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LOYOLA UNIVERSITY CHICAGO

PHYSICAL ACTIVITY, SELF-DETERMINATION, AND SELF-CONSCIOUS EMOTIONS IN ADOLESCENTS AND YOUNG ADULTS WITH AND WITHOUT AUTISM SYMPTOMATOLOGY

A THESIS SUBMITTED TO

THE FACULTY OF THE GRADUATE SCHOOL

IN CANDIDACY FOR THE DEGREE OF

MASTER OF ARTS

PROGRAM IN PSYCHOLOGY

BY

DAKOTA MORALES

CHICAGO, IL

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LIST OF ABBREVIATIONS

ASD	Autism Spectrum Disorder
BASES	Body and Appearance Self-Conscious Scale
BREQ	Behavioral Regulations in Exercise Questionnaire
PA	Physical Activity
RAI	Relative Autonomy Index
RPE	Rating of Perceived Exertion
SCEs	Self-Conscious Emotions
SDT	Self-Determination Theory
SRS	Social Responsiveness Scale
TD	Typically Developing

ABSTRACT

Previous literature suggests that autistic individuals engage in physical activity less frequently compared to typically developing peers (Bandini et al., 2013; Jones et al., 2017). This is noteworthy because exercise interventions for autistic individuals have found that engaging in physical activity can improve motor, social, and behavioral skills (Anderson-Hanley et al., 2011; Duffy et al., 2017; Nicholson et al., 2011; Oriel et al., 2011). Thus, the present study seeks to understand what factors may promote physical activity engagement, such as self-determination motivation regulations and body-related self-conscious emotions, in adolescents and young adults with and without autism symptomatology. Participants included 51 adolescents aged 15-17 years old and 139 young adults aged 18-30 years old who self-reported physical activity habits (i.e., frequency, duration, and intensity), and completed measures of autism symptomatology, self-determination motivation regulations, and body-related self-conscious emotions. The study results found that individuals with autism symptomatology engaged in physical activity less frequently, had higher levels of controlled motivation and lower autonomous motivation, and had more proneness to body-related guilt and shame, and less authentic and hubristic pride, compared to individuals without autism symptomatology. Moreover, individuals with more autonomous motivation and proneness to body-related guilt and authentic pride were more likely to meet physical activity guidelines. Future studies should examine the interaction between self-determination regulations and body-related self-conscious emotions on physical activity habits.

CHAPTER ONE

LITERATURE REVIEW

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterized by impaired social communication along with repetitive patterns of behaviors and restricted interests (American Psychiatric Association, 2013). Challenges related to social communication and social interactions include social-emotional reciprocity (e.g., failure to engage in normal "back and forth" conversation or reduced interest in social interactions), nonverbal communicative behaviors (e.g., abnormal eye contact, body language, and gestures), and a failure in understanding or developing relationships. Repetitive behaviors and restricted interests include stereotyped/repetitive motor movements, insistence on sameness (i.e., inflexible to changes in routines), fixated attention or focus (perseverative interests), and abnormal reactivity to sensory stimuli (hypo- or hyperactivity; American Psychiatric Association, 2013).

Much of the research done with individuals with ASD has focused on improving social and communication skills, stereotypy (i.e., persistent and repetitive actions often for no reason), and perseverative responses to different stimuli. Intervention strategies such as Applied Behavior Analysis and Cognitive Behavior Therapy have commonly been used to effectively promote adaptive outcomes (Boyd et al., 2012). Interestingly, physical activity is more cost effective compared to therapy-based treatments and is an alternative strategy that can provide opportunities to learn socially valued behaviors, develop motor skills, and engage in social interactions.

Unfortunately, when compared to their typically developing peers, individuals with ASD are less physically active and engage in more sedentary behaviors (Beets et al, 2011; Kuo et al, 2014; Soden et al, 2012). This is noteworthy because physical activity has been shown to improve cardiovascular and respiratory function, reduce cardiovascular disease risk factors, decrease morbidity and mortality, and reduce the effects of various types of mental health disorders and disease such as anxiety and depression (CDC, 1996; Kesaniemi et al., 2001; Maron et al., 1996; Paterson & Warburton, 2010; Rosenbaum et al., 2014). Individuals who engage in physical activity tend to have lessened risks for developing stress-related mental health disorders compared to sedentary individuals (Gerber & Puhse, 2009). In contrast, sedentary behaviors are associated with an increased risk for poor health outcomes, including serious disorders such as cardiovascular disease (Biswas et al., 2015; Proper et al., 2011).

Differences in physical activity levels between those with and without ASD have been found as early as childhood. For example, past studies have shown that children with ASD often do not meet nationally recommended physical activity levels (Bandini et al., 2013). Compared to their typically developing (TD) peers, children with ASD spend more time in electronic screen time or media-based activities (i.e., sedentary activity), less time in PA (Jones et al., 2017), and less time in moderate activity (Bandini et al., 2013). Some of these differences in physical activity engagement may be due to individuals with ASD having motor functioning impairments with balance, gait, and flexibility (Jansiweics et al., 2006; Minshew et al., 2004). Unfortunately, these impairments may be worsened by not engaging in regular physical activity (PA).

Physical activity and exercise interventions can allow for opportunities for social interaction and improve behavioral skills (Fox & Riddoch, 2000), both of which are core

symptoms associated with ASD. Exercise can improve motor development, physical fitness, executive functioning (i.e., working memory and attention), self-regulatory behaviors and decrease repetitive, stereotyped, and self-injurious behaviors in adolescents (Anderson-Hanley et al., 2011; Bremer et al., 2016; Oriel et al., 2011; Sorenson & Zarrett, 2014). Moreover, Rosenthal-Malek and Mitchell (1997) found that aerobic exercise significantly reduces self-stimulatory behaviors and increases academic performance in adolescents with autism. Physical activity can have benefits that are not only related to improving physical or mental health impairments, but also to decrease maladaptive behaviors (Lang et al., 2010). Maladaptive behaviors can include aggression, irritability, outbursts, and disobedience (Konset et al., 2013). Evidence supports the role of physical activity in its effects on maladaptive behaviors in that there was a greater improvement in maladaptive ASD behaviors (i.e., maladaptive behaviors reduced) in individuals with less severe ASD (Duffy et al., 2017).

However, most of the literature regarding the effects of physical activity and exercise on individuals with ASD has focused on children. For example, Sowa et al. (2012) found evidence that exercise interventions led to a 37% improvement in autism symptomatology, specifically, behavioral and academic improvements. Further, vigorous intensity exercise has been used to reduce the frequency of stereotyped behaviors, aggressive behaviors, and hyperactivity in children with ASD (Anderson-Hanley et al., 2011; Yilmaz et al., 2004; Lancioni et al., 1998; McGimsey & Favell, 1988). Additionally, in children with ASD, exercise preceding classroom sessions led to an increase in on-task behaviors and reductions in disruptive behaviors (Nicholson et al., 2011; Oriel et al., 2011). Given the positive effects seen with physical activity

and exercise in children with ASD, as it relates to motor, social, and behavioral skills, research should begin to focus on adolescents and young adults with ASD.

Studies have shown that as typically developing children age, level of physical activity also decreases (Czerwinski et al., 2015; Dumith et al., 2011; Jones et al., 2017). This is important to note because previous literature suggests that individuals with ASD already do not participate in physical activity compared to typically developing individuals, and this trend may cascade and be even worse as these individuals age from childhood into adolescents and young adulthood. Thus, the present study seeks to understand what factors may promote physical activity engagement, such as self-determination motivation regulations and body-related self-conscious emotions, in adolescents and young adults with and without ASD.

Self-Determination Theory

Motivation has been a long-standing concept related to physical activity engagement, exercise, and health behavior. For the purposes of this paper, motivation can be defined as the level of self-determination with which an individual approaches, or avoids, a behavior. Along these lines, Deci and Ryan (1985) developed the self-determination theory (SDT) to gain a better understanding of the relations between affect, cognition, and behaviors. The key element of SDT is that motivation drives behavior changes, and how likely individuals are to engage in physical activity or exercise. The SDT suggests that individuals seek to meet basic psychological needs such as competence (i.e., the need to feel effective, or experiencing mastery of performance), relatedness (i.e., feel connected to people they care about), and autonomy (i.e., need for volition and in responsible control of one's own life; Ryan & Deci, 2017). By meeting these psychological needs, autonomous forms of behavior regulation are more likely to occur (Ng et

al., 2012; Slemp et al., 2018; Vasconcellos et al., 2020). Conversely, by not meeting these psychological needs, controlled forms of behavior regulation are more likely to occur and may result in lower self-esteem and academic performance, and higher instances of disengagement of behaviors or tasks (Bartholomew et al., 2018; Reeve & Cheon, 2021; Ryan & Deci, 2020). Specifically, a recent meta-analysis shows that autonomously motivated students are more engage, effortful, and happy, and less bored, anxious, depressed, and likely to drop out of school (Howard et al., 2021).

Additionally, the SDT distinguishes between autonomous and controlled motivation with six mini-theories of motivation thought to lie on a continuum from amotivation to completely autonomous forms (i.e., intrinsic) of behavior regulation. Autonomous motivation is more self-determined and thus, is a stronger indicator of adaptive behavior change, whereas controlled motivation is determined by more extrinsic factors of motivation. As it relates to physical activity, controlled motivation has been found to be a weaker predictor of physical activity, compared to autonomous motivation (Duda et al., 2014; Rouse et al., 2011), and is positively associated with depression and anxiety (Ng et al., 2012), perhaps due to individuals not meeting the basic needs for competence, relatedness, and autonomy. Conversely, autonomous motivation is association with better mental health and health behaviors, such as engaging in physical activity (Ng et al., 2012).

More precisely, amotivation (i.e., low self-determination) is defined as a complete lack of motivation or lack of intention to engage in a behavior, whereas intrinsic motivation (i.e. high self-determination) refers to inner motivation, satisfaction or pleasure that lead individuals to engage in a behavior (e.g., “I exercise because it’s fun”; Lox, Martin Ginis, & Petruzzello, 2014,

p. 62). Four forms of extrinsic motivation can occur between intrinsic motivation and amotivation. From highest self-determination to lowest, these include integrated regulation (i.e., engaging in a behavior to confirm one's sense of self), identified regulation (i.e., behavior is motivated by personal goals), introjected regulation (i.e., behavior is dictated by a self-imposed sense of self), and external regulation (i.e., engaging in a behavior to obtain an external reward or avoid external punishment). As Teixeira et al. (2012) writes, "...individuals are either unmotivated or not sufficiently motivated to be physically active, or are motivated by types of externally-driven motivation that may not lead to sustained activity." Therefore, in the present study it is important to examine the degree of motivation an individual has, which can explain why the individual is more, or less, likely to engage in a behavior.

As it relates to individuals with autism, the need for competence, relatedness and autonomy are especially relevant due to social challenges often associated with autism symptomatology. To this point, studies show a promising finding that individuals with ASD do, in fact, show expressions of social interest and in social information (Fletcher-Watson et al., 2013; Jaswal & Akhtar, 2018; Krieger et al., 2012), and thus may be motivated to interact with others, create friendships, and engage in social behaviors.

Self-Conscious Emotions

Self-conscious emotions can also play a role in motivating and regulating people's behavior (Tangney & Fischer, 1995). By exploring the emotion-behavior relationship, literature suggests a link between self -conscious emotions (SCEs), motivation, and physical activity (Damian & Robins, 2013; Sabiston et al., 2010; Williams & DeSteno, 2008). According to Tangney and Tracy (2012), self-conscious emotions regulate interpersonal behavior by

prompting individuals to behave in a moral, socially appropriate way. They also involve individual's reactions to their own behavior, recognition that good or bad things can be a result of their own positive or negative attributes or behaviors, and arise when a person perceives and evaluates themself through the eyes of others (Leary, 2004). In other words, when an individual thinks that others have a positive perception of their own behaviors, feelings of pride may be perceived, whereas negative perceptions of one's behaviors can lead to feelings of shame or guilt.

It is also important to define individual SCEs (i.e., guilt, shame, and pride) and understand the underlying mechanisms between them as there is often confusion about the terms. Shame is a negative feeling about oneself occurring when the individual fails to meet internalized social standards (Sabiston & Castonguay 2014; Tracy & Robins, 2004). If individuals do not meet these standards that they have set for themselves, shame can lead to maladaptive behaviors, such as lack of PA engagement (Castonguay et al., 2015; Sabiston et al., 2010). Guilt is rooted in a specific behavioral transgression. Guilt arises in response to a specific behavior, not towards oneself. Although guilt and shame share some features, guilt is typically the result of a negative evaluation of a specific behavior whereas shame is a negative evaluation of the global self (Lewis, 1971). Furthermore, guilt is often related to self-blame, and involves a sense of remorse over the failure (Sabiston & Castonguay, 2014; Tracy & Robins, 2004). However, guilt may be used as a motivational tool to engage in positive health behaviors due to its positive association with physical activity and can lead to reparative behaviors in order to fix a situation. In contrast, shame may be more likely to bring on defensive and avoidance behavior

and may be considerably less productive method for promoting positive behaviors (Gilbert, 1997).

Pride is also considered a self-conscious emotion because it requires self-reflection and knowledge about the norms of society. Specifically, pride is produced when an individual engages in socially valued behaviors and the individual perceives that they have achieved a socially valued behavior. However, a distinction has been made between hubristic pride and authentic pride. Authentic pride is a response to specific behaviors and motivates an individual to engage in specific goal-directed behaviors. Hubristic pride consists of global aspects of the self, personal grandiosity, and superiority (Castonguay et al., 2013, Tracy & Robins, 2007). Authentic pride is associated with a positive personality profile whereas hubristic pride is related to narcissistic personality behaviors.

By examining proneness to body-related shame, guilt, and pride, it provides evidence for how individuals with ASD evaluate themselves and if they are aware of other's evaluation of them (Davidson et al., 2018). However, there is mixed literature in how individuals with ASD recognize self-conscious emotions. Some researchers found that adolescents and young adults were able to accurately identify self-conscious emotions and recognize facial expressions of pride (Hobson, et al., 2006; Tracey et al., 2011). Others have reported that individuals with ASD have difficulties reporting personal experiences of self-conscious emotions (Capps et al., 1992). In addition, research has shown that adults with ASD symptomatology had greater proneness to body-related shame compared to neurotypical adults who had greater proneness to body-related guilt, authentic pride, and hubristic pride (Davidson et al., 2017). Moreover, children with ASD showed less proneness to body-related guilt than neurotypical children (Davidson et al., 2018).

As Davidson and colleagues (2017; 2018) note differences in body-related SCEs between those with and without ASD symptomatology, it is unclear how these relations may be associated when examining physical activity level and self-determination as well. Therefore, it is important to examine body-related self-conscious emotions in individuals with ASD given the difficulties associated in the understanding of social actions, social reasoning, social norms, and the awareness of others' evaluations (Happe, 1993; Tager-Flusberg, 1999).

Linking Self-Conscious Emotions and the Self-Determination Theory

SDT has been used to link body-related self-conscious emotions, motivation, and health behavior (Brunet & Sabiston, 2009; Castonguay et al., 2015; Cox et al., 2013; Lazarus, 1999). In trying to examine the relations between SCEs and motivating behaviors, behaviors that are more self-determined in nature (i.e., identified and integrated) are associated with increased physical activity (Castonguay et al., 2015; Mullan & Markland, 1997; Silva et al., 2010; Teixeira et al., 2012).

Researcher have sought to specifically examine the associations between one's self-determination and self-conscious emotions. Additionally, research has provided evidence showing positive relations between shame and less self-determined regulations and negative associations with more self-determined ones (i.e., intrinsic motivation) and physical activity (Castonguay et al., 2015; Castonguay et al., 2016; Sabiston et al., 2010). This is consistent with the SDT, in that body-related shame may inhibit the production or maintenance of health-promoting behaviors and motivations. However, literature also suggests that body-related guilt can also be positively associated with PA behavior via introjected and identified regulations (Castonguay et al., 2015). For example, guilt can influence one's motivation to engage in

positive physical activity behaviors when an individual has not met a self-imposed obligation (i.e., introjected regulation) or when this decision is guided to achieve personal goals by external outcomes or products, rather than by feelings of enjoyment or accomplishment (i.e., identified regulation).

In contrast, pride has been associated with physical activity engagement (Castonguay et al., 2013; Mosewich et al., 2011; Sabiston et al., 2010) perhaps due to the ability to withstand temporary, short-term consequences (i.e., negative affect, pain, effort; Williams & DeSteno, 2008). Feelings of pride can be produced from not only appearance-based evaluations, but also evaluations of the body's physical functional abilities. Literature has shown associations between pride and physical engagement, but studies need to control for positive affect as this has also been associated with physical activity engagement (Lyubomirsky et al., 2005; Williams & Evans, 2014). To address this issue, Gilchrist et al. (2018) provide evidence that beyond simply feeling good (i.e., positive affect), pride is associated with physical activity engagement. For individuals with greater levels of pride, physical activity may be a way in which they can manage a positive self-concept. This can be a result of effort and achievement or because of comparisons between themselves and others (Gilchrist et al., 2018). Moreover, these relations between pride and physical activity have been shown with regard to both types of pride (i.e., authentic and hubristic). Gilchrist et al. (2018) found that both were associated with greater MVPA. Specifically, pride and MVPA were associated with more self-determined forms of motivation (Mack et al., 2015).

Recent literature has tried to explain the mechanisms behind these relations. For example, individuals who fail to meet social standards may experience feelings of guilt or shame, that in

turn can lead to external and introjected regulations. In contrast, meeting social standards may lead to feelings of pride that promote and maintain self-determined behaviors (i.e., identified and intrinsic regulations; Castonguay et al., 2012; Sabiston et al., 2010). However, it should also be noted that guilt may be used as a motivational tool to engage in positive health behaviors such as engaging in physical activity, due to its positive association with higher levels of self-determination.

While literature suggests a relation between body-related self-conscious emotions, self-determination, and physical activity, it is unclear how these relations operate when examining autism symptomatology and age.

Present Study

In light of the literature cited, the present study seeks to compare the effects of autism symptomatology and age on physical activity behaviors, self-determination motivation regulations, and body-related self-conscious emotions. The second goal was to examine the relations between levels of physical of activity, self-regulatory motivating behaviors, and body-related self-conscious emotions. The final aim of this study was to examine the predictive ability of motivation regulations and body-related self-conscious emotions on physical activity behavior.

In the present study, the decision was made to include participants without a formal ASD diagnosis, but that score above a threshold on a measure of ASD symptomatology (i.e., SRS-2; Constantino & Gruber, 2012). Specifically, total raw scores of 70 or greater on the SRS-2, in general population samples, can be indicative of autism symptomatology. This strategy to include individuals without a formal ASD diagnosis has previously been used (Scheerer et al.,

2020; Lei et al., 2020; Trevisan & Birmingham, 2016) as it includes both individuals without a formal diagnosis and those with high-functioning symptomatology (Cox et al., 2017; Newman et al., 2009). In addition, the SRS-2 is able to examine autism symptomatology in females, who have been under-diagnosed compared to males, even though both groups show comparable levels of autism symptomatology (Hull et al., 2020; Lai et al., 2017).

Research Aims and Hypotheses

Research Aim 1

The first research aim compares how autism symptomatology and age (i.e., adolescents and young adults) differ on physical activity behaviors, self-determination motivation regulations, and body-related self-conscious emotions.

Previous studies have shown that as individuals age, physical activity decreases (Czerwinski et al., 2015; Dumith et al., 2011; Jones et al., 2017). Moreover, individuals with autism often engage in physical activity less often and spend more time engaging in sedentary behaviors compared to their typically developing peers (Beets et al, 2011; Kuo et al, 2014; Soden et al, 2012).

Secondly, individuals with autism do in fact express interest in engaging in social behaviors (Jaswal & Akhtar, 2018; Krieger et al., 2012), but can find it difficult due to social challenges often associated with autism symptomatology. Thus, individuals with autism may find it more difficult to meet the basic need for competence, relatedness, and autonomy, which are the core constructs of the SDT.

Finally, in terms of body-related self-conscious emotions, adults with autism symptomatology have been found to have greater proneness to shame, and lesser proneness to

body-related guilt and pride compared to adults without autism symptomatology (Davidson et al., 2017). Moreover, a similar finding was found in a sample of children which revealed those with autism symptomatology showed less proneness to guilt than peers without autism symptomatology (Davidson et al., 2018).

Based on these findings, the resulting hypotheses are as follows:

First, in terms of physical activity levels, it is hypothesized that adolescents without autism symptomatology will engage in physical activity more frequently, at a longer duration, and at a higher intensity than adolescents with autism symptomatology, and adults with and without autism symptomatology. It is also expected that participants without autism symptomatology will engage in physical activity more frequently, at a longer duration, and at a higher intensity than those with autism symptomatology. Lastly, adolescents will engage in physical activity more frequently, at a longer duration, and at a higher intensity than adults.

Second, in terms of individual's self-determination motivation regulations, it is predicted that adolescents with autism symptomatology will have higher levels of controlled (i.e., amotivation or extrinsic regulation) motivation compared to adolescents with autism symptomatology, and adults with and without autism symptomatology. Conversely, it is expected that adults without autism symptomatology will have higher levels of autonomous (i.e., intrinsic regulation) motivation compared to adults with autism symptomatology and adolescents with and without autism symptomatology. Second, it is predicted that participants with autism symptomatology will have higher levels of controlled motivation (i.e., amotivation or extrinsic regulation) and lower levels of autonomous motivation (i.e., intrinsic regulation). Finally, it is expected that adults will have higher levels of autonomous motivation (i.e., intrinsic regulation)

and lower levels of controlled motivation (i.e., amotivation or extrinsic regulation) compared to adolescents.

Third, for body-related self-conscious emotions, it is predicted that adolescents with autism symptomatology will show more proneness to guilt compared to adolescents without autism symptomatology, whereas adults with autism symptomatology will show higher proneness to shame and lower proneness to guilt and pride than adults without autism symptomatology. Secondly, it is predicted that individuals with autism symptomatology will show higher levels of shame, and lower levels of guilt, authentic, and hubristic pride, compared to individuals without autism symptomatology. Lastly, it is predicted that adolescents will have higher levels of shame and guilt, and lower levels of pride, compared to adults.

Research Aim 2

The second goal is to examine the relations between levels of physical of activity, self-regulatory motivating behaviors, and body-related self-conscious emotions. Previous research has shown a negative associate between shame and more autonomous forms of self-determination, but a positive association with more controlled forms of self-determination (Castonguay et al., 2015; Castonguay et al., 2016; Sabiston et al., 2010). Conversely, guilt has been reported to be positively associated with autonomous forms of self-determination (i.e., introjected and identified regulations; Castonguay et al., 2015). Moreover, guilt and pride have been positively associated with physical activity behaviors (Castonguay et al., 2015; Mosewich et al., 2011; Sabiston et al., 2010).

Therefore, the resulting hypotheses are as follows:

First, it is hypothesized that autonomous self-determined motivations, guilt, authentic pride, and hubristic pride will be positively associated with engaging in physical activity frequency, duration, and intensity.

Second, it is hypothesized that controlled self-determined motivations and shame will be negatively associated with engaging in physical activity frequency, duration, and intensity.

Third, it is predicted that guilt, authentic and hubristic pride will be positively associated with self-determination.

Research Aim 3

The last aim of this study is to examine the predictive ability of self-determination motivation regulations and self-conscious emotions, separately, on physical activity behavior above and beyond autism symptomatology, age, and sex. Although previous literature has shown that individuals with autism often do not meet nationally recommended physical activity levels (Bandini et al., 2013), less is known on the predictive ability of self-determination motivation regulations and self-conscious emotions on meeting nationally recommended physical activity levels.

Thus, to further explore these associations, the resulting hypotheses are as follows:

First, for self-determination motivation regulations, it is hypothesized that autonomous motivation regulation will be predictive of meeting physical activity guidelines, whereas controlled motivation regulation will be predictive of not meeting physical activity recommendations.

Second, for body-related self-conscious emotions, shame will also be predictive of not meeting these recommendations, whereas guilt, authentic pride, and hubristic pride will be predictive of meeting physical activity recommendations.

CHAPTER TWO

METHODS

Participants

A total of 190 participants completed the online research study. Specifically, the adolescent group included 51 participants (M_{age} = 15;10 years old, SD = 0:05) and the young adult group included 139 participants (M_{age} = 20:09 years old, SD = 2:06). Additional demographic information is given in Table 1 including sex, race, physical activity engagement information, and autism symptomatology scores. Specifically, the Social Responsiveness Scale-2 (SRS-2; Constantino & Gruber, 2012), and ASD diagnostic history if provided, were used to determine an individual's level of autism symptomatology. The SRS-2 is a 65 item self-report form that identifies social impairments associated with ASD and symptom severity with 5 subscales: Awareness, Cognition, Communication, Motivation, and Repetitive Interests and Restricted Behaviors. Participants are instructed to respond to each statement that best describes their behavior over the past 6 months on a 4-point Likert scale (1=*Not True*, 2 = *Sometimes True*, 3 = *Often True*, 4 = *Almost Always True*).. *T*-scores are also provided for clinicians and stakeholders who use similar ASD screening tools, but all data analyses were conducted using raw scores of the SRS-2. Internal consistency of the SRS-2 for this sample was found to be adequate (α = .96) which corroborates previous findings (Ingersoll et al., 2011).

Measures

Physical Activity Information

Participants were asked about their exercise history and habits, including (1 how frequently in a given week (i.e. 0-7 days) they participant in physical activity, (2) the average duration in minutes of engaging in physical activity, and (3) the average intensity of the physical activity using the Borg's Rating of Perceived Exertion (RPE; Borg, 1998). RPE was established to allow an individual to subjectively rate their physical strain during exercise (Whaley et al., 1997). RPE is a scale ranging from 6 (no exertion at all) to 20 (maximal exertion). RPE can be used to identify an individual's subjective limit of fatigue or exertion which usually indicates an RPE of 17 (very hard) and above. RPE has been found to be a valid measure of an individual's subjective rating of physical exertion (Chen et al., 2002).

Behavioral Regulations in Exercise Questionnaire

The Behavioral Regulations in Exercise Questionnaire (BREQ-3; Cid et al., 2018) is a 24 item self-report questionnaire used to examine where an individual lies on the continuum of self-determination, or motivation, and includes six subscales: amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation. Each regulation style has 4 items, scored on a 5-point scale (0 = "not true for me", 2 = "sometimes true for me", 4 = "very true for me". The BREQ-3 was developed to address limitations from the original BREQ (Mullan et al., 1997) and BREQ-2 (Markland & Tobin, 2004). The BREQ-3 demonstrates adequate composite reliability for all items (Cid et al., 2018). For this study, subscales on the BREQ-3 showed good internal consistency: amotivation ($\alpha = .84$), external

regulation (α = .88), introjected regulation (α = .88), identified regulation (α = .76), integrated regulation (α = .87), and intrinsic regulation (α = .92).

Body and Appearance Self-Conscious Scale

The Body and Appearance Self-Conscious Scale **(**BASES; Castonguay et al., 2014) is a 16 item self-report questionnaire developed to assess body related self-conscious emotions. Items are scored on a 5-point scale (1 = never, 2 = rarely, 3 = occasionally, 4 = frequently, 5 = always) and includes 4 subscales: guilt, shame, authentic pride, and hubristic pride. The BASES subscale scores have been shown to demonstrate good validity (Castonguay et al., 2014). In this sample, results showed adequate internal consistence for each subscale: shame (α = .94), guilt (α = .90), authentic pride (α = .89), and hubristic pride (α = .93).

Procedure

All procedures and measures of the study were reviewed and approved by the Institutional Review Board at the host university. Adolescents were recruited from a high school in an urban city in central Illinois. The researcher provided all study materials to the school principal, school counselor, and one schoolteacher. First, the school principal and counselor approved of the study and provided consent to recruit adolescents from the high school. Next, one teacher for three separate classrooms administered and collected parent consent forms and then facilitated the online survey to adolescents during a designated class period. Adolescents whose parents did not provide consent were given the option of being on their phone or computer during this time to make it appear as if they were also completing the study. Young adults were recruited through an online participant portal at the host university.

All participants were given an online link through which they could reach the online survey. Once participants followed the link, they were first presented with an informed consent page. Once providing consent, participants were directed to the survey questions. Participants who did not provide consent were thanked for their time, and then allowed to exit the survey without seeing any survey questions.

Data Plan

Research Aim 1

For the first research aim, separate two-way multiple analysis of variances (MANOVAs) will be conducted to examine if there is an interaction between autism symptomatology and age on physical activity levels, self-determination, and body-related self-conscious emotions. For each MANOVA, the independent variables are autism symptomatology (i.e., those scoring above threshold and those scoring below threshold) and age (adolescents and young adults). The dependent variables for each separate MANOVA include physical activity levels (i.e., frequency, duration, and intensity), self-determination motivation regulations (i.e., amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation), and body-related self-conscious emotions (i.e., guilt, shame, authentic pride, and hubristic pride).

Research Aim 2

For the second research aim, simple Pearson correlation tests will be conducted to examine the relations between physical activity levels, self-determination, and body-related self-conscious emotions. Physical activity levels will be measured by examining the frequency (e.g., in days per week) of how often individuals engage in physical activity, the duration of engaging

in physical activity for a single bout is captured in minutes, and the average intensity of the physical activity is measured via the Rate of Perceived Exertion (Borg, 1998). Acknowledging there may be potential differences in the strength and significance of the associations between study variables with regards to autism symptomatology and age, additional correlations will be run to examine if the same pattern of associations hold true or differ.

Research Aim 3

For the third research aim, binary hierarchical logistic regressions will be conducted to examine the predictive ability of self-determination motivation regulations and body-related self-conscious emotions, separately, on meeting nationally recommended physical activity guidelines. A binary hierarchical logistic regression was chosen due to the dependent variable (i.e., meeting physical activity guidelines or not meeting physical activity guidelines) being treated as a dichotomous variable and to examine the predictive ability of self-determination regulations and body-related self-conscious emotions beyond the effects of autism symptomatology, age, and sex. To determine if an individual meets, or does not meet these guidelines, physical activity levels of frequency (i.e., days per week), duration (i.e., average time of single bout of physical activity), and intensity of engagement are combined to follow the recommendations outlined by the DHHS (2018). Specifically, the recommendations state that for adolescents to achieve substantial health benefits, to engage in at least 60 minutes of moderate-to-vigorous physical activity daily and for adults should engage in at least 150-300 minutes of moderate intensity, or 75-150 minutes of vigorous intensity aerobic physical activity in a week (DHHS, 2018). To examine this, two separate models were analyzed (i.e., self-determination and body-related self-conscious emotions). For each model, the first variables entered were autism symptomatology,

age, and sex. Sex was included to account for the imbalance between males and females in the sample. Then, self-determination regulations (i.e., amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation) and body-related self-conscious emotions (i.e., guilt, shame, authentic pride, and hubristic pride) were entered in the second step for each respective model.

CHAPTER THREE

RESULTS

Preliminary Analyses

All data analyses were performed using IBM SPSS (v. 27.0; Chicago, IL USA). Preliminary analyses were conducted on the dependent variables to ensure appropriateness of procedures.

The first research aim used a two-way MANOVA to compare how autism symptomatology (i.e., those scoring above and below threshold) and age (i.e., adolescents and adults) interact to affect levels of physical activity, self-determination, and body-related self-conscious emotions. A scatterplot determined a linear relationship for each group of the independent variables. Pearson correlation tests revealed no evidence of multicollinearity ($|r| < 0.9$), there were no univariate outliers in the data, as assessed by inspection of a boxplot, and there were no multivariate outliers in the data, as assessed by Mahalanobis distance ($p > .001$). Box's M test ($p = .016$-$.262$) determined there was homogeneity of covariances and Levene's Test of Homogeneity of Variance ($p > .05$) confirmed there was homogeneity of variances.

The second research aim used Pearson correlation analyses to examine the associations between physical activity behaviors (i.e., frequency, duration, and intensity), self-determination regulations (i.e., amotivation, external regulation, introjected regulation, identified regulation,

integrated regulation, and intrinsic regulation), and body-related self-conscious emotions (i.e., shame, guilt, authentic pride, and hubristic pride). Scatterplots determined a linear relationship between all variables and normality of the variables was confirmed by examining skewness (i.e., less than +/-2.0) and kurtosis (i.e., less than +/-7.0; West et al., 1995).

The third research aim used binary hierarchical logistic regressions to examine the predictive ability of self-determination motivation regulations and body-related self-conscious emotions, separately, on meeting nationally recommended physical activity guidelines. To determine if all continuous independent variable were linearly related to the logit of the dependent variable, the Box – Tidwell (1962) procedure was conducted. After Bonferroni correction was applied, results confirmed that both sets of predictors (i.e., self-determination motivation regulations and body-related self-conscious emotions) were found to be linearly related to the logit of the dependent variables ($p < .003$). In addition, based on the standardized residuals, it was determined that there were no outliers. Lastly, Hosmer-Lemeshow goodness-of-fit tests for all binary hierarchical logistic regressions were not significant ($x^2 = 5.37 – 8.11\ 6.33$, $p > .05$), indicating that the models are not a poor fit.

Participant Characteristics

Participant characteristics for those scoring above and below threshold are presented in Table 1 including age, sex, and race. For autism symptomatology, measured via the SRS-2, participants scoring above threshold (T-score ≥ 60) indicate a non-clinical level of autism symptomatology. Independent samples *t*-tests revealed that individuals with autism symptomatology scored higher on both SRS-2 T-scores and raw scores compared to those without autism symptomatology, $t(189\text{-}191) = 15.49\text{-}15.68$, $p < .001$, Cohen's $d = 3.16\text{-}3.17$.

The relative autonomy index (RAI) is a single score derived from the subscales of the BREQ-3 that gives a score of the degree to which an individual feels self-determined. The RAI is scored by multiplying each subscale with a specific weight (i.e., amotivation = -3, external regulation = -2, introjected regulation = -1, identified regulation = +1, identified regulation = +2, intrinsic regulation = +3), then summing these weighted scores. Higher, positive scores indicate more autonomous self-determination, whereas lower, negative scores indicate more controlled self-determination. Independent samples *t*-tests showed that individuals without autism symptomatology had higher RAI scores compared to individuals with autism symptomatology, $t(194) = 2.90$, $p = .004$, Cohen's $d = 0.51$. In other words, individuals without autism symptomatology have more autonomous self-determination regulation compared to those with autism symptomatology.

Differences Between Autism Symptomatology and Age on Study Variables

To address research aim 1, a two-way MANOVA was conducted to examine the interaction effect of age (i.e., adults and adolescents) and autism symptomatology (i.e., individuals scoring above threshold and individuals scoring below threshold of autism symptomatology) on physical activity behaviors, self-determined motivation regulations (Table 2), and body-related self-conscious emotions (Table 3), separately.

The interaction effect between autism symptomatology and age on physical activity behaviors was not statistically significant, $F(3, 176) = 2.35$, $p = .074$, partial $\eta^2 = .039$. However, results found a significant main effect of autism symptomatology, $F(3, 176) = 3.59$, $p = .015$, partial $\eta^2 = .058$, on physical activity frequency only, $F(1, 178) = 10.29$, $p = .002$, partial $\eta^2 = .055$. Specifically, individuals with autism symptomatology reported engaging in physical

activity less frequently during the week (M = 3.31, SD = 1.51) compared to individuals without autism symptomatology (M = 4.23, SD = 2.02). Moreover, results showed a significant main effect of age, $F(3, 176) = 36.40$, $p < .001$, partial $\eta^2 = .383$. Specifically, physical activity frequency, $F(1, 178) = 7.37$, $p = .007$, partial $\eta^2 = .040$, and intensity, $F(1, 178) = 71.86$, $p < .001$, partial $\eta^2 = .288$, was significant between age groups in that adults reported engaging in physical activity less frequently (M = 3.60, SD = 1.83) compared to adolescents (M = 5.24, SD = 1.79) but at a higher intensity (M = 12.90, SD = 2.34) compared to adolescents (M = 8.48, SD = 1.94).

The interaction effect between autism symptomatology and age on self-determined motivation regulations was not statistically significant, $F(6, 176) = 1.05$, $p = .394$, partial $\eta^2 = .408$ (see Table 2). However, results showed a significant main effect of autism symptomatology, $F(6, 176) = 2.57$, $p = .021$, partial $\eta^2 = .081$, on external, $F(1, 181) = 9.23$, $p = .003$, and integrated, $F(1, 181) = 5.73$, $p = .018$, regulation. Specifically, individuals with autism symptomatology reported more external regulation (M = 1.18, SD = .940) than their peers without ASD symptomatology (M = .729, SD = .736), and less integrated regulation (M = 1.42, SD = 1.03) compared to individuals without autism symptomatology (M = 1.78, SD = 1.05). In addition, results showed a significant main effect of age, $F(6, 176) = 2.19$, $p = .046$, partial $\eta^2 = .070$, on external regulation, $F(1, 181) = 8.45$, $p = .004$, partial $\eta^2 = .045$. Specifically, it was found that adults (M = .704, SD = .764) reported less external regulation compared to adolescents (M = 1.14, SD = .823).

The interaction effect between autism symptomatology and age on body related self-conscious emotions was not statistically significant, $F(4, 176) = .916$, $p = .456$, partial $\eta^2 = .287$

(see Table 3). However, there was a main effect of autism symptomatology, $F(4, 171) = 3.79$, $p = .006$. Guilt, $F(1, 174) = 7.47$, $p = .007$, shame, $F(1, 174) = 14.51$, $p < .001$, authentic pride, $F(1, 174) = 4.50$, $p = .035$, and hubristic pride, $F(1, 174) = 4.76$, $p = .031$, were significantly different in those with autism symptomatology compared to individuals without autism symptomatology. Specifically, those with autism symptomatology reported more guilt ($M = 3.06$, $SD = 1.13$) than individuals without autism symptomatology ($M = 2.47$, $SD = .996$), more shame ($M = 3.45$, $SD = 1.10$) compared to individuals without autism symptomatology ($M = 2.52$, $SD = .971$), less authentic pride ($M = 2.26$, $SD = .800$) compared to individuals without autism symptomatology ($M = 2.74$, $SD = .992$), and less hubristic pride ($M = 1.81$, $SD = .806$) compared to individuals without autism symptomatology ($M = 2.39$, $SD = .980$). Additionally, results showed a significant main effect of age, $F(4, 176) = 3.55$, $p = .008$, partial $\eta^2 = .077$, such that authentic pride, $F(1, 174) = 9.03$, $p = .003$, was found to be significant between age groups. Specifically, adults ($M = 2.81$, $SD = .936$) reported more authentic pride compared to adolescents ($M = 2.13$, $SD = .900$).

Correlations Between Study Variables

The second research question examined the associations between physical activity behaviors, self-determined motivation regulations, and self-conscious emotions by conducting Pearson correlation tests. See table 4 for correlation results.

Results showed that raw SRS-2 scores were negatively associated with the frequency of engaging in physical activity, $r(192) = -.16$, $p < .05$. In addition, raw SRS-2 scores were positively associated with more controlled form of self-determination (i.e., amotivation and external regulation; $r(191\text{-}192) = .22 – .27$, $p < .01$), and guilt and shame, $r(186\text{-}187) = .33 – .52$,

$p < .001$). On the other hand, results showed that raw scores on the SRS-2 were negatively associated with autonomous forms of self-determination (i.e., integrated and intrinsic regulations; $r(191) = -.21 – -.25$, $p < .01$), and authentic and hubristic pride, $r(187) = -.25 – -.30$, $p < .001$).

As predicted, there was a positive association between physical activity behaviors (i.e., frequency, duration, and intensity) and more autonomous forms of self-determination (i.e., identified, integrated, and intrinsic regulation; $r(188\text{-}195) = .28 – .50$, $p < .001$) and a negative association with more controlled forms of self-determination (i.e, amotivation and external regulation; $r(194\text{-}196) = -.11 – .31$, $p < .05$. In addition, physical activity behaviors had a positive association with authentic pride, $r(180\text{-}187) = .17 – .38$, $p < .05$ whereas only the frequency of engaging in physical activity had a negative association with guilt and shame ($r(186\text{-}188) = -.16 – -.26$, $p < .05$).

Moreover, guilt and shame showed positive associations with controlled forms of motivation (i.e., external and introjected regulation; $r(184\text{-}187) = .22 – .33$, $p < .01$), and negative associations with more autonomous forms of motivation (i.e., integrated and intrinsic regulation; $r(185\text{-}187) = -.15 – -.30$, $p < .05$). Conversely, authentic pride showed a negative association with external regulation, $r(185) = -.24$, $p < .001$, and authentic pride showed positive associations with identified, integrated, and intrinsic regulations, $r(186) = .18 – .39$, $p < .001$. Hubristic pride was only positively associated with integrated and intrinsic regulations, $r(186) = .18 – .22$, $p < .05$.

Correlations by Autism Symptomatology and Age

Based on the significant main effects found of autism symptomatology and age on physical activity behaviors, self-determination motivation regulations, and body-related self-conscious emotions, further Pearson correlations were conducted to examine whether the same patterns of findings occurred when examining autism symptomatology and age.

For individuals without autism symptomatology (i.e., scoring below threshold on the SRS-2), physical activity frequency was positively associated with more autonomous forms of regulation (i.e., introjected, identified, integrated, and intrinsic regulation; $r(154) = .25 – .48$, $p < .01$) and body-related authentic pride, $r(146) = .18$, $p < .05$. Moreover, physical activity frequency was negatively associated with body-related guilt, $r(145) = -.28$, $p < .001$. External regulation was negatively related to physical activity intensity, $r(153) = -.37$, $p < .001$, and authentic pride, $r(144) = -.23$, $p < .01$, but was positively related to body-related guilt, $r(146) = .18$, $p < .05$, and shame, $r(146) = .18$, $p < .05$. Conversely, integrated regulation was positively associated with physical activity frequency, duration, and intensity, $r(150\text{-}154) = .29 - .48$, $p < .001$, and authentic pride, $r(145) = .34$, $p < .001$ but was found to be negatively associated with guilt and shame, $r(144\text{-}146) = -.16 – -.21$, $p < .05$. Lastly, body-related guilt was negatively associated with physical activity frequency, $r(145) = -.28$, $p < .001$, whereas body-related authentic pride was positively related to physical activity duration, and intensity, $r(142\text{-}146) = .15 – .29$, $p < .001$.

For individuals with autism symptomatology (i.e., scoring above threshold on the SRS-2), physical activity frequency was positively associated with more autonomous forms of regulation (i.e., integrated and intrinsic regulation; $r(41) = .31 – .40$, $p < .05$). Moreover,

integrated regulation was positively associated with body-related authentic pride, $r(41) = .31 – .40$, $p < .05$. Lastly, body-related authentic pride was significantly related with physical activity intensity, $r(41) = .32$, $p < .05$.

For adults, physical activity frequency and intensity was positively associated with more autonomous forms of self-determination (i.e., identified, integrated, and intrinsic; $r(136) = .51 – .62$, $p < .001$) and body-related authentic pride, $r(133) = .31 – .40$, $p < .05$. Moreover, physical activity frequency and intensity was negatively associated with more controlled forms of self-determination (i.e., amotivation and external regulation; $r(136\text{-}137) = -.18 – -.30$, $p < .05$) and body-related guilt and shame, $r(132\text{-}134) = -.14 – -.22$, $p < .05$. External regulation was positively associated with autism symptomatology, $r(132) = .37$, $p < .001$, and body-related guilt and shame, $r(131\text{-}131) = .31 – .33$, $p < .001$, but was negatively associated with authentic pride, $r(132) = -.22$, $p < .05$.

For adolescents, a similar pattern occurred. Specifically, physical activity frequency and intensity was positively associated with more autonomous forms of self-determination (i.e., identified, integrated, and intrinsic; $r(51) = .36 – .56$, $p < .001$) but was negatively associated with body-related guilt, $r(46) = -.34$, $p < .05$. Moreover, external regulation was positively associated with body-related guilt and shame, $r(46) = .35 – .43$, $p < .05$, but was negatively associated with hubristic pride, $r(46) = -.32$, $p < .05$.

Predictors of Meeting Physical Activity Guidelines

To address research aim 3, a binary hierarchical logistic regression analysis was conducted to examine if self-determined motivation regulations and body-related self-conscious emotions significantly predicted whether individuals meet or do not meet the recommended

physical activity guidelines. To examine this, two separate models were analyzed (i.e., self-determination and body-related self-conscious emotions, respectively). For each model, the first variables entered were autism symptomatology, age, and sex. Then, self-determination regulations (i.e., amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation) and body-related self-conscious emotions (i.e., guilt, shame, authentic pride, and hubristic pride) were entered in the second step. The dependent variable in all models was whether individuals meet or do not meet the recommended physical activity guidelines.

Self-Determined Motivation Regulations

For the first step of model 1, the results show that autism symptomatology and age were not significant predictors of whether individuals meet the recommended physical activity guidelines, $x^2(3) = 1.92$, $p = .589$, -2 log-likelihood = 233.02, *Nagelkerke* $R^2 = .015$ (see Table 5). However, when self-determined motivation regulations (i.e., amotivation, external regulation, introjected regulation, identified regulation, integrated regulation, and intrinsic regulation) were entered into the model (step 2) as predictors, the model was shown to be a significant predictor of physical activity, $x^2(9) = 44.47$, $p < .001$, -2 log-likelihood = 190.47, *Nagelkerke* $R^2 = .305$. Specifically, the results show that introjected regulation (B = -.596, SE B = .213, Wald = 7.79, $p = .005$, exp(B) = .551) and identified regulation (B = 1.09, SE B = .376, Wald = 8.36, $p = .004$, exp(B) = 2.97) significantly predicted whether individuals met, or do not met, the recommended physical activity guidelines, regardless of other factors (i.e., autism symptomatology, age, sex). Results reveal that ascribing more towards introjected regulations was associated with a reduction in the likelihood of meeting physical activity guidelines, whereas ascribing more

towards identified regulations was associated with an increased likelihood of meeting physical activity guidelines. See Table 5 for hierarchical logistic regression output for self-determination motivation regulations.

Body-Related Self-Conscious Emotions

For the first step of model 1, the results show that autism symptomatology and age were not significant predictors of whether individuals meet the recommended physical activity guidelines, $x^2(3) = 1.82$, $p = .612$, -2 log-likelihood = 230.46, *Nagelkerke* $R^2 = .014$ (see Table 6). When body-related self-conscious emotions (i.e., guilt, shame, authentic pride, and hubristic pride) were entered into the model (step 2) as predictors, the overall model was shown to be significant ($x^2(7) = 19.86$, $p = .006$, -2 Log likelihood = 212.41, *Nagelkerke* $R^2 = .148$). Specifically, the results show that guilt (B = .599, SE B = .274, Wald = 4.78, $p = .029$, exp(B) = .550), shame (B = -.839, SE B = .305, Wald = 7.55, $p = .006$, exp(B) = 2.31), and authentic pride (B = .825, SE B = .293, Wald = 7.93, $p = .005$, exp(B) = 2.28) significantly predicted whether individuals met, or do not met, the recommended physical activity guidelines. Results reveal increased proneness to body-related guilt and authentic pride is associated with an increased likelihood of meeting physical activity guidelines, whereas higher scores of shame was associated with a reduction likelihood of meeting physical activity guidelines. See Table 6 for hierarchical logistic regression output for body-related self-conscious emotions.

CHAPTER FOUR

DISCUSSION

Although physical activity can offer a number of physical and psycho-social benefits (Dillon et al., 2016; Ketcheson et al., 2018; Sorenson & Zarrett, 2014; Sowa & Meulenbroek, 2012), literature suggests that individuals with autism engage in physical activity at a lower rate compared to individuals without autism (Bandini et al., 2013; McCoy et al., 2016), and become less active as they age (Pitchford et al., 2013). Factors such as self-determination and one's proneness to body-related self-conscious emotions may exert influence on physical activity engagement. For example, self-determination, within the context of this study, can elicit various motivational drives one has to engage in physical activity behaviors. In addition, evaluating self-conscious emotions in individuals with autism symptomatology can reveal one's ability to reflect on social interactions and evaluate their own actions in relation to social norms. Thus, reflecting on experiences can result in positive or negative feelings about the self and prompt future behaviors. Therefore, the primary aim of this study was to compare the effects of autism symptomatology and age on physical activity behaviors (i.e., frequency, duration, and intensity), self-determination motivation regulations, and body-related self-conscious emotions separately. Additionally, it was of interest to examine the associations between the study variables, and if motivation regulations and self-conscious emotions predict physical activity behavior. Results of the first research aim partially supported the hypotheses. It was hypothesized that there would be

a significant interaction between autism symptomatology and age on autism symptomatology and age on physical activity behaviors, self-determination motivation regulations, and self-conscious emotions, separately. Results did not find a statistically significant interaction effect for any of the models. However, consistent with study hypotheses, individuals scoring above threshold, which is indicative of autism symptomatology, reported engaging in physical activity less frequently compared to individuals scoring below threshold (Beets et al, 2011; Benson et al., 2019; Kuo et al, 2014; McLeod et al., 2021; Soden et al, 2012). In addition, it was found that adults engage in physical activity less frequently compared to adolescents which corroborates findings from non-autistic populations suggesting that physical activity level decreases with age (Czerwinski et al., 2015; Dumith et al., 2011; Jones et al., 2017).

Moreover, in line with study hypotheses, individuals with autism symptomatology reported more external regulation and less integrated regulation compared to individuals without autism symptomatology (Cheak-Zamora et al., 2020; Wehmeyer & Shogren, 2008; see Kim, 2019, for a review). Some literature suggest that this may be due social and communicative challenges that are often present in autism symptomatology (Fullerton & Coyne, 1999; Stancliffe, 1997; Wehmeyer et al., 2010), and thus making it more difficult to achieve and meet the psychological needs of the self-determination theory (i.e., competence, relatedness, and autonomy). Webster et al. (2022) examined how each of these characteristics can be improved in autistic individuals and lead to more autonomous forms of self-determination. For example, Webster and colleagues (2022) state that increase competence (i.e., building of individuals skills and effectively executive and fulfill tasks; Roman & Davids, 2016) can decrease anxieties an

individual may have on a particular task or skill and suggest that programs to support competence in activities should be centered around scaffolding and self-regulation strategies, rather than 1:1 support which increases levels of dependence on others (Sefotho & Onyishi, 2021). As for relatedness (i.e., sense of belonging or connectedness; Roman & Davids, 2016) offering multiple opportunities to interact with new environments and individuals would aid in developing a sense of relatedness. Lastly, Webster et al. (2022) posits that by supporting autistic individuals to have a greater say in their life, or an active rather than passive role, and allowing for direct involvement in making choices, a greater sense of autonomy (i.e., making individual choices, or having agency, that provide a sense of meaning; Roman & Davids, 2016) can be obtained.

It was also found that adults reported less external regulation compared to adolescents suggesting that adults are more autonomous than adolescents. This finding is understandable given that adolescence is a period where autonomy tends to develop rapidly and accelerate. As cited by Inguglia et al. (2015), autonomy increases during adolescence from changes in physical functioning, cognitive processing, increasing of social connections, and a need for independence. The transition from adolescence to young adulthood indicates a time where the individual begins to be less influenced by parents or other adults, and determine their own behaviors and actions (Buhl, 2008). Thus, the study findings may suggest that adults may engage in more autonomous behaviors as it relates to physical activity because they have developed physically, have had ample experiences and opportunities, and have acquired age-appropriate social skills so that they can engage in different types of physical activities.

Lastly, as hypothesized, individuals scoring above threshold on autism symptomatology reported more proneness to guilt and shame, but and less authentic and hubristic pride, compared to individuals scoring below threshold. Similarly, research suggests that individuals with autistic symptomatology exhibit more proneness to shame and less proneness to authentic and hubristic pride (Davidson et al., 2017) and are able to accurately identify self-conscious emotions (Tracy et al., 2011). However, Gaziel-Guttman et al. (2022) recently found that young adults with ASD experienced lower levels of shame in shame-evoking situations compared to individuals without ASD. Other literature found that parents of children with ASD reported fewer expressions of shame (Hobson et al., 2006) and that instances of shame are mentioned infrequently (Crane et al., 2010). To further our understanding of self-conscious emotions in autistic individuals, future research should examine if individuals differ in their expressions of self-conscious emotions compared to their ability to identify them. For example, autistic individuals may be able to accurately label emotions such as shame and pride, but may have difficulty in the self-expression of such emotions (Williams & Happe, 2009).

The hypotheses with regards to the second research aim were supported in that there were significant relations between autism symptomatology, physical activity levels, self-determination motivation regulations, and body-related self-conscious emotions. It was found that autism symptomatology was negatively associated with physical activity frequency, autonomous forms of self-determination, and proneness to pride, but positively associated with more controlled forms of self-determination, proneness to guilt, and proneness to shame. Lastly, as expected, there was a positive association between physical activity behaviors and more autonomous forms

of self-determination and proneness to authentic pride (Gilchrist et al., 2018; Mack et al., 2015), but a negative association with amotivation regulation.

To further examine the interplay among these variables the third research aim examined the likelihood of meeting physical activity guidelines based on self-determination behavior regulations and body-related self-conscious emotions. Specifically, it was found that individuals ascribing towards introjected regulation (i.e., more controlled motivation) were less likely to meet physical activity guidelines, whereas those with higher identified regulation (i.e., more autonomous motivation) were more likely to meet the guidelines (Table 5). This corroborates previous literature (Ng et al., 2012; Staples et al., 2022; see Teixeira et al., 2012, for a review) such that more autonomous regulations are predictive of adaptive behavior change and engage in physical activity more voluntarily and actively (Seymour et al., 2021), whereas as more external, or controlled, regulations are not. To this point, Thogersen-Ntoumani and Ntoumanis (2006) found that those who were engaging in healthy forms of physical activity displayed significantly more autonomous regulation. That is, individuals are more likely to meeting physical activity guidelines if such a behavior is motivated by personal goals. On the other hand, if engaging in physical activity is felt as an obligation, or if such a behavior is dictated by a self-imposed sense of self, then the individual is less likely to meet physical activity guidelines. Thus, engaging in physical activities that promote more autonomous regulation may encourage individuals to engage in adaptive forms of exercise more often (Staples et al., 2022). Based on the literature reviewed, interventions aimed at increasing physical activity engagement and adherence should target building up individuals' autonomous regulation. For example, as suggested by Seymour and colleagues (2021), one possibility is for interventions to provide physical activity instruction

as an opportunity to engage in an activity with professional assistance. This may motivate an individual to engage in and maintain the physical activity via more autonomous processes such as skill mastery, providing feedback to improve competence, an opportunity to engage in social situations (i.e., relatedness).

In line with previous literature (Castonguay et al., 2014; Castonguay et al., 2017; Lucibello et al., 2020; Sabiston et al., 2010) individuals with more proneness to guilt and authentic pride were more likely to meet physical activity guidelines, whereas those ascribing towards more proneness to shame were less likely to meet the guidelines.

Although body-related guilt may seem to be used as a motivational tool to engage in health behavior due to the reparative nature to "fix" a behavioral transgression it has often been associated with externally motivated regulations, as has been the case shown within this study, which is also associated with difficulties in the maintenance of physical activity (Castonguay et al., 2015; Tracy & Robins, 2004; Ryan & Deci, 2000). As suggested by Castonguay and colleagues (2014), it may be difficult to maintain physical activity behavior because the individual is externally focused on body-related aspects of the self, such as one's appearance or weight status. Therefore, even though the correlation between guilt and physical activity may seem positive, findings should be taken with caution because higher perceptions of body-related guilt may foster maladaptive forms of physical activity and have negative outcomes on physical and mental health (i.e., body dissatisfaction, depression, anxiety, and disordered eating; Maltby & Day, 2001).

An encouraging finding was the positive association between body-related authentic pride and meeting physical activity guidelines which is supported by previous literature

(Castonguay et al., 2013; Gilchrist et al., 2018; Mosewich et al., 2011; Sabiston et al., 2010). Gilchrist et al. (2013) posit that physical activity may be a way to promote positive self-concept and self-worth (Thogersen-Ntoumani & Ntoumanis, 2006) as a result of effort and achievement. Thus, seeing the positive association between body-related authentic pride and physical activity, interventions should incorporate elements such as realized effort, building competence and confidence, and setting manageable goals to promote aspects of pride (i.e., goal achievement and accomplishment; Castonguay et al., 2014).

The finding revealing that higher instances of body-related shame reduce the likelihood of meeting physical activity guidelines is unsurprising given that body-related shame is linked to social comparison and avoidant behaviors (Castonguay et al., 2012; Sabiston et al., 2010; Tangney & Tracy, 2012; Tracy & Robins, 2004), resulting in an overall avoidance to physical activity. Specifically, this can occur if an individual feels ashamed about their body in social situations where the body is being evaluated or put on display. As suggested by Castonguay and colleagues (2014), interventions can try to manipulate the cognitive appraisals that elicit shame. For example, to increase physical activity behavior, individuals can be encouraged to hold realistic expectations of their bodies (i.e., actual vs. ideal self) or target appraisals toward a specific modifiable behavior rather than changing the "look" of an overall person.

Limitations & Future Directions

Although these findings support previous research and addresses gaps in the literature, certain limitations must be addressed. First, autism symptomatology was not found to be a significant predictor on meeting physical activity guidelines in either model, which was unexpected given that individuals with autism engage in physical activity less frequently

compared to peers without autism (Bandini et al., 2013; McCoy et al., 2016). However, data for this study was collected during the COVID-19 pandemic. Recent literature shows reductions in physical activity levels for a sample of adolescents with ASD (Phytanza et al., 2021). In a recent review on the impact of COVID-19 on university students physical activity levels, it was found that low, moderate, vigorous, and total physical activity levels have been reduced compared to pre-lockdown levels (López-Valenciano et al., 2021). A separate review (Violant-Holz et al., 2020) found that adults reduced their physical activity levels which was also associated with increased stress, anxiety, depressive symptoms, and social isolation. Moreover, parents of children with ASD reported barriers that may have affected physical activity engagement of their child during the pandemic including safety concerns and inadequate access to educational infrastructure (Esentürk, 2021). For this study, autism symptomatology was determined using a self-report measure (i.e., SRS-2) which has previously been a strategy used to assess individuals who may not have received a formal diagnosis of ASD but score above threshold on autism symptomatology (e.g., Dijkhuis et al., 2020; Lei et al., 2020; Trevisan & Birmingham, 2016). However, as South and colleagues (2017) contend, use of the SRS-2 may be capturing symptoms of other conditions including anxiety. Thus, the non-significant finding between autism symptomatology and physical activity may be due to the unexpected fluctuation in physical activity levels caused by the COVID-19 pandemic and potential co-occurring psychological conditions. Future studies should aim to tease apart these co-occurring conditions so a clearer relation between autism symptomatology and physical activity can be understood.

Secondly, perhaps researchers should not solely focus on the motivational drives for physical activity engagement. More than likely, there are a variety of factors which determine an

individual's willingness to participate in physical activity. As such, Arnell and colleagues (2018) propose a conceptual model called the *Conditional Participation in Physical Activity* for individuals with autism. It posits that for sustainable physical activity engagement, five conditions must be considered: 1.) competence and confidence (i.e., perceived competence, self-confidence, level of vulnerability), 2.) motivation (i.e., enjoyment, meaningfulness, self-regulation), 3.) adjustment to external demands (i.e., adjust to social, environmental, and physical activity demands), 4.) predictability (i.e., familiarity of task and knowing what to do), and 5.) freedom of choice (i.e., availability and accessibility, possibility to choose or influence activity). Clearly, autistic individuals express a variety of different conditions to engage in physical activity and if these conditions are not met, it decreases the individuals' willingness to be physical active. Future studies should aim to explore these conditions under a developmental framework. That is, understanding early in life experiences throughout childhood and adolescence can determine functioning in adulthood. For example, negative or positive experiences can cascade into adulthood and either promote or inhibit adaptive physical activity behaviors.

CHAPTER FIVE

CONCLUSION

Nevertheless, the study found that individuals with autism symptomatology engaged in physical activity less frequently, reported more controlled motivation (i.e., external regulation) and less autonomous motivation (i.e., integrated regulation), reported more proneness to body-related guilt and shame, and less authentic and hubristic pride, compared to individuals scoring below threshold. Moreover, individuals ascribing towards more autonomous motivation and proneness to body-related guilt and authentic pride were more likely to meet physical activity guidelines. On the other hand, individuals with more controlled motivation and proneness to body-related shame were less likely to meet these guidelines. Future studies should examine how self-determination regulations moderate the association between body-related self-conscious emotions and physical activity levels.

Table 1. Participant Information

	Overall (n = 190) *M* (*SD*)/ *n* (%)	Adolescents (n = 51) *M* (*SD*)/ *n* (%)	Young Adults (n = 139) *M* (*SD*)/ *n* (%)	t / χ^2	*p*	*d/phi*
Age (year; months)	19;05 (2;11)	15;10 (0;05)	20;09 (2;06)	24.89	<.001	2.57
Sex[a]				10.42	.001	0.24
Males	60 (30.9%)	25 (49%)	33(26.7%)			
Females	134 (69.1%)	26 (51%)	102 (73.3)			
Racial/Ethnic Identity				47.39	<.001	0.50
White or Caucasian	102 (51.5%)	17 (33.3%)	80 (57.6%)			
Black or African American	10 (5.1%)	0 (0%)	10 (7.2%)			
Asian or Asian American	28 (14.1%)	2 (4%)	25 (18.0%)			
Hispanic or Latino/Latina	35 (17.7%)	23 (45.1%)	10 (7.2%)			
Native Hawaiian/ Pacific Islander	1 (.5%)	0 (0%)	1 (0.7%)			
More than one race	15 (7.6%)	7 (13.6%)	8(5.8%)			
Other	7 (3.5%)	2 (4%)	5 (3.5%)			
Physical Activity						
Frequency	4.03 (2.00)	5.25 (1.78)	3.57 (1.90)	5.51	<.001	0.90
Duration	46.84 (25.51)	42.20 (20.97)	48.59 (27.35)	1.49	.137	0.25
Intensity	11.72 (3.01)	8.47 (1.92)	12.93 (2.42)	11.81	<.001	1.94
PA Level				.797	.372	0.07
Yes	113 (59.2%)	32 (64%)	76 (56.7%)			
No	78 (40.8%)	18 (36%)	58 (43.3%)			
SRS-2 Raw Score	47.56 (26.92)	51.52 (8.45)	52.95 (9.67)	.920	.359	0.15

Effect sizes given by Cohen's *d* or *phi*, as appropriate. Results for the treatment subscales and for the overall total score of the SRS-2 are reported as *T*-scores (*M* = 50, *SD* = 10), with a *T*-score of 60 or greater indicative of the clinically significant difficulties associated with ASD and quantifies their severity. GPA = Grade point average. RAI = relative autonomy index. SRS-2 = Social Responsiveness Scale, Second Edition. [a] = 3 4 young adults self-reported that they preferred not to reveal their sex

Table 2. Two-Way MANOVA of Autism Symptomatology and Age on Physical Activity Behaviors

Source	DV	F (3,176)	*p*	η_p^2	SS	*df*	MS	F	η_p^2
Autism Symptomatology		3.59	.015	.058					
	Frequency				32.55	1	32.55	10.28*	.055
	Intensity				0.94	1	0.94	0.19	.001
	Duration				810.36	1	810.36	1.22	.007
Age		36.40	< .001	.383					
	Frequency				23.35	1	23.35	7.37**	.040
	Intensity				361.73	1	361.73	71.86***	.288
	Duration				1075.17	1	1075.17	1.61	.009
Autism Symptomatology *Age		2.35	.074	.039					
	Frequency				13.67	1	13.67	4.32*	.024
	Intensity				3.08	1	3.08	0.61	.003
	Duration				13.58	1	13.58	0.02	< .001
Error									
	Frequency				563.69	181	3.17		
	Intensity				3679.00	181	5.03		
	Duration				118569.55	181	666.12		
Total									
	Frequency				3679.00	185			
	Intensity				26471.00	185			
	Duration				520219.75	185			

SS = sum of squares. MS = Mean square. * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 3. Two-Way MANOVA of Autism Symptomatology and Age on Self-Determination Regulation

Source	DV	F (6,176)	*p*	η_p^2	SS	*df*	MS	F	η_p^2
Autism Symptomatology		2.57	.021	.081					
	Amotivation				0.47	1	0.47	1.26	.007
	Extrinsic				5.30	1	5.30	9.23**	.049
	Introjected				0.44	1	0.44	0.34	.002
	Identified				1.72	1	1.72	2.58	.014
	Integrated				6.18	1	6.18	5.73*	.031
	Intrinsic				2.91	1	2.91	2.63	.014
Age		2.19	.046	.070					
	Amotivation				0.30	1	0.30	0.79	.004
	Extrinsic				4.86	1	4.86	8.45**	.045
	Introjected				0.09	1	0.09	0.07	.000
	Identified				0.17	1	0.17	0.26	.001
	Integrated				3.93	1	3.93	3.64	.020
	Intrinsic				2.32	1	2.32	2.10	.011
Autism Symptomatology *Age		1.05	.394	.035					
	Amotivation				0.09	1	0.09	0.23	.001
	Extrinsic				0.01	1	0.01	0.01	.000
	Introjected				1.51	1	1.51	1.19	.007
	Identified				0.99	1	0.99	1.48	.008
	Integrated				1.75	1	1.75	1.62	.009
	Intrinsic				0.07	1	0.07	0.06	.000
Error									
	Amotivation				67.81	181	0.38		

Table 3 (continued)

	Extrinsic	104.03	181	0.58
	Introjected	229.91	181	1.27
	Identified	121.20	181	0.67
	Integrated	195.33	181	1.08
	Intrinsic	199.90	181	1.10
Total				
	Amotivation	97.00	185	
	Extrinsic	243.92	185	
	Introjected	982.81	185	
	Identified	1431.63	185	
	Integrated	737.88	185	
	Intrinsic	1154.81	185	

SS = sum of squares. MS = Mean square. * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 4. Two-Way MANOVA of Autism Symptomatology and Age on Self-Conscious Emotions

Source	DV	F (4,171)	*p*	η_p^2	SS	*df*	MS	F	η_p^2
ASD Symptomatology		3.79	.006	.082					
	Guilt				7.91	1	7.91	7.47**	.041
	Shame				14.66	1	14.66	14.51***	.077
	Authentic Pride				3.67	1	3.67	4.50*	.025
	Hubristic Pride				4.07	1	4.07	4.76*	.027
Age		3.55	.008	.077					
	Guilt				0.48	1	0.48	0.46	.003
	Shame				0.37	1	0.37	0.36	.002
	Authentic Pride				7.36	1	7.36	9.03*	.049
	Hubristic Pride				1.34	1	1.34	1.57	.009
Autism Symptomatology *Age		0.92	.456	.021					
	Guilt				0.11	1	0.11	0.10	.001
	Shame				0.50	1	0.50	0.50	.003
	Authentic Pride				0.73	1	0.73	0.89	.005
	Hubristic Pride				1.86	1	1.86	2.18	.012
Error									
	Guilt				184.23	174	1.06		
	Shame				175.75	174	1.01		
	Authentic Pride				141.87	174	0.82		
	Hubristic Pride				148.67	174	0.85		
Total									
	Guilt				1401.94	178			
	Shame				1520.19	178			

Table 4 (continued)

	Authentic Pride	1403.94	178
	Hubristic Pride	1078.81	178

SS = sum of squares. MS = Mean square. * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 5. Correlations of Study Variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1. Age	-														
2. Autism Symptomatology	.11	-													
PA Behaviors															
3. Frequency	-.33***	-.16*	-												
4. Duration	.11	.06	.31***	-											
5. Intensity	.52***	-.10	-.02	.36***	-										
Self-Determination Regulations															
6. Amotivation	-.13	.22**	-.18*	-.14	-.28***	-									
7. External Regulation	-.21**	.27***	-.07	-.11	-.31***	.31***	-								
8. Introjected Regulation	-.01	.11	.18*	.10	.16*	-.20**	.15*	-							
9. Identified Regulation	.10	-.14	.45***	.28***	.37***	-.48***	-.22**	.56***	-						
10. Integrated Regulation	.13	-.21**	.46***	.29***	.47***	-.40***	-.19**	.45***	.70***	-					
11. Intrinsic Regulation	.16*	-.25***	.39***	.33***	.50***	-.43***	-.35***	.29***	.66***	.66***	-				
Self-Conscious Emotions															
12. Guilt	-.02	.33***	-.26***	-.06	-.09	.14	.33***	.30***	-.11	-.18*	-.26**	-			
13. Shame	-.05	.52***	-.16*	-.07	-.13	.18*	.28***	.22**	-.09	-.15*	-.30***	.78***	-		
14. Authentic Pride	.21**	-.30***	.18*	.17*	.38***	-.13	-.24***	-.07	.22**	.35***	.39***	-.35***	-.44***	-	
15. Hubristic Pride	.07	-.25***	-.01	-.01	.17*	.03	-.11	-.09	.07	.18*	.22**	-.21**	-.38***	.69***	-

For autism symptomatology, SRS-2 raw scores were used for all correlation analyses. PA = physical activity. * = $p < .05$, ** = $p < .01$, *** = $p < .001$

Table 6. Hierarchical Logistic Regression of Predictors of Meeting PA Guidelines

								95% C.I. for Exp(B)	
	Predictor	B	S.E.	Wald	*df*	Sig.	Exp(B)	Lower	Upper
Step 1									
	Constant	.633	1.28	.246	1	.620	1.88		
	SRS-2	-.007	.006	1.53	1	.217	.993	.981	1.00
	Age	.000	.064	.000	1	.998	1.00	.883	1.13
	Sex	.191	.349	.301	1	.620	1.21	.611	2.40
Step 2									
	Constant	-2.59	1.72	2.29	1	.130	.075		
	SRS-2	.003	.008	.0125	1	.724	1.00	.988	1.02
	Age	-.043	.076	.318	1	.573	.958	.826	1.11
	Sex	.059	.401	.022	1	.883	1.06	.483	2.33
	Amotivation	.256	.339	.571	1	.450	1.29	.665	2.51
	External Regulation	.326	.264	1.52	1	.217	1.39	.826	2.32
	Introjected Regulation	-.596	.213	7.79	1	.005	.551	.363	.837
	Identified Regulation	1.09	.376	8.36	1	.004	2.97	1.42	6.20
	Integrated Regulation	.514	.269	3.64	1	.057	1.67	.986	2.84
	Intrinsic Regulation	.360	.249	2.10	1	.148	1.43	.880	2.33

SRS-2 = Social Responsiveness Scale, Second Edition.

Table 7. Hierarchical Logistic Regression of Predictors of Meeting PA Guidelines

								95% C.I. for Exp(B)	
	Predictor	B	S.E.	Wald	df	p	exp(B)	Lower	Upper
Step 1									
	Constant	.734	1.30	.320	1	.572	2.08		
	SRS-2	-.008	.006	1.79	1	.181	.992	.980	1.00
	Age	-.003	.064	.002	1	.965	.997	.879	1.13
	Sex	-.014	.346	.320	1	.968	.986	.501	1.94
Step 2									
	Constant	-.481	1.53	.100	1	.752	.618		
	SRS-2	-.012	.008	2.45	1	.118	.988	.973	1.00
	Age	-.043	.072	.357	1	.550	.958	.831	1.10
	Sex	.324	.399	.656	1	.418	1.38	.632	3.02
	Guilt	.599	.274	4.78	1	.029	.550	.321	.940
	Shame	-.839	.305	7.55	1	.006	2.31	1.27	4.21
	Authentic Pride	.825	.293	7.93	1	.005	2.28	1.29	4.05
	Hubristic Pride	-.481	1.53	.100	1	.192	.709	.422	1.19

SRS-2 = Social Responsiveness Scale, Second Edition.

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VITA

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