indicates there is not a clear relationship between anxiety and adolescents. Among adolescents and young adults ages 10-21, the authors examined bidirectional relationships between anxiety, physical activity, screen time, and depression. Within their study of 1,160 adolescents between 2006-2010, the authors found that there was no significant relationship between initial levels of physical activity and anxiety as predictors of change over the years, though increases in anxiety were associated with increases in screen-time (covariance = .07, $p = .06$) and increases in depression (covariance = .41, $p < .05$) (Gunnell et al., 2016).

Other research also indicates a different type of relationship between exercise and anxiety than previously provided. In 2017, He et al. (2018) examined various types of exercise among 14–15-year-old adolescents and prevalence of various mental health disorders, including mood disorders (major depressive disorder, dysthymia, and bipolar I/II disorder), anxiety disorders (agoraphobia, generalized anxiety disorder [GAD], phobias, posttraumatic stress disorder, and separation anxiety disorder), as well as attention deficit hyperactivity disorder (ADHD), and behavioral disorders. Although the authors found that physically active adolescents had lower odds of mood disorders,

including depression, they also noted that physically active adolescents were more likely to have GAD than peers who were sedentary or exercised less than one time per week (He et al., 2018). Findings such as this indicate that there may be other mitigating factors regarding adolescent anxiety that are not well-researched, limiting the ability of researchers to identify any clearly defined links between the effectiveness of exercise on anxiety reduction.

Overall, research regarding the interplay of anxiety and exercise indicates that adolescents who are physically active are less likely to experience anxiety. However, it is worth noting that with regards to anxiety among mental health concerns, the benefits of exercise do not seem to be as clear as that for depression. Due to the gaps in this specific area, exercise and anxiety levels were explored in the context of adolescents in RTCs.

Exercise in RTCs

Key components of physical activity interventions identified within the literature include early intervention; monitoring of metabolic indicators; using a multidisciplinary approach that includes mental health professionals, staff, and family if possible that can facilitate continuation of interventions after RTCs; behavior change strategies; individualized exercise programs if possible that are tailored to goals; and supervision of programming by exercise professionals and/or physiotherapists (Lederman et al., 2017).

There has been an overall increase in exercise intervention implementation in a variety of residential facility programming due to the positive impact that physical activity has on mental health (Lederman et al., 2017). One pilot investigation regarding a sports-based intervention for adolescent females with trauma histories was reported on by

D'Andrea et al. in 2013. In this study, females ages 12 to 21 were provided with opportunities to voluntarily enroll in trauma-informed sports league that utilized the "Do the Good" curriculum and provided seasonal sports opportunities such as basketball, soccer, and softball. Mental health symptoms were assessed every three months and outcomes indicated a statistically significant decrease in internalizing disorders (depression, anxiety) and externalizing disorders (aggressive behaviors) that could not be accounted for simply by time in the program (D'Andrea et al., 2013).

McIlvain et al. (2015) also conducted a pilot study regarding residential adolescents' participation in yoga. The authors found that adolescents who participated in the exercise program had an overall decrease in behavioral interventions required during their time in RTC. This is particularly important in RTCs where behavioral interventions in response to aggressive acts often result in consequences for the adolescent (McIlvain et al., 2015). In a qualitative study regarding exercise programming for adolescents in a residential chemical dependency center, adolescents who participated regular and personalized exercise during care also reported improved mental health overall, reduced cravings and withdrawals, as well as improvements in self-esteem (More et al., 2018). Although there are only a handful of pilot studies regarding outcomes of exercise interventions that are available with the literature, each of these studies indicate that various exercise regimens produce improvement overall in mental health, reduction in problem behaviors, as well as some improvements in self-efficacy where it was assessed.

Overall, there remains a paucity of research focusing on exercise programming impact on adolescents within RTCs. This study will look at correlations between trauma,

depression, and anxiety on subsequent exercise participation. This study will also look at changes in depression and anxiety scores as a function of weekly participation in exercise during adolescents time in an RTC.

Summary

Adolescents who enter RTCs often have higher levels of trauma, depression, and anxiety than their peers. The literature suggests that exercise plays a role in facilitating improvements in mental health, as well as preventing declines in mental health. However, research on exercise or physical activity and impacts on mental health have been studied primarily for adolescents in a non-clinical population. There is only a paucity of research that assesses exercise effects for adolescents in RTCs, with only one study found that addressed exercise impact for traumatized adolescents.

This study informs residential service facilitation regarding the provision of low-cost programming, such as exercise, and the impact this may have on further reducing the negative mental health consequences of trauma, such as high rates of depression and anxiety. Paired with other treatments being offered within RTCs, such as psychotherapy, regular exercise may promote a further and longer-term reduction in mental health symptoms. This study identified a gap in the literature regarding assessing potential positive impacts of exercise on reducing anxiety and depression, specifically for adolescents in RTC with trauma. Physical activity programming is a low-cost option that also requires a low level of staff training prior to implementation as compared to other types of treatment options. The goal of this study was to contribute knowledge on the relationships of depression, anxiety, trauma, and exercise for adolescents in RTCs. This

pilot study provides foundational information for a future large-scale study to be completed in the future.

In addition to the identified gap in the literature, other areas remain to be studied. Specifically, further research could address impact of exercise in association with other symptoms of trauma, including oppositional and aggressive behaviors. It may also be beneficial to compare potential differences between genders and overall impact of physical activity participation in residential services.

Chapter 3 comprises technical components of this study and how it was carried out, such as the research design and rationale, methodology, instrumentation used, data analysis procedures, potential threats to validity, and ethical procedures followed in the research.

Chapter 3: Research Method

Introduction

This pilot study used archival data collected for adolescents ages 13-17 from an upper Midwest RTC. The levels of trauma, depression, and anxiety symptoms, along with exercise participation were collected and analyzed in order to answer research questions. This chapter explains the methodology that was used to execute the archival data analysis, research design rationale, as well as explain the procedures of data collection from the agency of origin. Variables of the study were identified and described as they relate to the research design and research questions. Factors impacting the validity and reliability of this study are discussed, as well as ethical issues that were addressed in conducting this study.

Purpose of the Study

Adolescents are placed in RTCs from a variety of referral sources, including child protection agencies, public mental health agencies, and juvenile justice authorities (Connor et al., 2002). Many, if not most, of adolescents entering RTCs have previously been removed from their families due to substance use, parental neglect, and/or parental abuse (Griffith et al., 2009). Many adolescents who experience trauma from their close caregivers and families also tend to fall into the category of having complex traumatic experiences and subsequently experience higher rates of impairment, as well as meet criteria for depression, anxiety, or disruptive disorders (D'Andrea et al., 2012).

Research continues to provide evidence that exercise effectively reduces depression and anxiety as well increases self-efficacy for adolescents (Arat & Wong,

2017; Benight & Bandura, 2004; McDowell et al., 2017). Regarding exercise in RTCs, most available research is focused on small, limited pilot studies, highlighting a significant gap in the literature for this area (D'Andrea et al., 2013; McIlvain et al., 2015; More et al., 2018). This study fills literature gaps in the areas of exercise programming in RTCs in relation to anxiety, depression, and trauma. This pilot study used archival data to perform analyses on the variables, as well as provides a power analysis for a future, large-scale study of the same variables.

Specifically, the purpose of this study was to assess impact of weekly exercise participation on change scores of depression and anxiety over length of stay in RTC. Additionally, the study assessed the correlation between initial trauma, anxiety, and depression scores and subsequent exercise participation.

Research Design and Rational

This pilot study utilized a quantitative, longitudinal research design to evaluate hypotheses and answer research questions posed within this study. The archival data facilitated comparison of initial and final scores for depression, trauma, and anxiety with exercise participation, respectively. Additional analyses included repeated measures ANOVA with exercise participation as the independent variable and depression and anxiety as the dependent variables.

Adolescent exercise participation was measured weekly between the initial data collection and the final data collection of depression and anxiety scores. The variable was measured as a percentage of exercise participation out of total opportunities to exercise within the specified period. Trauma scores were collected from the CATS and data was

collected only once, at the initial entry to RTC. Depression and anxiety scores were measured approximately every four weeks.

The rationale for using quantitative methodology was to allow for numerical analysis of data collected on the PHQ-9, CATS, and the GAD-7. Additionally, using quantitative methods with archival data allowed for independent work without potential participant bias impacting data collection or interpretation. The study was non-experimental with no manipulation of variables. Statistical methods provide researchers with a useful way of observing relationships between variables and relaying patterns of relationships with numbers (Rudestam & Newton, 2007). Using a quantitative approach allowed for testing of hypotheses developed in this study to accurately answer the research questions. Archival data was collected from an upper Midwest RTC between 11/01/2020-03/31/2021. Archival data can offer advantages over other types of research, including allowing access to study data regarding protected populations, such as minors (Payne et al., 2003).

Methodology

Population Description

Population, Sampling, and Sampling Procedures

The current study utilized data collected between 11/01/2020-03/31/2021 as collected by the upper Midwest RTC. The target population was adolescents in RTC aged 13-17 years. No additional information or demographics were obtained, as adolescents are considered a protected population by the Institutional Review Board.

Inclusion and exclusion criteria

To be included in this study, the data collected for participants met certain criteria. All participant data included initial and final depression and anxiety scores, as well as a single trauma score. Additionally, each participant's exercise activity was tracked for the period in RTC between the initial and final data collection scores.

Power Analysis

This pilot study provided statistical information for a larger scale study, in terms of appropriate sample size and data suitable in assessing effects of exercise participation for adolescents in RTCs.

Procedures for Participation and Data Collection

Program participation at agency

Adolescents participated in regular exercise programming as part of a wellness initiative within the RTC. Weekly exercise offerings included on- and off-campus physical activity options. If adolescents were not able to participate within a given week, there was no penalty, nor were there initiatives offered to adolescents who chose to participate. In addition to participation, scores on the CATS, GAD-7, PHQ-9, and the age of participant was also tracked to assist in inclusion/exclusion criteria.

Permission procedures

The use of archival data for this study required collaboration with an upper Midwest RTC, whose staff believed exercise participation was transformative approach for reducing intensity of mental health symptoms. The data used within the current study was collected between 11/01/2020-03/31/2021. Adolescents are currently considered a

vulnerable population, meaning that there are additional considerations when working with this population for research. However, by using archival data, I was able to reduce the impact of potential harm to this population as the information had already been collected. A data use agreement with the agency, as well as additional considerations to eliminate participant identification within the data set, was required to protect the adolescents involved in the data. The participating agency removed all identifying information prior to providing the data set used in this study. A data use agreement was approved and signed by an agency legal representative to provide legal permission of use of the data for research purposes.

Procedures for participation and data collection for current study

This study utilized review of de-identified archival records. There was an estimated 15-20 adolescent who had participated in the exercise initiative between 11/01/2020-03/31/2021 for which data was analyzed. Each data profile met the following criteria: an initial trauma score as recorded on the CATS, at least two separate depression symptom scores reported on the PHQ-9, at least two anxiety symptom scores reported on the GAD-7, and exercise participation within the data points gathered.

Within this study, adolescent participation in exercise was tracked weekly between the first and last data point collections on the PHQ-9 and the GAD-7. All results were analyzed regardless of amount of exercise participation. This pilot study provided data analysis and information for sample size for a larger scale RTC study on exercise participation, anxiety, depression, and trauma.

Prior to any data review, an approved IRB application was required and obtained. Approval was gained for IRB to allow me access to this archival data set. The IRB approval number was 10-06-20-0348036. Upon receiving data for use in this study, HIPAA compliant standards for confidential information were maintained. Only agency issued and maintained technology was used, which included encryption protection on computers and e-mail correspondence. Paper copy data was also kept in compliance with HIPAA and agency privacy standards, including double-lock standards in office areas.

Instrumentation and Operationalization

To assess trauma, depression, and anxiety levels for adolescents ages 13-17 for this study, the variables were measured using the CATS (Sachser et al., 2017), PHQ-9 (Kroenke et al., 2001) and GAD-7 (Spitzer et al., 2006).

Patient Health Questionnaire (PHQ-9)

The Patient Health Questionnaire (PHQ-9) is a self-administered and self-report version of the PRIME-MD diagnostic instrument for common mental health disorders and was created by Kurt Kroenke, Robert Spitzer, and Janet Williams in 2001. Criteria questions are based on the nine criteria for Major Depressive Disorder outlined in the Diagnostic and Statistical Manual for Mental Disorders (DSM-IV) (American Psychiatric Association [APA], 1994). Users report frequency and severity of symptoms experienced in the previous two-week period (Kroenke et al., 2001). The instrument contains nine items rated on a 4-point scale ranging from “not at all” (0) up to “nearly every day” (3). The total item score range is 0-27 with higher scores indicating increased frequency of depressive symptoms over the previous two weeks (Kroenke et al., 2001). Initially

created for use in primary care settings with adults, the PHQ-9 has also been validated for use with adolescents aged 13-16 years old in primary care settings (Allgaier et al., 2012). The PHQ-9 is available in more than 30 languages and is free to users.

Psychometric Properties.

Initial validity studies for the PHQ-9 consisted of a large-scale study of 3,000 adult participants from the Primary Care study and 3,636 adult patients from the Obstetrics-Gynecology study (OB-GYN). Criterion validity was assessed using independent structured interviews for 580 participants. At a cut-point score of 10, the authors found specificity at 88% and sensitivity at 88% for Major Depressive Disorder. Construct validity was assessed using a 20-item General Health Survey with a reported effect size of .71. Limitations to the initial study included the use of a cross-sectional design (Kroenke et al., 2001).

Psychometric Properties for use with Adolescents. There are additional studies that have also established validity and reliability of the PHQ-9 for use with adolescent populations down to age 13. Results from these studies indicate similar specificity and sensitivity validity statistics as those cited by the original authors of the PHQ-9. A brief review of the major studies is provided.

Richardson et al. (2010) assessed the use of the PHQ-9 with 442 adolescent adolescents aged 13-17 years old presenting to primary care facilities. Utilizing ROC analysis, In the research, Richardson et al. (2010) indicated a specificity of 77.5% and sensitivity value of 89.5% within the adolescent population. A cut-point of 11, rather than 10, for moderate depressive symptomology, increases the validity of the PHQ-9 for

specificity. The authors indicate that these values are sufficient for establishing the PHQ-9 as a valid measure for use with the adolescent population (Richardson et al., 2010).

Allgaier et al. (2012), examined criterion validity of the PHQ-9 with 322 adolescents ages 13-16 years old that presented to in-patient and out-patient pediatric care in Germany. Assessing validity of the PHQ-9 against structured diagnostic interviewing by a mental health professional, the study indicates a Cronbach's alpha of 0.82 for the PHQ-9 as being able to predict an outcome of a depressive diagnosis. Using a dimensional algorithm to detect sensitivity and specificity, the PHQ-9 has a specificity of 86.5% and sensitivity of 90% in detecting Major Depressive Disorder for adolescents (Allgaier et al., 2012). Validity outcomes in the use of the PHQ-9 for adolescents was consistent with outcomes for use in adult populations.

Lastly, Burdzovic Andreas and Brunborg (2017) also addressed PHQ-9 validity for use with adolescents by examining depression symptoms in a school-based sample of 8846 adolescents in grades 8-12. Confirmatory factor analysis for PHQ-9 item loading for the construct of "depression" indicated a Cronbach's alpha of 0.86. When separated by gender, the authors cite Cronbach's alpha of 0.81 for boys and 0.88 for girls within the study. When observing a single common factor, a Cronbach's alpha of 0.70 or higher is acceptable within the Applied Psychology discipline (Cortina, 1993).

Taken together, the validity studies completed by Allgaier et al. (2012), Burdzovic Andreas and Brunborg (2017), and Richardson et al. (2010), provide substantiation for the valid use the PHQ-9 for use with a variety of adolescent populations.

Generalized Anxiety Disorder 7-Item (GAD-7)

The second measurement item within this study was the Generalized Anxiety Disorder 7-Item Assessment (GAD-7). The GAD-7 was created by Spitzer et al. (2006) and was designed as a brief measure for Generalized Anxiety Disorder. Initially designed for use at the primary care level, the GAD-7 was created as a separate measure from the PHQ-9 for initial assessment. The authors recognize that although depression and anxiety symptoms co-occur, they are distinct dimensions (Spitzer et al., 2006). Criteria questions are based on diagnostic criteria for Generalized Anxiety Disorder outlined in the DSM-IV (APA, 1994). Users report frequency and severity of symptoms experience on the previous two-week period (Spitzer et al., 2006). There are 7 items rated on a 4-point scale ranging from "not at all" (0) up to "nearly every day" (3). The total item score range is 0-21 with higher scores indicating increased frequency of anxiety symptoms over the previous two weeks. Copyright usage for the GAD-7 is held by Pfizer Inc., though it is free to use for clinical and research purposes (Spitzer et al., 2006).

Psychometric Properties

The original GAD-7 study, created by Spitzer et al. (2006), was provided to 2,740 adults throughout fifteen different clinics at the primary care level between November 2004 and June 2005. The initial purpose of this phase of instrument development (n = 2,739) was to select scale items as well as determining cut-off scores for making a diagnosis of Generalized Anxiety Disorder (GAD). The secondary phase (n = 591) was to determine test-retest reliability. As a result of this initial validity and reliability testing, internal consistency of the GAD-7 was excellent (Cronbach =.92). Test-retest reliability

was also good (intraclass correlation = 0.83). Comparison of scores derived from the self-report scales with those derived from the MHP-administered versions of the same scales yielded similar results (intraclass correlation = 0.83), indicating good procedural validity (Spitzer et al., 2006).

Psychometric properties for use with adolescents. There are additional studies that have also established validity and reliability of the GAD-7 for use with adolescent populations down to age 13, both within the United States as well as internationally. Results from these studies indicated similar specificity and sensitivity validity statistics as those cited by the original authors of the GAD-7. A review of the most significant research is presented.

One such study was conducted in Germany for the general population there and included children ages fourteen and up from primary care facilities (Löwe et al., 2008). In this study of 5,080 participants, of which 296 were in the 14-24-year-old age range. The GAD-7 was assessed for construct validity against the PHQ-2, the Rosenberg Self-Esteem Scale, the Questionnaire on Life satisfaction, as well as the Resilience Scale. Inter-correlations between the other scale constructs were low to moderately low, with the highest construct correlation being with the PHQ-2 at r = 0.64 (95% CI: 0.63-0.66) (Löwe et al., 2008). Intercorrelations between items on the GAD-7 ranged from between r = 0.45 to r = 0.65. Internal consistency of this screener also was assessed, with a score of $\alpha = .89$, with mean item scores ranging from 0.30 to 0.54. This study generated normative data for the following age groups: 14-24, 25-34, 45-54, 55-64, 65-74, and 75 plus (Löwe et al., 2008).

More recent results confirm similar findings. Mossman et al. (2017) used the GAD-7 for adolescents aged 12-17 for clinical correlation ratings, specificity, and sensitivity of questionnaire items. Participants (n = 40) were assessed with both the GAD-7 and the Pediatric Anxiety Rating Scale (PARS). The GAD-7 and PARS scores were strongly correlated ($R = 0.65$, $p < 0.001$) with a main effect for symptom severity of ($p < 0.001$). GAD-7 scores ≥ 11 and GAD-7 scores ≥ 17 indicated the clearest specificity (100%) and sensitivity (97%) for detection of moderate and severe anxiety, respectively. Conclusions of this study indicated that a scores obtained on the GAD-7 provide an accurate, easy to administer (2 minutes average), and strongly correlated with a clinician-rated PARS (30 minutes to administer) ($n = 40$; $R > 0.65$, $p < 0.05$) (Mossman et al., 2017).

Child and Adolescent Trauma Screen (CATS)

The CATS was published by Sachser et al. in 2017 and was used to obtain information on trauma experiences reported by adolescents at entry to residential services. This measure was designed to be used as a short screening for potential traumatic events and was based on the APA's DSM-5 criteria for PTSD. The CATS is freely accessible to clinicians and researchers without charge and is available in English, German, Norwegian, and Spanish versions (Sachser et al., 2017).

The CATS is available in two formats: caregiver-report, and self-report versions. Within this study, the data being collected utilized the self-report version of the CATS. The CATS was normed on three samples of trauma-exposed children in the United

States, Germany, and Norway with a total sample size of 1,089 between the samples, which included both self-report and care-giver report (Sachser et al., 2017).

The self-report version contains two sides of information collection related to trauma experiences and trauma symptoms. Respondents were requested to answer whether they had experienced a number of traumatic events. The second page of the CATS is a 20-item questionnaire regarding symptoms of trauma experienced by the respondent. Items were reported on a 4-point scale with anchors of: 0 = never, 1 = once in a while, 2 = half the time, and 3 = almost always.

Psychometric Properties

The initial norming data for the CATS consisted of three samples from the United States, Germany, and Norway. The version created for the United States included 249 self-reports for 7-17-year-old adolescents and 267 care-giver reports for the same age range. Within the German sample, there were 117 self-reports and 95 caregiver reports for 7-17-year-old adolescents. In the final sample, collected from Norwegian residents, there were 109 self-reports and 62 caregiver-reports collected. The internal consistency of the CATS was assessed using Cronbach's alpha with a reported reliability rating from .88-.94 between the caregiver-reports and self-reports (Sachser et al., 2017). Convergent-discriminant validity was also assessed against measures of depression (PHQ-9 and Mood and Feelings Questionnaire [MFQ]), anxiety (GAD-7; Screen for Child Anxiety Related Disorders [SCARED]), and externalizing symptoms (Strengths and Difficulties Questionnaire [SDQ]; Pediatric Symptom Checklist [PSC-17]) using bivariate correlation coefficients. Pearson's r coefficients for correlations with measures of depression ranged

between .62-.82. Pearson's r coefficients for correlations with measures of anxiety ranged between .40-.77. Pearson's r coefficients for correlations with measures of externalizing behaviors ranged between -.15-.43. These correlation coefficients are reported for all language versions combined (Sachser et al., 2017). Limitations noted by Sachser et al. (2017) include the use of the CATS on only three populations within the study with a need to have additional language and population validity studies incorporated for wider use in measuring of trauma.

Data Analysis

For this pilot study, I utilized the International Business Machines (IBM) Statistical Package (SPSS), version 27, to analyze the archival data that fit the inclusion criteria (IBM, 2015). Data cleaning was performed to correct or eliminate inaccurate or missing data. The analysis described in this study was run to address assumptions of correlation and repeated measures ANOVA, as well as to report outcomes to answer research questions.

The projected sample size was identified as 15-20 cases. However, the sample size of data that fit all inclusion criteria was 11 cases, lower than projected. In order to answer the research questions appropriately, three correlation analyses were run with the use of SPSS version 27 with the variables exercise, depression, anxiety, and trauma. The study design also included two repeated measures ANOVAs to evaluate interaction effects of exercise on depression and anxiety scores for adolescents.

For research questions using correlation, statistical analysis is run to determine probability value that there is/is not a linear relationship between variables. Generally, the

closer the value is to 0, the less likely there is a positive or negative linear correlation between two variables. A correlation less than .50/-.50 is considered low, .50/.70 (-.50/-.70) is moderate, and >.70/-.70 is a high correlation. In general, a p-value of less than 0.5 is accepted to indicate rejection of the null hypothesis (Cohen, 1992). In keeping with similar research within this field, the accepted p-value was retained for questions pertaining to rejection/retention of null hypotheses.

Research Questions

RQ1: Is there a correlation between initial depression scores and amount of exercise participation for adolescents in RTCs?

$H_0 1$: There is no correlation between initial depression scores and amount of exercise for adolescents in RTCs.

$H_a 1$: There is a correlation between initial depression scores and amount of exercise for adolescents in RTCs.

RQ2: Is there a correlation between initial anxiety scores and amount of exercise participation for adolescents in RTCs?

$H_0 2$: There is no correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

$H_a 2$: There is a correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

RQ3: Is there a correlation between initial trauma scores and amount of exercise participation for adolescents in RTCs?

$H_0 3$: There is no correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

$H_a 3$: There is a correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

RQ4. Is there a statistically significant change in depression score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

$H_0 4$: There is no statistically significant change in depression score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

$H_a 4$: There is a statistically significant change in depression score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

RQ5. Is there a statistically significant change in anxiety score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

$H_0 5$: There is no statistically significant change in anxiety score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

$H_a 5$: There is a statistically significant change in anxiety score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

Threats to Validity

Within quantitative research, there are potential threats to the validity of any given study. Internal validity refers to the ability of a study to be replicated at a point in the future using the "same sample, setting, context, and time" whereas external validity refers to the extent that a study's findings could be replicated across "different populations of persons, settings, contexts, and times" (Onwuegbuzie, 2000, p. 13). The importance of discussing the threats to both the internal and external validity of a study has been identified by many researchers (McMillan, 2000; Onwuegbuzie, 2000). The following sections identify both internal and external validity threats that plausibly may have influenced the outcomes of the study, even though they were not directly being studied. Due to the nature of the archival research involved, the potential threats to validity were identified at three stages of the study: the intervention stage, data analysis stage, and data interpretation stage.

External Validity

Population validity. The extent to which results from one study are generalizable to other, larger populations or to different subpopulations is a known as population validity (Onwuegbuzie, 2000). Within the current study design, the population was restricted to data collected from adolescents placed in an RTC setting between 11/01/2020-3/31/2021. Research also centers on adolescents within RTCs, representing a specific subset of the population and any findings from this study are limited to this specific population or populations with similar characteristics.

Ecological Validity

Ecological validity refers to the ability to generalize results from one type of study to other similar settings, variables, or study conditions, or to the extent one can separate the findings of a study from the specific setting in which the study took place (Onwuegbuzie, 2000). When using archival data, such as in the current research, the data was collected from a specific location, an upper Midwest RTC. RTCs are not all created equal, such that the opportunity to participate in exercise programming at one RTC may not reflect a mandatory provision at other RTC. The ecological validity of this study is inherently low due to the provision of exercise and physical activity opportunities linked to the adolescent's placement within the specific upper Midwest RTC.

Multiple Treatment Interference

As noted within the internal validity section, multiple treatment interference was present within this research and posed a threat to both internal and external validity.

Specificity of variables.

The threat of specificity of variables refers to the way that a researcher operationally defines variables. The more unique the set of variables, the population, the setting, and the instruments or measures, the less generalizable to findings of the research will be to additional populations (Onwuegbuzie, 2000). Within this study, the variable "exercise" referred to participation in an exercise program for each week they were in RTC programming between the initial data collection of scores (depression, anxiety, trauma) and the final data collection of scores (depression, anxiety).

Selection x treatment interaction

The introduction of multiple treatment interventions for adolescents who are providing archival data for the study was inherent within this research design. There was the potential for self-selection bias within this study as adolescents were offered, though not required, to participate in weekly exercise. There is a strong likelihood that pre-existing characteristics of the participants accounted for some of the outcomes from the data, which reduced the confidence in stating treatment outcomes were due directly from participation in the exercise intervention.

Internal Validity

History.

History refers events and conditions that may influence outcomes in the research, even those events and conditions that are not being studied, nor related to the treatment being studied. The longer a study is being conducted, the more opportunity events in history have to influence outcomes (Onwuegbuzie, 2000). Data used in this current research had a time frame of approximately 5 months (11/01/2020-3/31/2021), making the data vulnerable to influence by factors and variables outside of the focus of the study. For this reason, time spent in an RTC, regardless of exercise participation or initial mental health symptoms, was expected to have an unknown influence on the adolescents and their data reporting, as was suggested in prior research (Strickler et al., 2016).

Maturation.

The process of maturation of participants in a study is unavoidable with forms of longitudinal research. Within the upper Midwest RTC that provided data, adolescents

may spend up to 18 months in programming. However, the limitations of this study include a 5-month time frame, typically less than a full-duration stay in an RTC. During this time frame, adolescents may have experienced physical, emotional, and intellectual changes that are not being studied but may have influenced outcomes of depression and anxiety levels (Onwuegbuzie, 2000).

Testing.

When providing a measurement instrument multiple times within a study, a potential testing bias may be introduced, whereas the initial score or measurement influences the participants' responses on subsequent measurements (Onwuegbuzie, 2000). Validity threats due to testing are often likely when the testing administered is a cognitive measure requiring information provision and the time between the administration of measures is short. Within this study, the PHQ-9 and the GAD-7 were administered approximately every four weeks for each participant, so some participants may take the GAD-7 and PHQ-9 more than twice depending on their time in programming at the start of the exercise and wellness initiative. Both the PHQ-9 and GAD-7 have provided good test-retest scores within their psychometric property sections.

Instrumentation.

When research utilizes measures that lack appropriate levels of validity and reliability, the use of these instruments poses a threat to the overall internal validity of the study (Onwuegbuzie, 2000). Within the current research, the instruments utilized included the PHQ-9, GAD-7, and the CATS. These measurement instruments had

varying levels of validity and reliability, making them reliable and valid tools for use within this study.

The PHQ-9 (Kroenke et al., 2001) has been well-researched for use with adolescents down to age thirteen. Acceptable levels of validity and reliability have been noted within adolescent populations both within the United States and globally (Allgaier et al., 2012; Burdzovic Andreas & Brunborg, 2017; Richardson et al., 2010).

The GAD-7 has been researched with use in the adolescent population down to age 12-17 (Mossman et al., 2017) with acceptable levels of validity and reliability within this population being reported.

The CATS tool has only one validity study available to report on psychometric properties for use with adolescents (Sachser et al., 2017). Two additional pilot studies were also located within research data banks as having used the CATS with adolescents. These studies were not conducted explicitly to test the validity and reliability of the use of the CATS with adolescent populations, though they do substantiate the CATS as a reliable clinical measure (Pfeiffer & Goldbeck, 2017; Unterhitzenberger et al., 2019). The published research regarding validity and reliability of the CATS does indicate acceptable values for use with adolescents. Although additional psychometric data would be preferred, I was unable to locate additional published articles at this time.

Differential selection of participants.

Differential selection of participants, or selection bias, occurs when groups are formed based on already-formed groups rather than randomization (Onwuegbuzie, 2000). There may be a variety of factors influencing an adolescent's decision to participate in

the exercise intervention. There is a possibility that adolescents with differing CATS scores additionally have differences in other areas, such as cognitive, affective, and personality attributes (Onwuegbuzie, 2000), which makes this non-random sampling procedure open to potential selection bias.

Attrition.

Internal validity for this study may have been impacted by attrition rates of participants during the time of data collection. Attrition refers to the loss of participants during the data collection phase (Onwuegbuzie, 2000). The current research design utilized archival data potential vulnerable to attrition of participants from the residential program prior to completion. This procedure resulted in the exclusion of the data collected for that participant from being used within this current study if all selected data points had not been collected.

Multiple treatment interference.

Within the context of the data collection, if participants were being exposed to multiple interventions, this may pose as a threat to both internal and external validity (Onwuegbuzie, 2000), During the time of data collection by the agency, adolescents that were participating in exercise programming were simultaneously participating in other programming, such as weekly psychotherapy and academic courses. There was likelihood that these other interventions also influenced a participant's involvement in exercise programming as well as their anxiety and depression levels. However, a separate isolated intervention period for exercise was not possible within the design of this study. Thus, it

was impossible to account for alternative research designs that would require reducing the potential interference of multiple interventions.

Time x treatment interaction.

A time x treatment interaction validity threat may be introduced to a study when members of one group are exposed to the intervention longer than members of another treatment group (Onwuegbuzie, 2000). All adolescents had at least two data points for variables of depression and anxiety, though some may have had additional data points for the variables, based on their length of stay in programming, as well as ability to participate in the exercise programming. Due to the variability of time an adolescent may have spent in RTC, this data point restriction was a recognized limitation in this archival pilot study.

Data Analysis Validity

During data collection and analysis, there were notable validity threats. The following are threats to internal validity during the data analysis stage affecting the accuracy of the present study's findings.

Statistical regression.

Statistical regression may happen when researchers attempt to analyze longitudinal data or statistically equate groups. This was especially true for unequal size groups or those with underlying characteristics differences (Onwuegbuzie, 2000). This was a notable limitation for the current study design.

Assumptions.

This pilot study involved both correlation and repeated measures ANOVA statistical analysis. For correlation, the assumptions that were reviewed included: level of measurement, related pairs, absence of outliers, and linearity (Cohen, 1992). For a repeated measure ANOVA, assumptions to be reviewed included: level of measurement (DV), categorical groups (IV), absence of outliers, normal distribution, sphericity (Lix & Keselman, 2019).

Ethical Procedures

During their stay in RTC, adolescents were asked to participate in a supplemental exercise program. Adolescents who agreed to participate in exercise programming also received an initial assessment of depression (PHQ-9), anxiety (GAD-7), and trauma (CATS) around the start of exercise participation. Participation in exercise programming was not required and there were no consequences for lack of participation. No incentives were offered to adolescents for participation in the exercise programming. All data collected was kept private according to HIPPA and ethical guidelines as set forth by the American Psychological Association [APA], (2017).

Upon collection, all data was kept confidential, with specific identifiers being removed. The data set was then compiled into a data key (Appendix A). This study was compliant with general research guidelines as outlined by the APA, including seeking and gaining IRB approval (APA, 2017). Specifically, APA code 8.01 discusses following Institutional review board (IRB) protocols for research and code 8.02 discussing informed consent. Adolescents were considered a vulnerable population, and as such,

only archival data collected was used in order to limit any undue harm. During this study, there were no incentives provided to participants (code 8.06), no voice recording of participants (code 8.03), no deception was used with archival data (code 8.07), and no animals were used within the study (code 8.09) further reducing potential harm to participants in the original data collection phase. Additionally, APA code 8.08 discusses debriefing of participants, and in this case, use of archival data prohibits the contact of myself with any participants within the original data collection phase, so debriefing was not provided at this level (APA, 2017).

A data use agreement was created from the agency legal team to provide legal permission of use of the data for research purposes. Approval was gained for IRB to allow me access to this archival data set, once all identifiers were removed. The IRB approval number was 10-06-20-0348036.69.

Summary

This chapter discussed the research design, the rationale for using this specific design, reviewed the instrumentation to be used within this study, as well a thoroughly reviewed potential limitations of the study, including internal and external validity concerns. In addition, a review of the ethical procedures that were employed within this study was also proposed.

The following chapter will discuss results of the study, including review of the statistical analysis findings following data collection.

Chapter 4: Results

Introduction

The purpose of this archival quantitative pilot study was twofold: to establish power required for a larger scale study of adolescents in RTC with similar variables as the ones used; and to explore the relationship of exercise to variables depression, anxiety, and trauma. The following chapter reviews the research questions, analysis assumptions, results of the data analysis, as well as results summary.

Insight was gained from eleven cases regarding interaction effects of exercise on depression and anxiety as well as correlations between exercise participation relative to incoming depression, anxiety, and trauma scores for adolescents in RTC. The data collection instruments used in the study were the PHQ-9 (Kroenke et al., 2001), the GAD-7 (Spitzer et al. 2006), and the CATS (Sachser et al., 2017). All scores on the PHQ-9, GAD-7, and CATS were kept in numeric form to ensure variables maintained a continuous format to meet assumptions of analysis.

For the PHQ-9, users report frequency and severity of symptoms experienced in the previous two-week period. There were 9 items rated on a 4-point scale ranging from “not at all” (0) up to “nearly every day” (3). The total item score range was 0-27 with higher scores indicating increased frequency of depressive symptoms over the previous two weeks (Kroenke et al., 2001).

For the GAD-7, users reported frequency and severity of symptoms experienced in the previous two-week period. There were 7 items rated on a 4-point scale ranging from “not at all” (0) up to “nearly every day” (3). The total item score range was 0-21

with higher scores indicating increased frequency of anxiety symptoms over the previous two weeks (Spitzer et al., 2006).

The CATS is a 20-item questionnaire regarding symptoms of trauma that may be occurring for the respondent. Items were reported on a 4-point scale ranging from "never" (0) to "almost always" (3) (Sachser et al., 2017).

The final variable, exercise, was calculated two ways, depending on the research question being addressed. Total exercise participation was recorded weekly between the initial data collection period and the final data collection period. Exercise participation was calculated each week based on amount of exercise, recorded as 0 (not at all), 1 (one time weekly), or 2 (twice weekly).

For Correlation Analyses questions (RQ1, RQ2, RQ3), exercise participation was calculated as a percentage total, which included total exercise participation in RTC between time points, divided by total exercise participation opportunities the youth was presented with. This number was then converted to a percentage score for each case. This calculation was done to ensure that the variable, exercise, was loaded as a continuous variable, in order to adhere to the assumptions of correlational analysis (Field, 2018).

To address interaction effects of exercise on depression and anxiety change scores for RQ4 and RQ5 using the Repeated Measures ANOVA, participant percentage scores previously calculated were recoded into a categorical variable with two groups: high exercisers and low exercisers. According to Field (2018), in order to ensure data analysis integrity and meet assumptions for a Repeated Measures ANOVA, the independent variable must be categorical in nature at the data entry phase, whereas the dependent

variables in the study must be continuous at the interval or ratio level. For the IV of exercise in RQ4 and RQ5, cutoff scores were calculated such that cases with less than 85% exercise participation were placed into category 1 (low exercisers) and cases that had exercise participation at 85% or more were placed in category 2 (high exercisers). The cutoff score of 85% was determined to ensure that both categories had close to equal numbers as possible to retain the integrity and meet assumptions of the statistical analysis (Field, 2018).

Research Questions

RQ1: Is there a correlation between initial depression scores and amount of exercise participation for adolescents in RTCs?

$H_0 1$: There is no correlation between initial depression scores and amount of exercise for adolescents in RTCs.

$H_a 1$: There is a correlation between initial depression scores and amount of exercise for adolescents in RTCs.

RQ2: Is there a correlation between initial anxiety scores and amount of exercise participation for adolescents in RTCs?

$H_0 2$: There is no correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

$H_a 2$: There is a correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

RQ3: Is there a correlation between initial trauma scores and amount of exercise participation for adolescents in RTCs?

$H_0 3$: There is no correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

$H_a 3$: There is a correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

RQ4. Is there a statistically significant change in depression score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

$H_0 4$: There is no statistically significant change in depression score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

$H_a 4$: There is a statistically significant change in depression score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

RQ5. Is there a statistically significant change in anxiety score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

$H_0 5$: There is no statistically significant change in anxiety score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

$H_a 5$: There is a statistically significant change in anxiety score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

Data Collection

Data that contributed to this study came exclusively from an archival data set where data were already being tracked by an upper Midwest RTC. All data points required were documented clearly within the data use agreement signed by the researcher, the legal representative for the agency, and as approved by the Institutional Review Board through the University. Archival data was collected for twenty-one adolescents, between the ages of 13-17, who had previously participated in regular exercise opportunities within their residential programming between 11/01/2020-03/31/2021. Approval was gained for IRB to allow access to this archival data set, once all identifiers were removed. The IRB approval number was 10-06-20-0348036.

Inclusion criteria outlined that all cases must have two data collection points for depression scores using the PHQ-9, two data collection points using the GAD-7, a trauma score as recorded on the CATS, as well as some level of participation in the exercise programming. While some data was collected for each of the twenty-one adolescents, only eleven total cases had data that fit with the inclusion criteria noted in Chapter 3, which is 52% of the total cases in the data set. This was compiled into the data key referenced in Appendix A.

Demographic limitations of the study included only youth between the ages of 13-17. Additional demographic analyses were not conducted as IRB specifications dictated removal of any identifying information for this protected population. As such, harm to participants was reduced and no adverse effects of the study were applicable. The participants in this study represented a small RTC population in a rural area. This study is

generalizable only to other RTC programming and similar-aged adolescents in RTCs. Information gathered in this pilot study is not generalizable to additional populations and is to be used to inform a larger scale study only.

In order to answer the research questions appropriately, three correlation analyses were run with the use of SPSS version 27 with the variables exercise, depression, anxiety, and trauma. The study design also included two repeated measures ANOVAs to evaluate interaction effects of exercise on depression and anxiety change scores for adolescents.

Results

Evaluation of Assumptions for Correlation Analysis

Before conducting the correlations for RQ1, RQ2, and RQ3, an evaluation of assumptions was completed. According to Field (2018), there are several assumptions to be considered when conducting a correlation analysis. Assumptions reviewed included the use of continuous data, scatterplots (linearity relationship), outliers (no outliers were removed due to sample size), and normality (due to small sample size, data was assumed to be normally distributed). A Shapiro-Wilk test was performed to assess for normality. Significance was less than .05, though due to small sample size this limited normality ability for the data set.

Results for Research Question 1

RQ1: Is there a correlation between initial depression scores and amount of exercise participation for adolescents in RTCs?

H_01: There is no correlation between initial depression scores and amount of exercise for adolescents in RTCs.

H_a1: There is a correlation between initial depression scores and amount of exercise for adolescents in RTCs.

Individual depression scores could range from 0-27. A correlation analysis was performed in SPSS v. 27 to assess whether initial depression scores (M = 14.27, SD = 3.47) were related to subsequent exercise participation (M = 84.36, SD = 14.28). Results for correlation analysis indicated a weak negative correlation between the initial depression score and exercise participation, (r = -.34, n = 11, p = .31). This indicates that the higher the initial depression score the lower the exercise participation during RTC. The null hypothesis, therefor, failed to be rejected. While the results are not significant, they are directional using the results from the sample. It is likely that there was not enough power in the study to obtain significance as suggested by the directional results indicating that initial depression score is related to subsequent exercise participation. Tables 1 and 2 provide descriptive statistics and correlations for RQ1.

Table 1

Descriptive Statistics for Initial Depression Scores and Subsequent Exercise in RTC

	Mean	SD	N
Initial PHQ score	14.27	3.47	11
Exercise Amount	84.36	14.28	11

Table 2

Correlation Values for Initial Depression Scores and Exercise

	Exercise Amount

Initial PHQ-9 Score	Correlation	-.34
	Sig. (2-tailed)	.31
	N	11

Results for Research Question 2

RQ2: Is there a correlation between initial anxiety scores and amount of exercise participation for adolescents in RTCs?

$H_0 2$: There is no correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

$H_a 2$: There is a correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

Individual anxiety scores could range from 0-21. A correlation analysis was performed in SPSS v. 27 to assess whether initial anxiety scores (M = 12.90, SD = 4.44) were related to subsequent exercise participation (M = 84.36, SD = 14.28). Results indicated a weak negative correlation between the initial anxiety score and exercise participation, ($r = -.34$, $n = 11$, $p = .31$). The null hypothesis, therefor, failed to be rejected. While the sample results are not significant, they do trend in the direction hypothesized. Tables 3 and 4 outline the descriptive statistics and correlations for RQ2.

Table 3

Descriptive Statistics for Initial Anxiety Score and Subsequent Exercise in RTC

	Mean	SD	N
Initial GAD Score	12.90	4.44	11
Exercise Amount	84.36	14.28	11

Table 4

Correlation Values for Initial Anxiety Scores and Exercise

		Exercise Amount
Initial GAD-7 Score	Correlation	-.34
	Sig. (2-tailed)	.31
	N	11

Results for Research Question 3

RQ3: Is there a correlation between initial trauma scores and amount of exercise participation for adolescents in RTCs?

H_03: There is no correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

H_a3: There is a correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

A correlation analysis was performed in SPSS v. 27 to assess whether participant trauma score (M = 32.18, SD = 17.02) was related to subsequent exercise participation

(M = 84.36, SD = 14.28). Results indicated a weak negative correlation between initial trauma score and subsequent exercise participation, (r = -.08, n = 11, p = .83). The null hypothesis, therefor, failed to be rejected. The trend in the data, though not significant, indicates that the higher the level of trauma, the less the subsequent exercise participation. Tables 4 and 5 outline the descriptive statistics and correlation for RQ3.

Table 5

Descriptive statistics for Trauma Scores and Subsequent Exercise in RTC

	Mean	SD	N
CATS score	32.18	17.02	11
Exercise Amount	84.36	14.28	11

Table 6

Correlation Values for Trauma Scores and Exercise

		Exercise Amount
CATS Score	Correlation	-.08
	Sig. (2-tailed)	.83
	N	11

Evaluation of Assumptions for Repeated Measures ANOVA

Before conducting a Repeated Measures ANOVA to address research questions 4 and 5, an evaluation of assumptions was completed. According to Field (2018), there are several assumptions to be considered for a repeated measures ANOVA. These include

sphericity, dependent observations, nominal independent variable, continuous normally distributed dependent variable, and potential outliers (all data retained due to small sample size). The assumption of sphericity was checked within each research question and reported within those results. Each of the 11 data cases had two separate time points entered for depression and anxiety scores, and results were recorded as a continuous, numerical variable. Since the scores were recorded at two separate time points, time as the independent variable, is nominal, where every participant depression and anxiety score were measured twice. Tests for normality showed that all dependent variables are normally distributed, except for initial PHQ -9 score. The Shapiro-Wilk test did not support that the initial PHQ-9 score was normally distributed, with alpha, $p > .05$.

Results for Research Question 4

RQ4. Is there a statistically significant change in depression score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

H_04: There is no statistically significant change in depression score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

H_a4: There is a statistically significant change in depression score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

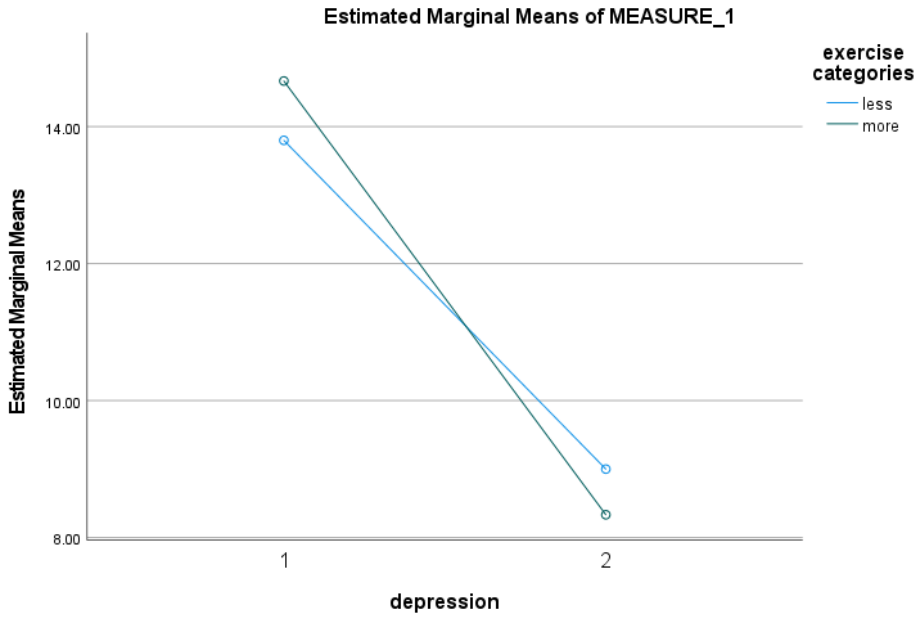
Initial and final depression scores, along with level of exercise as a interaction effect, were analyzed using a Repeated Measures ANOVA. The Huynh–Feldt estimate of

the departure from sphericity was $\varepsilon = 1.00$. The change between initial depression and final depression scores over time was significantly different, $F(1, 9) = 11.43$, $p = .01$ $\eta^2 = .56$. However, exercise did not have a significant effect on change in depression scores, $F(1, 9) = .22$, $p = .65$. The null hypothesis failed to be rejected. A post-hoc analysis was not appropriate for this model because only two groups were compared.

Though there was no statistically significant effect of exercise on depression change scores, there was a general trend noted in the data. Figure 1 shows this trend, visually, that there was a greater change in depression for the higher exercise group. Though not a statistically significant finding, this trend provides evidence to conduct a larger scale study. A review of means of respondents did indicate that youth who exercised more did have a greater change in depression scores from initial to final data collection than youth who exercised less. Further implications of these results will be discussed in Chapter 5. Figure 1 presents a visual model of the results of the ANOVA with interaction effects of exercise. Estimated marginal means indicates that these are the means determined, adjusted for any other variables found within the model.

Figure 1

Line Chart Indicating Depression Change Score Between Groups



Results for Research Question 5

RQ5. Is there a statistically significant change in anxiety score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

$H_0 5$: There is no statistically significant change in anxiety score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

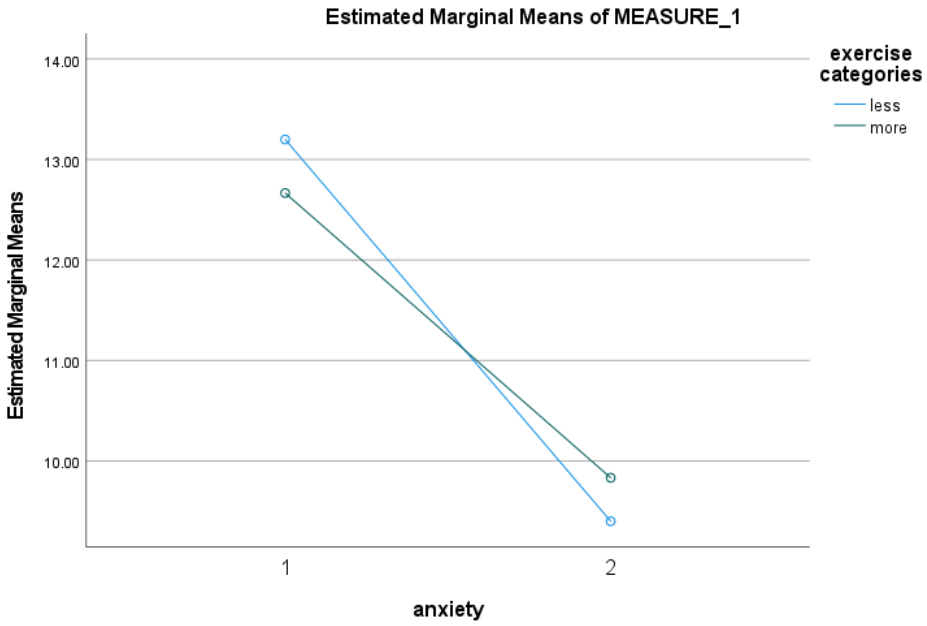
$H_a 5$: There is a statistically significant change in anxiety score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

Initial and final anxiety scores, along with level of exercise as a main effect, were analyzed using a Repeated Measures ANOVA. The Huynh–Feldt estimate of the departure from sphericity was $\varepsilon = 1.00$. The change between initial anxiety and final anxiety score was not significantly different, $F(1, 9) = 3.00$, $p = .12$, $\eta^2 = .25$. Exercise did not have a significant effect on change in anxiety scores, $F(1, 9) = .06$ $p = .81$. The null hypothesis failed to be rejected. A post-hoc analysis was not appropriate for this model because only two groups were compared.

Though there was no statistically significant effect of exercise on anxiety change scores, a review of means of respondents did indicate that youth anxiety scores reduced over time. Figure 2 displays these findings. Though not clinically significant, youth who exercised less evidenced a greater reduction in anxiety scores than those who exercised more. Further implications of these results will be discussed in Chapter 5. Figure 2 presents a visual model of the results of the ANOVA with interaction effects of exercise. Estimated marginal means indicates that these are the means determined, adjusted for any other variables found within the model.

Figure 2

Line Chart Indicating Anxiety Change Score Between Groups



Summary

The results of the initial three research questions posed within this study indicated weak negative correlations between ongoing exercise participation in RTC and initial depression, anxiety, and trauma scores for youth. This suggests that the higher the initial mental health symptom scores for depression, anxiety, and trauma, the less participation in exercise programming in RTC. While the results are not clinically significant, there is a trend suggested within this data that will be helpful to inform larger scale studies in the future.

The results of the remaining two research questions, assessing interaction effects of exercise on change in depression and anxiety symptoms, indicate no interaction effects were found. In review of the trends found in the data, though no statistically significant

effects of exercise were found, it is likely due to reduced power in the study due to low sample size. These findings are important to inform a larger scale study of exercise effects on mental health symptoms of depression and anxiety. The following chapter will discuss implications of these results and inform future study guidance and suggestions.

Chapter 5: Discussion, Conclusions, and Recommendations

Discussion

The purpose of this quantitative study was to provide power toward a larger-scale study of the variables of anxiety, depression, exercise, and trauma for adolescents in RTCs. Mental health variables of depression, anxiety, and trauma were all assessed using widely available and easy to score instruments. The variable of exercise participation was assessed each week for youth in RTC. Chapter 5 contains several sections, including a summary, interpretations, significance, limitations, recommendations, implications of the research, and conclusions of the study.

Summary of Research

Given the dearth of information that is available linking exercise to more positive mental health outcomes for youth, this pilot study was created to assess current exercise participation relative to trauma, depression, and anxiety for adolescents in RTCs. The analyses performed also assessed how exercise may impact anxiety and depression as a function of exercise participation over time. The purpose of this pilot study was to inform a larger scale study with more youth and same/similar variables. This study implemented quantitative research with a longitudinal design and archival data. The data were captured with the use of several measures, including the CATS (Sachser et al., 2017), PHQ-9 (Kroenke et al., 2001) and GAD-7 (Spitzer et al., 2006). Additional information regarding exercise participation was recorded on a Microsoft Excel Data sheet during the specified timeframe of 11/01/2020-03/31/2021. Data was then scrubbed with identifiers omitted and entered in the data key, referenced in Appendix A.

Inclusion criteria for this study were specific, where all cases must meet all conditions. Each case was to have an initial and final depression score; an initial and final anxiety score; an initial trauma score; and some level of exercise participation. This allowed for both correlation analyses and repeated measures ANOVA analyses to answer the research questions. All youth in the study were between the ages of 13-17 and further demographics for the youth were omitted prior to receiving the data set, in order to maintain compliance with IRB. Of the 21 cases included in the data set, only 11 total cases met all inclusion criteria for this study. Included data was placed into the Data Key, referenced in Appendix A. There were 7 cases that did not include final scores for depression and anxiety, as well as 4 cases that did not include a trauma score.

The literature review focused on previous research regarding adolescents, exercise, anxiety, depression, trauma, and RTCs. The identified gap in the literature was specifically related to effectiveness of exercise interventions in RTCs for anxiety, depression, and trauma symptoms experienced by adolescents. This pilot study was generated in pursuit of filling some of the research gap in this area. The results of the analyses did not indicate significant relationships between the mental health and exercise variables within this study, likely because of the small sample size. However, in review of the trends of the data, there is an identified need for a larger scale study with these variables to understand effect sizes of exercise on symptoms of anxiety, depression, and trauma over time for youth in RTC, as well as to assess correlation of mental health scores for adolescents with their willingness to participate in exercise.

Interpretation of Findings

This research produced information on relationships and interactions between exercise participation, anxiety, depression, and trauma for adolescents in RTCs. Three research questions were developed to look at correlations between incoming levels of mental health concerns and willingness to participate in subsequent exercise within RTC programming. An additional two questions were developed to look at the interaction effects of exercise on depression and anxiety change scores for youth in an upper Midwest RTC.

Theoretical Foundation

Attachment theory (Bowlby, 1977) and Social Cognitive Theory (Bandura, 1989) lay the foundation for the current pilot study by examining variables of trauma, depression, anxiety, and how exercise may reduce these symptoms.

Attachment theory highlights the need for healthy attachments in early infancy and childhood. Often, RTCs are a last resort at helping youth develop healthy attachments skills, decreasing mental health concerns, and generating skills that help them develop into healthy adults. Youth with mental health concerns often have a harder time engaging in healthy activities, such as exercise, offered by RTCs (D'Andre et al., 2012; McDowell et al., 2019). Exercise may be promising RTC intervention for helping youth reduce frequency and intensity of overall mental health symptoms.

This pilot study also explored elements of social cognitive theory, and in particular the development of self-efficacy, in youth. While self-efficacy was not explicitly studied with a quantified measure, the idea proposed by Bandura (1989) is that

adolescents with low self-efficacy tend to have less belief in their ability to change their own outcomes. Exercise has been shown to increase healthy self-efficacy (Dishman et al., 2019; Nock et al., 2016), and to decrease mental health symptoms such as depression and anxiety (He et al., 2018; McDowell et al., 2017). By examining effects of exercise participation on depression and anxiety over time, this study provided insight into exercise as a key component of RTC programming for adolescents. Exercise programming is often more cost-effective, in terms of implementation, than other interventions, such as therapeutic interventions, which require highly skilled trainers and graduate-level mental health workers to implement (Kleppang et al., 2018; McDowell et al., 2017; Rethorst, 2019).

Correlational Research Findings

RQ1: Is there a correlation between initial depression scores and amount of exercise participation for adolescents in RTCs?

$H_0 1$: There is no correlation between initial depression scores and amount of exercise for adolescents in RTCs.

$H_a 1$: There is a correlation between initial depression scores and amount of exercise for adolescents in RTCs.

RQ2: Is there a correlation between initial anxiety scores and amount of exercise participation for adolescents in RTCs?

$H_0 2$: There is no correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

H_a2: There is a correlation between initial anxiety scores and amount of exercise for adolescents in RTCs.

RQ3: Is there a correlation between initial trauma scores and amount of exercise participation for adolescents in RTCs?

H_03: There is no correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

H_a3: There is a correlation between initial trauma scores and amount of exercise for adolescents in RTCs.

Youth entering RTC often have high levels of mental health symptoms, including trauma, anxiety, and depression (D'Andrea et al., 2012; Izmirian et al., 2019). Building on the research gap identified in Chapter 2 regarding availability of exercise interventions for youth in RTC, initial levels of trauma, depression, and anxiety were analyzed along with amount of exercise each adolescent participated in.

In RQ1, findings suggest a weak negative correlation between depression scores and exercise participation, ($r = -.34$, $n = 11$, $p = .31$). This is not a statistically significant result, though the directionality of scores suggests that adolescents who have higher initial depression scores tend to exercise less during RTC than those with lower scores. This finding is in keeping with similar research of exercise and depression for non-clinical adolescent populations (Arat & Wong, 2017; Kangas et al., 2015).

In RQ2, findings suggest a weak negative correlation between anxiety scores and subsequent exercise participation ($r = -.34$, $n = 11$, $p = .31$). This is not a statistically significant result, though the directionality of scores suggests that adolescents who have

higher initial anxiety scores tend to exercise less during RTC than those with lower scores. This finding is consistent with research on anxiety and exercise for non-RTC adolescents (Arat & Wong, 2017; Saeed et al., 219).

In RQ 3, findings suggest a weak negative correlation between trauma scores and exercise participation ($r = -.08$, $n = 11$, $p = .83$). This is not a statistically significant result, though the directionality of scores suggests that adolescents with higher trauma scores exercise less than those with lower scores. This finding is consistent with previous research on trauma and exercise in youth (Steinke & Derrick, 2018).

Repeated Measures ANOVA Research Questions Findings

RQ4. Is there a statistically significant change in depression score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

$H_0 4$: There is no statistically significant change in depression score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

$H_a 4$: There is a statistically significant change in depression score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

RQ5. Is there a statistically significant change in anxiety score between the initial and final data collection for adolescents and is there an interaction between degree of participation in exercise and change scores?

H_05: There is no statistically significant change in anxiety score between the initial and final data collection for adolescents and there is no interaction between degree of participation in exercise and change scores.

H_a5: There is a statistically significant change in anxiety score between the initial and final data collection for adolescents and there is an interaction between degree of participation in exercise and change scores.

RQ4 and RQ5 address interaction effects on changes in depression and anxiety scores for adolescents during their stay in RTC. RQ4 specifically deals with depression change scores and interaction effects of exercise while RQ5 specifically addresses changes in anxiety scores and interaction effects of exercise. The outcomes of the Repeated Measures ANOVA for both RQ4 and RQ5 indicate that there were no statistically significant effects of exercise on changes in depression and anxiety scores. This is to say that the changes in depression and anxiety scores cannot be attributed specifically to amount of exercise the youth participated in. There was not enough data in this pilot study to allow the equation to produce statistically definitive results of exercise effects for either anxiety scores or depression scores for adolescents. However, the trend for the data does indicate directionality that those adolescents who participated in high amounts of exercise had greater decrease in depression. Interestingly, youth who exercised in lower amounts had a greater reduction in anxiety scores than those adolescents who exercised more often. This finding is consistent with research that suggests that most youth in RTC experience a decrease in anxiety and depression symptoms throughout their stay (Schneider et al., 2018). The data outcomes for these

research questions provides support for a larger scale study to be conducted on same or similar variables in the future.

Limitations

Within this study, there are several limitations to the findings that will be reviewed. First, the sample size of 11 was smaller than the projected 15-20 cases due to a variety of occurrences. This exercise program was in initial stages of introduction at the RTC, where they were already experiencing low census numbers due to Covid-19 safety protocols. Also contributing to reduced data, was the design of the original data collection. Many of the initial data points were collected through the exercise program director, however the CATS needed to be collected separately. Not all cases being tracked by the wellness director were able to obtain an associated CATS score from a mental health professional, so those cases were not used. Additionally, some of the youth declined to fill out some of the information as the study progressed, such as the GAD-7 and/or PHQ-9, rendering some of that data also to be excluded from the study.

Maturation is also a limitation identified within longitudinal research. Within this study, all participants had a span of time that they were housed in RTC and continuing programming. When maturation is introduced into the study, it becomes a limitation to be able to explain how much of the change is explained by the identified variables versus how much change can happen across time. There is some research previously identified that discuss adolescents in RTC and that time itself plays a role in positive outcomes (Lino et al., 2016; Strickler et al., 2016; Turner & Deane, 2016).

Due to the specific nature of the archival data within this study, sample representation was limited. Only one partner agency provided data toward this pilot study, which limits the generalizability of results to other RTC adolescent populations. Because the data set was collected from adolescent youth ages 13-17 residing in an RTC, further generalizations to other adolescent populations, or non-clinical populations is not warranted.

There was an insufficient amount of data to contribute adequate power toward this study. Increased power in a statistical analysis will lend itself toward confidence in statistical output, as well as reduce the likelihood of wrongfully rejecting or retaining the null hypothesis. The nature of this pilot study is to provide a foundation for additional, larger scale studies that can incorporate increased data points into the study. The directionality of the results in this pilot study indicate that more definitive results may likely be obtained if a larger scale study is produced.

Recommendations

Research

The first recommendation follows from the limitations section of this chapter. Specifically, the small sample size of this pilot study provided limited interpretations of the research. Being able to assess the same variables on a larger scale will provide more concrete information on rejection or acceptance of the null hypothesis than was able to be performed with the current sample size.

A G*Power analysis was used to determine the appropriate sample size required for future studies. G*Power provides the effect size needed for the researcher to

determine the likelihood of rejecting or accepting the null hypothesis (Faul et al., 2009). Cohen's work (1992) provides effect size guidelines for scholarly data analysis. An effect size of 0.02 -is considered small, .15 is considered a medium effect size, and .35 is considered a large effect size when working with multiple correlation studies. Given the design of this study, and the number of variables outlined, an effect size of .15 would be adequate for a future, larger scale study. An alpha level of .05 is an acceptable level of risk for mistakenly rejecting the null hypothesis within the scientific literature. A power level of .80 is also considered sufficient when estimating sample size for a planned study (Cohen, 1992). With four predictor variables, the total sample size needed would be 107 cases.

Additionally, due to the protected adolescent population for this data set, other demographic information, such as age, gender, or ethnicity, was not obtained. Future research that incorporates demographic data may provide valuable insight into differences between genders, ages, and ethnicities.

Applying to the Field of Psychology

It was identified in chapter 2 that many adolescents entering RTC have a higher degree of mental health concerns than their non-RTC counterparts. Additionally, research has found that adolescents who engage in regular exercise also experience decreases in depression and anxiety. Staff working in RTCs with youth have a unique opportunity to promote mental health by introducing exercise options for them, which is simultaneously a low-cost option, as compared to other therapies.

The current study was able to explore links between exercise participation in RTC and subsequent effects on depression and anxiety. Further, this study examined the effects of incoming trauma, depression, and anxiety levels on adolescent's engagement in exercise programming. This study was able to produce valuable information that may benefit psychologists and assist with reducing some of the barriers identified for adolescents in RTC. Specifically, the findings in this study may provide the foundation for future research into low-cost programming in RTCs that simultaneously can reduce mental health concerns related to trauma, depression, and anxiety for these youth. Additionally, this study can provide further insight into programming options for RTCs that provide meaningful benefits for adolescents and can be introduced with less intensive training and cost than other intensive therapy options.

Implications

Social Change

The results from this study are indicative of advancements in programming for adolescents in RTCs. We now know that early childhood trauma experiences have a significant impact on mental health concerns for youth later in life (D'Andrea et al., 2012). Exercise itself is also a versatile tool for lifelong health that has been shown to aid in resiliency, prevent declines in mental health, and provide a host of health benefits across the lifespan (Dishman et al., 2019; He et al., 2018; McDowell et al., 2019). Developing healthy exercise habits in childhood and adolescence has been shown to promote exercise engagement in adulthood as well (Miller & Siegel, 2017).

RTC programming, by design, is time-limited in nature, with most programs lasting 1-12 months (Lynch et al., 2017). After completion of programming, care teams are tasked with finding long-term placements or facilitating transitions for youth back to their families. For adolescents reuniting with families, healthy routines and decreases in mental health concerns can have significant impact on reunification and/or transition efforts.

On a broader level, continuing exploration into exercise as a low-cost treatment for mental health and trauma can provide valuable insight for future RTC programming and, even larger, for policy change with funding for RTCs. Many RTCs depend largely on federal, state, and private grant funding in order to provide safe housing for at-risk youth (Lynch et al., 2017; MNDHS, 2019). Continuing to explore low-cost programming that simultaneously provides health and mental health benefits is crucial to helping program directors keep costs within guidelines for program longevity (Leve et al., 2012).

Conclusion

I conducted this study with the intention of providing foundational work of a small pilot study toward future completion of a larger-scale study regarding the variables of exercise, trauma, depression, and anxiety for the specific population of adolescents in RTC. It was determined that there was not enough power in this small-scale pilot study to provide significant results for these variables, therefore the null hypotheses presented in the research questions could not be rejected. However, the trends noted in the data suggest that there would likely be significant findings within a larger dataset. This would allow for a deeper understanding of the relationships of the variables presented, which

have not been widely studied within RTC populations, leaving a large gap in the literature. It is hoped that this pilot study will pave the way for future research with larger samples to gain a clearer understanding of the impact of exercise on mental health for adolescents in residential treatment.

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Appendix A: Data Key

EXERCISE CATEGORY 1 = LESS THAN 85% (LOW EXERCISERS)											
EXERCISE CATEGORY 2 = 85% OR HIGHER (HIGH EXERCISERS)											
CASE #	SPSS CASE #	Exercise amount	EXERCISE %	Exercise category	INITIAL PHQ	FINAL PHQ	DEP CHANGE SCORE	INITIAL GAD	FINAL GAD	ANX CHANGE SCORE	CATS SCORE
2	1	5/6	83	1	13	9	-4	10	9	-1	22
3	2	8/16	50	1	20	9	-11	21	13	-8	48
7	3	10/13	77	1	12	7	-5	12	6	-6	32
8	4	5/5	100	2	12	13	1	17	8	-9	49
11	5	10/12	83	1	13	15	2	11	16	5	2
12	6	6/6	100	2	18	8	-10	11	13	2	16
14	7	10/13	77	1	11	5	-6	12	3	-9	14
16	8	11/13	85	2	18	16	-2	14	21	7	57
21	9	11/13	85	2	11	8	-3	4	1	-3	40
23	10	5/5	100	2	11	2	-9	13	2	-11	41
24	11	15/17	88	2	18	3	-15	17	14	-3	33