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A CONTEXTUAL APPROACH TO UNDERSTANDING PSYCHIATRIC COMORBIDITIES IN ADOLESCENTS WITH AUTISM SPECTRUM DISORDER: INDIVIDUAL, PEER, AND FAMILY FACTORS

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A dissertation submitted in partial fulfillment of the requirements for the Doctor of Philosophy at Virginia Commonwealth University

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I dedicate this dissertation to my grandfather, Harold. I hope I've made you proud.

Table of Contents

List of Figures

List of Tables

Abstract

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Psychiatric comorbidities are common in youth with Autism Spectrum Disorders (ASD) and can have a negative impact on adaptive functioning and quality of life. Research has primarily focused on individual characteristics associated with internalizing problems such as age, intelligence, and social functioning. However, developmental theory supports the notion that individual level factors are necessary but not sufficient to understand the mental health of youth with ASD. Using the Family Ecology Framework as a guide, the purpose of this study was to examine how peer and family contexts are associated with anxiety and depression symptoms of adolescents with ASD. Using data

from adolescents with ASD (13-17 years old) and their primary caregivers (N = 166), this study tested a conditional process model in which youths' social-communication skills were associated with their mental health symptoms indirectly via experiences of peer victimization, with family competence acting as a buffer against the negative impact of peer victimization on anxiety and depression symptoms. Results suggest that the peer context is important when considering the mental health of adolescents with ASD. Specifically, deficits in social-communication skills were associated with higher levels of parent-reported anxiety and depression symptoms through increased adolescent-reports of peer victimization; however, the hypothesized buffering effect of family competence was not statistically significant. Findings from this study suggest the benefits of utilizing developmentally sensitive, contextual approaches when examining psychiatric comorbidities in adolescents with ASD.

A Contextual Approach to Understanding Psychiatric Comorbidities in Adolescents with Autism Spectrum Disorder: Individual, Peer, and Family Factors

Psychiatric comorbidities, or the occurrence of two or more forms of psychopathology in the same person (Matson & Nebel-Schwalm, 2007), are a significant problem for many youth with Autism Spectrum Disorder (ASD). Estimates suggest that up to 70% of adolescents with ASD have at least one psychiatric comorbidity and up to 40% have more than one (Simonoff et al., 2008). Common comorbidities such as depression and anxiety have been linked to increases in core ASD symptomatology, higher healthcare costs, and decreased quality of life (Kelly, Garnett, Attwood, & Peterson, 2008; Lavelle et al., 2014; Zuckerman, Lindly, Bethell, & Kuhlthau, 2014). The challenges associated with psychiatric comorbidities pose a significant threat to the well-being of youth with ASD. Identifying factors associated with these comorbidities is therefore critical to effective prevention and intervention efforts.

Developmentally sensitive, contextual approaches, including ecological and systems models of development, have been highlighted as particularly useful frameworks for understanding adjustment in youth with ASD (e.g., Cridland, Jones, Magee, & Caputi, 2014; Danforth, 2013). Drawing from both ecological and systems theories of development, the Family Ecology Framework (FEF; Pedersen & Revenson, 2005) provides a model for understanding how characteristics of an individual's disability are associated with their mental health outcomes while also taking into account the salient contexts (e.g., peer, family) of adolescents' lives. This process-oriented framework provides a nuanced approach to exploring the mechanisms through which individual

characteristics relate to youth adjustment as well as potential moderating factors that protect youth against the harmful effects of certain risks.

According to the FEF, peers are an important and developmentally salient context when considering mental health outcomes for adolescents with ASD. One aspect of the peer environment that has received significant attention is experiences of peer victimization, which has been consistently linked to anxiety and depression symptoms in youth with ASD (e.g., Ung et al., 2016). The FEF posits that characteristics of the peer environment, such as experiences of peer victimization, likely act as mechanisms through which youths' ASD symptoms, such as social-communication skills, are associated with mental health outcomes. The FEF also proposes a number of moderating variables, including family factors that may protect youth from the negative impact of peer victimization on mental health outcomes. Thus, this study proposes a conditional indirect effects model in which family competence buffers the indirect effect of peer victimization on the association between social-communication skills and mental health outcomes in adolescents with ASD.

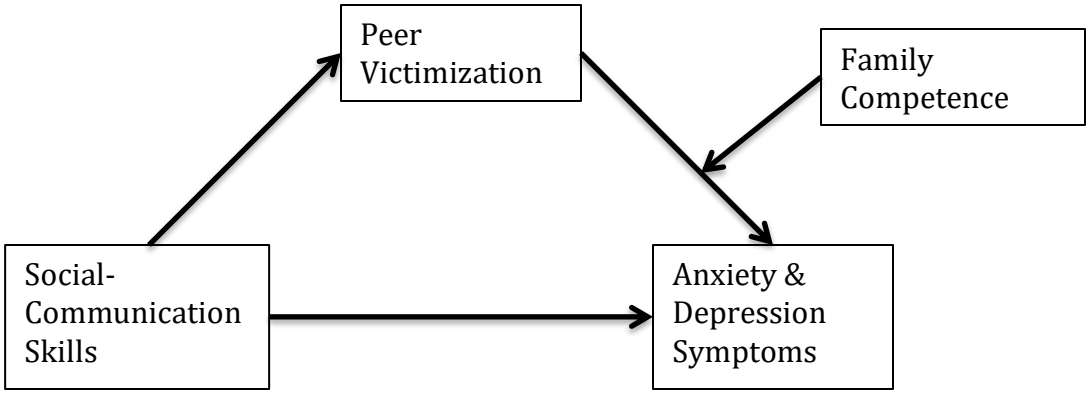

Figure 1. Hypothesized conditional indirect effects model

Background

Autism Spectrum Disorder

Autism spectrum disorder is a heterogeneous neurodevelopmental disorder characterized by impairments in social communication, and persistent patterns of restricted, repetitive behaviors. According to the *Diagnostic and Statistical Manual of Mental Disorders* [5th ed.; *DSM-5*; American Psychiatric Association (APA), 2013], the pervasive deficits associated with ASD occur across a wide spectrum of severity that appears in early childhood and persists across the lifespan. The prevalence of ASD [one in 59 children; Centers for Disease Control and Prevention (CDC), 2018] continues to rise and the healthcare and education costs associated with the disorder exceed $11 billion annually, with individual families paying up to six times more than families of neurotypical children (Lavelle et al., 2014). In addition to the core features of ASD, other common symptoms includes language impairment, motor deficits, neurocognitive impairments, challenging behaviors, sleep disturbances, and comorbidities with other psychiatric disorders (Shochet et al., 2016). There is no known cure for ASD and treatments aim to facilitate skill acquisition, improve functional skills, and promote overall quality of life (Anagnostou et al., 2014). Thus, understanding factors that impede optimal outcomes is critical in promoting the development of individuals with ASD. One key barrier commonly associated with suboptimal outcomes is the comorbid psychopathology found in these individuals.

Psychiatric Comorbidities in ASD: Anxiety and Depression

Comorbid psychopathology, or the occurrence of two or more forms of psychopathology in the same person (Matson & Nebel-Schwalm, 2007), is common in

youth with ASD and research suggests that individuals with ASD experience these problems at higher rates than neurotypical individuals (Gurney, McPheeters, & Davis, 2006; Mayes, Calhoun, Murray, Ahuja, & Smith, 2011). Prevalence rates of at least one comorbid psychiatric disorder range from 30 to 70% of youth with ASD and include mood and anxiety disorders, attention deficit/hyperactivity disorder, and conduct problems, among others (Gjevik, Eldevik, Fjæran-Granum, & Sponheim, 2011; Mazefsky, Kao, & Oswald, 2011; Simonoff et al., 2008).

Internalizing disorders such as anxiety and depression are especially prevalent in youth with ASD. Several studies have shown that youth with ASD experience anxiety symptoms at higher rates than their neurotypical peers. For example, in a study of children and adolescents with ASD and without intellectual disability, 76% of youth with ASD presented with anxiety symptoms compared to 36% of neurotypical controls (Caamaño et al., 2013). Similarly, Amr and colleagues (2012) found that two thirds of a sample of children with ASD met criteria for at least one psychiatric diagnosis, with anxiety being the most prevalent (58%). Another study found anxiety disorders to be the most prevalent comorbidity in a sample of children and adolescents with ASD (41%) as identified through clinical interview (Gjevik et al., 2011). Mood problems are also common. Individuals with ASD are four times as likely to experiences depression sometime in their lives compared to neurotypical peers (Hudson, Hall, & Harkness, 2018). A recent systematic review found rates of depression in individuals with High Functioning ASD (HFASD) to vary widely (1 – 47%), although almost all studies found rates to be higher than those found in the general population (Wigham, Barton, Parr, & Rodgers, 2017).

Importantly, psychiatric comorbidities such as anxiety and depression can exacerbate the core symptoms of ASD and negatively impact an individual's functionality, overall health, and quality of life (Ahmedani & Hock, 2012; Kuhlthau et al., 2010; Matson & Nebel-Schwalm, 2007; Mattila et al., 2010). In addition, mounting evidence suggests that comorbidities associated with ASD present significant challenges to care (Gadow, Guttmann-Steinmetz, Rieffe, & DeVincent, 2012; Joshi et al., 2010; Kim, Szatmari, Bryson, Streiner, & Wilson, 2000; Simonoff et al., 2008; Vickerstaff, Heriot, Wong, Lopes, & Dossetor, 2007). While mental health service use is high in youth with ASD (49%), many parents of these youth (13.3-22.8%) report deficits in their child's mental health care as well as heavy financial burden associated with psychiatric care (~$2,500-12,000/year; Chiri & Warfield, 2012; Narendorf, Shattuck, & Sterzing, 2011; Wang, Mandell, Lawer, Cidav, & Leslie, 2013). Thus, psychiatric comorbidities in individuals with ASD present a significant public health concern as well as a significant barrier to the well-being of individuals with ASD and their families. This may be particularly true for adolescents with ASD, a developmental period associated with heightened risk for internalizing disorders.

Adolescence as a Crucial Period of Socio-Emotional Development for all Youth

Adolescence is a time of great social, emotional, cognitive, and physical change for all youth (Steinberg, 1999). Increasing independence, developing identities, and increasingly demanding and influential social contexts make adolescence an important developmental period for understanding later adult outcomes. Indeed, the ability to successfully accomplish these stage-salient tasks has been related to adaptive functioning (e.g., work competence, romantic relationships) into adulthood for neurotypical youth

(Roisman et al., 2004). Along with the onset of pubertal physical changes, the developmental tasks of adolescence include the formation of high quality friendships, autonomy from parents, identity formation, and forming romantic relationships (Picci & Scherf, 2015; Roisman, Masten, Coatsworth, & Tellegen, 2004). As such, neurotypical adolescents navigate increasingly complex social relationships while transitioning to secondary school that often involves larger schools, bigger classrooms, multiple teachers, less structure, and increased academic demands (Benner, 2011). These changes in biological and cognitive functioning as well as new social environments trigger changes in interpersonal relationships, exemplified by the growing importance of peers to neurotypical youth (Collins & Laursen , 2004). The ability to successfully accomplish these stage-salient tasks has been related to adaptive functioning (e.g., work competence, romantic relationships) into adulthood for neurotypical youth (Roisman et al., 2004).

The salience of adolescent social demands for youth with ASD. Adolescents with ASD face similar stage salient tasks as their neurotypical peers but may find them especially challenging. Adolescence is often considered a time of both "continuity and change" for individuals with ASD (McGovern & Sigman, 2005), suggesting a period of developmental change occurring within the context of the persistent challenges associated with ASD. Those with ASD experience social and adaptive functioning difficulties throughout the lifespan, including impairments in social competence and peer relationships, and feelings of anhedonia (Eaves & Ho, 2008; Joshi et al., 2010; Williamson, Craig, & Slinger, 2008). Research supports the "continuity" of ASD, highlighting social problems as the most persistent phenotype of ASD over the life course (Seltzer, Shattuck, Abbeduto, & Greenberg, 2004), a particular challenge during the

salient social context of adolescence. During adolescence, deficits in social-communication may be expressed via little time engaged in conversations with friends or doing activities with peers (Orsmond & Kuo, 2011). In fact, boys with ASD described difficulties developing and maintaining friendship, difficulties interacting with opposite sex peers, experiences of bullying, and overall limited social opportunities with peers as specific social challenges they face as adolescents (Cridland, Caputi, Jones, & Magee, 2015). Such social challenges can feed into a cycle of reeducated opportunities to practice and develop important social skills, in turn further aggravating social problems (Glick & Rose, 2011; Hartman, Geurts, Franke, Buitelaar, & Rommelse, 2016).

This "continuity" of social deficits into adolescence may amplify challenges associated with the social, emotional, and cognitive "changes" of adolescence. In their two-hit model of ASD, Picci and Scherf (2014) suggest that neurocognitive reorganization, puberty, and the heavy social demands typical of adolescence interact to produce a "second hit" on the already compromised social neural system of youth with ASD. The interaction between continuity and change, or the "second hit," perpetuates social difficulties and makes navigating the developmental tasks of adolescence especially challenging for youth with ASD. This could manifest in a number of ways. First, the inherent differences in social-communication skills that define ASD such as challenges engaging in conversation, reading non-verbal cues, and building age-appropriate friendships (APA, 2013) may make the social world of adolescence difficult to navigate. Second, behavioral manifestations of the disorder may further impede social development. For example, repetitive behaviors or rigidity could make it difficult for youth to relate to their peers and lead to exclusion from peer groups (Carter et al., 2014).

These problems could also hinder relationships with teachers and place students at a disadvantage in the less structured secondary school environment. Third, teens with ASD are at particular risk for experiencing peer victimization and bullying (Maïano, Normand, Salvas, Moullec, & Aimé, 2016), leading to higher rates of social withdrawal and isolation (Anderson, Maye, & Lord, 2011). Thus, the changes brought on by adolescence combined with the unique and persistent challenges associations with ASD make the salient social demands of this developmental period particularly difficult for those on the autism spectrum.

It may be that the increasingly social world of adolescence is particularly challenging for "high functioning" youth, or those who are verbally fluent and have no cognitive impairment or learning disability. It is theorized that these individuals are more interested in social interaction but also more aware of their social differences (Mazurek & Kanne, 2010). Combined with the increased social demands of adolescence, increased social awareness may put youth at risk for disengaging from peers. High functioning youth with ASD are more likely to identify past unsuccessful attempts at social relationships and experience greater distress in the face of unsuccessful social bids. In addition, they are more likely to internalize these negative interactions and experience significant loneliness associated with a lack of (or poor quality) friendships (Shochet et al., 2016). As the prevalence of ASD continues to rise, particularly in individuals without intellectual disability (CDC, 2014), and impairments endure across the lifespan, developmental changes and psychosocial difficulties in adolescence make it a prime period for the study of psychiatric comorbidities in individuals with ASD.

Anxiety and depression during adolescence. For neurotypical youth, adolescence is a period in which the risk for socio-emotional problems such as depression and anxiety, risky behaviors, substance abuse, and violence increase (Steinberg, 2008). Risk for depression and anxiety increases significantly after early adolescence (Hale, VanderValk, Akse, & Meeus, 2008; Lewinsohn, Rohde, Seeley, Klein, & Gotlib, 2000), and depression symptoms in neurotypical adolescents have been related to fewer and poorer quality relationships, risk for social isolation, decreased levels of self-care and adaptive functioning, and increased risk for self-injury and suicidal ideation (Shochet et al., 2016).

For adolescents with ASD, the risk for and prevalence of internalizing disorders such as anxiety or depression also increases during adolescence, although the precise trajectory of these symptoms is not clear. Cross-sectional research has been mixed, with some studies finding higher rates of internalizing symptoms in adolescents compared to children with ASD (e.g., Dubin, Lieberman-Betz, & Michele Lease, 2015; Greenlee, Mosley, Shui, Veenstra-VanderWeele, & Gotham, 2016; Vasa et al., 2013) and others reporting no age differences (e.g., Strang et al., 2012). Longitudinal evidence suggests that depression and anxiety symptoms are high in middle childhood and remain high through adolescence, with girls showing greater increases across time compared to boys with ASD (Gotham, Brunwasser, & Lord, 2015).

Adolescence is also a time when youth with ASD and their families focus heavily on transitioning out of secondary school and into adulthood (Friedman, Warfield, & Parish, 2013). For many individuals, particularly those who do not go to college, graduation from high school or exit from public school services at age 21 results in a

decrease in access to services and social opportunities (Newman et al., 2011). For youth with ASD that do continue with post-secondary education, mental health concerns play a role in the high college drop-out rates in this population (Jackson, Hart, Brown, & Volkmar, 2018). Importantly, mental health problems such as depression or anxiety during adolescence can negatively impact how youth with ASD adapt to these transitions (Volkmar, Jackson, & Hart, 2017).

An Ecological Model of Mental Health Comorbidity in Youth with ASD

Given the increased risk for psychiatric comorbidities in adolescents with ASD and the negative impact such difficulties can have on long term outcomes, research informed by theoretical orientations that account for developmentally salient contexts has implications for interventions. Ecological models of development (e.g., Bronfenbrenner, 1986) are one such approach and suggest an important interaction between the individual and levels of their environment. When applied to research of adolescents with ASD, an ecologically-informed approach would highlight the importance of the proximal influence of several systems (i.e., family, peer) to their development (Danforth, 2013). Similarly, a systems perspective suggests that development is the product of individuals interacting with their contexts over time (Sameroff, 2009). Individuals bring certain characteristics and genotypic influences that continually interact with levels of the environment to produce developmental outcomes. In the case of ASD, core features and symptoms of the disorder may by modified throughout the individual's life as she/he continually interacts with family, peer, and school environments, which then change the way those environments react to the individual and ultimately lead to outcomes, including mental health problems. The application of ecological and systems-based

models has been widely successful in developmental research of neurotypical youth; however, application to atypical development, and particularly to individuals with ASD, has not yet been fully realized.

Family Ecology Framework. Drawing from both ecological and systems models of development, the Family Ecology Framework (FEF; Pederson & Revenson, 2005) provides a guiding model for understanding psychiatric comorbidities in adolescents with ASD. Originally developed to explain how parental illness influences adolescent and family well-being, the FEF emphasizes the associations among multiple levels of the individual's environment and is easily transferred to a broad array of research questions and populations, including youth with ASD. Importantly, this model was specifically developed for understanding outcomes for adolescents. The FEF has four basic principles: (a) individual behavior can only be explained within a social context, (b) there are a number of social systems in which the individual resides, (c) there is a transactional relationship between the individual and the social systems in which they reside, and (d) factors beyond the level of individual characteristics and attributes must be included to understand adaptation and maladaptation (Pederson & Revenson, 2005).

The FEF is also a process-oriented model that focuses on the mechanisms through which individual characteristics produce developmental outcomes as well the contexts in which these processes are most relevant. The original FEF model posits that characteristics of the parent's illness affect adolescent well-being indirectly through individual- and family-level factors such as youth stress response, daily hassles, family role redistribution, etc. (Pederson & Revenson, 2005). Applied to youth with ASD, the FEF would suggest that characteristics of ASD influence adolescent mental health

outcomes indirectly through context-level factors. As shown in Figure 2, one suggested pathway highlights how individual and ASD-related characteristics impact social a number of contexts including peer relationships, which in turn shapes adolescent mental health outcomes.

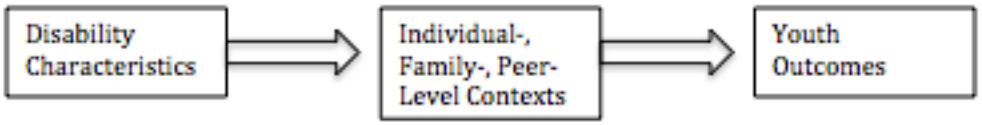

Figure 2. Conceptual model of proposed study based on the Family Ecology Framework (Pedersen & Revenson, 2005).

Individual and disability risk factors. Much like traditional ecological and systems models of development, the FEF begins with a consideration of the individual. Several individual characteristics have been identified as important risk factors for comorbid mood and anxiety problems in youth with ASD. Depression has been linked to higher cognitive functioning, self-awareness of social deficits, adolescence, and quality of social relationships in individuals with ASD (De la Iglesia & Olivar, 2015). A number of studies have found increasing age (i.e., adolescence vs. children) to be associated with emotional symptoms in those with ASD. For example, higher age was correlated with higher parent-reported ratings of anxiety in both children and adolescents with ASD (Lecavalier, 2006) as well as parent-reported history of depression (Greenlee et al., 2016). Higher age has been related to lower self-perceived social competence, which then related to higher self-reported depression symptoms in youth with ASD and without intellectual disability (Vickerstaff et al., 2007). A meta-analysis of comorbid anxiety in children and adolescents with ASD reported that higher rates of anxiety were found in

studies with a higher mean age, although that was not true for all studies included (van Steensel, Bögels, & Perrin, 2011).

In addition to age, intellectual ability and severity of autism symptoms have also been associated with depression and anxiety in youth with ASD; however, the nature of the relationship has yet to be determined. For example, in a large study of youth with ASD that included a range of intellectual ability, higher IQ and "less severe" ASD symptoms were associated with increased parent-report of anxiety and depression (Mazurek & Kanne, 2010). Mayes and colleagues found a similar association between higher IQ, increasing age, and both anxiety and depression symptoms in a sample of over 600 children and adolescents with ASD; however, they also found more severe ASD symptoms to be associated with mental health problems in their sample (Mayes, Calhoun, Murray, & Zahid, 2011). Another study found depression and anxiety symptoms to be high for children and adolescents regardless IQ or ASD severity (Strang et al., 2012).

While the link between IQ, ASD severity, and mental health outcomes is unclear, some have suggested that the potential association between higher IQ and milder ASD can be explained via social functioning. Comorbid psychopathology, including social anxiety and depression, has been directly linked to poorer social skills (or more social problems) in children and adolescents with ASD (Chang, Quan, & Wood, 2012; Dubin, Lieberman-Betz, & Lease, 2015; Pouw, Rieffe, Stockmann, & Gadow, 2013; Waters & Healy, 2012), and indirectly via self-perceived social incompetence in high-functioning youth with ASD (Vickerstaff et al., 2007). Overall, the research suggests that deficits in social-communication may be an important risk factor for negative mental health outcomes in higher-functioning adolescents with ASD. However, the Family Ecological

Framework posits that individual characteristics alone are not sufficient to explain mental health outcomes, but should be examined along with developmentally salient contextual factors in order to best explain adjustment outcomes for adolescents.

Contextual risk factors. The FEF points to contextual risk factors as a potential mechanism through which characteristics such as social functioning may influence mental health outcomes. Particularly relevant to adolescence is the peer context. In neurotypical youth, high quality friendships have long been shown to promote positive social and cognitive development and contribute to a general sense of well-being (Hartup & Stevens, 1999). Youth with ASD report an interest in and desire for friends although they find peer friendships to be difficult and spend less time in social interactions compared to their neurotypical peers (Humphrey & Symes, 2010; O'Hagan & Hebron, 2017). Experiences of loneliness and social isolation are common for youth with ASD and can negatively impact social interactions when they do occur (Hughes, Banks, & Terras, 2013). While most adolescents with ASD report having a least one friend (Bauminger & Kasari, 2000), many identify that they have fewer friends and that their friendships look different than their neurotypical peers (Bauminger et al., 2008; Rao, Beidel, & Murray, 2008). Although peer relationships may be different for youth with ASD, the peer context remains an important one when considering mental health outcomes in this population.

Peer context and mental health outcomes. Positive peer relationships (e.g., high quality friendships) may be protective for neurotypical youth, but negative peer experiences such as peer victimization have been explicitly linked to mental health outcomes for adolescents. Peer victimization, or the experience of being the target of

another's aggressive or bullying behavior and social exclusion (Juvonen & Graham, 2001), has been linked to depression, anxiety, loneliness, and poor academic adjustment in neurotypical populations, and this link intensifies during adolescence in particular (see Troop-Gordon, 2017 for a review).

Adolescents with ASD are no strangers to experiences of peer victimization. They are victimized at exceptionally high rates (46-94%), much more frequently than their neurotypical peers (Sreckovic, Brunsting, & Able, 2014). Evidence also supports a similar association between peer victimization and anxiety/depression symptoms, loneliness, and increased risk for suicidal ideation using both parent (Cappadocia, Weiss, & Pepler, 2012; Shtayermman, 2007; Sterzing, Shattuck, Narendorf, Wagner, & Cooper, 2012; Storch et al., 2012; Ung et al., 2016; Zablotsky, Bradshaw, Anderson, & Law, 2013) and adolescent report of peer victimization (Adams, Fredstrom, Duncan, Holleb, & Bishop, 2014).

Peer context and individual characteristics. While the link between peer victimization and risk for mental health problems in youth with ASD is supported empirically, the association between disability characteristics and experiences of peer victimization in individuals with ASD is less clear. Some studies have found a positive association between social deficits and peer victimization (Adams et al., 2014; Cappadocia et al., 2012; Sterzing et al., 2012) while others have not (Storch et al., 2012). In addition, a negative association between social-communication deficits and peer victimization has also been reported (Rowley et al., 2012). Key methodological differences (e.g., informants, sample characteristics) may account for these discrepant results. More research is needed to fully understand associations between individual

characteristics, negative peer experiences, and mental health outcomes in youth with ASD. Based on the FEF assertion that developmentally salient contexts act as an indirect link between illness or disability characteristics and youth adjustment (Pederson & Revenson, 2005), this study examines the peer context as a mechanism through which disability characteristics impacts mental health outcomes in adolescents with ASD (Figure 3).

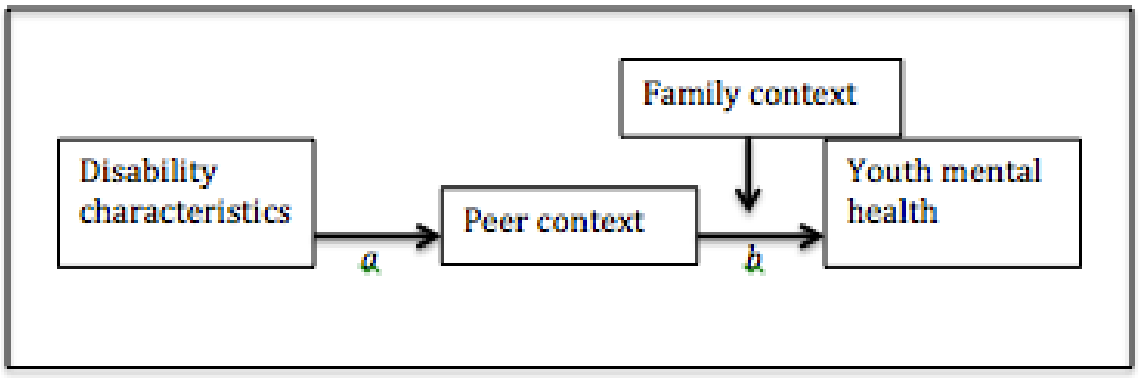

Figure 3. Mediating pathways within a Family Ecology Framework for research on psychiatric comorbidities (Pederson & Revenson, 2005).

Family Competence as a Protective Factor for Adolescents with ASD

In addition to contextual factors acting as a mechanism of effect, the FEF also identifies a number of contextual variables that are hypothesized to moderate the pathways from individual characteristics to mental health outcomes through the peer context. These include variables at the individual, dyadic, family, and extrafamilial/societal levels of analysis and are theorized to alter the magnitude and direction of both the *a* and *b* paths (Figure 3). Of interest to the proposed study is the

potential role of the family context as a moderating pathway when considering the mental health of adolescents with ASD.

Developmental and contextual theorists from Vygotsky to Bronfenbrenner have recognized the importance of the family to development throughout the lifespan. Families are typically the primary context for social, emotional, and cognitive development in the early years (Bronfenbrenner, 1989) and while new contexts are continually added throughout the lifespan, the family remains important. Roles, structure, dynamics, and what an individual needs from the family may change but the presence of the family remains constant. Lifespan reliance on the family system may be particularly true for individuals with disabilities, including those with ASD (Volkmar, Reichow, & McPartland, 2014). Adolescence, for example, is a period marked by increased autonomy seeking, normative increases in parent-child conflict, and restructuring of family roles for neurotypical (Collins & Laursen, 2004). While similar processes take place for youth with ASD, they also continue to rely on caregivers for social scaffolding, school support, and daily living skills (Mount & Dillon, 2014). The ongoing need for support at home and at school as well as the continued stress placed on families throughout adolescence highlights the important and unique role families may play in ASD related outcomes.

Family environment in ASD. The ways in which families function to support the physical, social, and psychological development of family members has long been a topic of investigation in developmental psychology. When families function well they are able to provide the support, resources, and structure that promote optimal development (Crosbie-Burnett & Klein, 2013). How families function on a daily basis has important implications for youth with ASD. The impact of family interactions on mental health

symptoms may be unique for individuals with ASD given deficits in socio-emotional skills that help foster healthy relationships (Kelly et al., 2008). It may be that youth with ASD are particularly sensitive to family conflict, for example, given problems with behavioral rigidity, sensory sensitivity, and perspective taking. Difficulties in emotional expressions and general communication skills may also inhibit successful family communication, a key component of overall family competence (Kelly et al., 2008).

A small but growing base of empirical evidence supports the notion that family processes are associated with outcomes for individuals with ASD. Cross-sectional evidence points to associations between a number of family variables and child outcomes. For instance, in a clinical sample of children and youth (6-16 years old) with ASD, family conflict was positively associated with anxiety and depression symptoms, which in turn were related to more severe ASD symptom profiles (Kelly et al., 2008). Another clinical sample of children with ASD found a curvilinear association between family routines and internalizing symptoms such that the lowest and highest level of routines were associated with the most internalizing problems (Stoppelbein, Biasini, Pennick, & Greening, 2016).

Longitudinal evidence also highlights the importance of family factors for ASD related outcomes. A family's ability to adapt in the face of challenge predicted fewer behavior problems two years later in a sample of children and adults with ASD (10-22 years old; Baker, Seltzer, & Greenberg, 2011). In a community sample of children with developmental disabilities, 56% of whom had a diagnosis of ASD, poor family functioning predicted future behaviors problems in the classroom (Stoutjesdijk, Scholte, & Swaab, 2016). Similarly in a clinical sample of youth (7-18 years old) with ASD and

anxiety, family functioning was related to trajectories of anxiety symptoms over time (van Steensel, Zegers, & Bögels, 2017). While the heterogeneity of samples, methods, and measures makes definitive conclusions about the role of family processes in outcomes for youth with ASD difficult, the evidence appears to suggest that the family environment may be important to consider when thinking about the mental health of adolescents with ASD. Still, little research has investigated the ways in which family factors such as family competence may act as a buffer against negative experiences in other contexts such as peer relationships.

Buffering role of healthy families. According to the FEF, the family environment may be particularly important to consider as a contextual moderator of the association between peer victimization and mental health outcomes for adolescents. We are aware of no research examining this particular hypothesis in youth with ASD; however, research focused on other moderators and in other populations provides preliminary evidence to back up the model proposed by the FEF. For instance, social support theories have long suggested that social support facilitates coping and adaptation in the face of stress (Cobb, 1976). In this sense, social support acts as a buffer, or protective factor, against the negative consequences of stress exposure (Williams, Barclay, & Schmied, 2004). A recent study of adolescents with intellectual and developmental disabilities found that perceived social support from parents weakened the association between victimization in 7th grade and depression symptoms in 8th grade (Wright, 2017). For youth with ASD, a healthy, competent family may be more able to act as a source of social support when youth experience stressful events such as peer victimization, a notion that has some support empirically. Perceived social support from a

number of sources, including parents and family members has been associated with fewer feelings of loneliness in adolescent boys with ASD (Lasgaard, Nielsen, Eriksen, & Goossens, 2010), as well as better quality of life, and adaptive functioning in adults with ASD (Khanna, Jariwala-Parikh, West-Strum, & Mahabaleshwarkar, 2014).

Research on the impact of stress exposure and youth adjustment offers another example of the potential buffering effect of the family context on adolescent outcomes. Evidence from research of youth living in poverty suggests: (1) family processes such as parenting, attachment, and family routines act as mechanisms through which poverty influences adolescent psychopathology, and (2) indicators of family functioning such as low levels of conflict act as a protective factors against the development of psychopathology in the face chronic stress (Sheidow, Henry, Tolan, & Strachan, 2014). It stands to reason that for youth with ASD, being part of a healthy, competent family could act as a protective factor against the negative effects of stress exposure (i.e., peer victimization) on mental health outcomes. Research specifically exploring the family environment as a potential protective factor for youth with ASD is needed and has the potential to inform intervention efforts.

Potential Covariates: Sex, Age, ASD symptoms, and School Context

Mental health symptoms can be influenced by a number of variables other than those discussed previously. Several potential covariates, including adolescent age and sex, severity of restricted and repetitive behaviors, and classroom placement, were chosen for inclusion in the current study based on their relevance to mental health comorbidities and experience of peer victimization during adolescence.

Adolescent age and sex. It is widely accepted that the trajectories of internalizing symptoms in neurotypical populations, particularly depression symptoms, is influenced by an interaction between age and sex. For example, depression symptoms generally rise in early adolescence and then plateau or decrease in older adolescence and young adulthood, with a lower likelihood of decreasing in females. Recent studies using mixed modeling techniques have consistently found subgroups within this trajectory, identifying groups that increase and decrease over time, with females consistently linked to trajectories of elevated depression symptoms across adolescence (see Ellis et al., 2017 for a review).

In the ASD literature, evidence implicating sex and age as factors associated with mental health comorbidities is less clear. In general, as stated previously, studies have found that adolescents with ASD have a higher prevalence of internalizing symptoms compared to their neurotypical peers and to younger children with ASD. In addition, there are several studies that have found no association between internalizing symptoms, including depression and anxiety, and sex (e.g., Magiati et al., 2016; Solomon, Miller, Taylor, Hinshaw, & Carter, 2012; Worley & Matson, 2011). However, many studies that examined gender differences in internalizing symptoms utilize small sample sizes per group (e.g., $n = 20$), and often include a wide age range (e.g., 6-18, or 8-18 years old). A study by Gotham et al. (2015) suggests that these limitations have hindered our understanding of the nature of the association between age, sex, and internalizing symptoms in youth with ASD. By examining longitudinal trajectories of internalizing symptoms from school age to young adulthood in individuals with ASD, Gotham and colleagues (2015) found a significant age by sex interaction for both depression and

anxiety symptoms such that females showed greater increases in symptoms through adolescence than males. Given this evidence as well as the increasing understanding that females with ASD present a unique ASD phenotype that includes differences in social behaviors and relationships (Happé, 2019), both age and sex will be tested as potential covariates in this study.

Restricted and repetitive behaviors. The presence of restricted and repetitive behaviors has been directly linked to internalizing symptoms, particularly anxiety, in individuals with ASD. For instance, in a sample of 8-16 year-olds, a greater presence of RRBs was found for those with ASD and high levels of anxiety compared to those with ASD and low levels of anxiety (Rodgers, Glod, Connolly, & McConachie, 2012). Similarly, a study of children and adolescents with ASD found RRBs to directly predict comorbid psychopathology, including anxiety (Stratis & Lecavalier, 2013). There are several potential explanations for the association between RRBs and anxiety symptoms. It may be that RRBs act as a coping mechanism to reduce anxiety, RRBs may be anxiety provoking in and of themselves, or anxiety may exacerbate the presentation of RRBs (Joyce et al., 2017). Some evidence also suggests that RRBs are associated with elevated experiences of parent-reported peer victimization in adolescents with ASD (Adams et al., 2014). Although it is beyond the scope of this study to examine the potential mechanisms linking RRBs and internalizing symptoms, RRBs will be tested as a potential covariate to account for this association.

Special education classroom placement. A key mandate of the Individuals with Disabilities Education Act (IDEA) is the educational placement of student with disabilities in the least restrictive environment. Classroom placement (i.e., general-or

special-education) has implications for academic achievement as well as the overall well-being of individuals with disabilities, including those with ASD. Proponents of mainstream or inclusive educational settings cite enhanced social skill acquisition through increased access to neurotypical peers, increased acceptance by peers, reduced negative stereotypes, and increased social participation as reasons why inclusion can be beneficial (Rose, Monda-Amaya, & Espelage, 2011). If students are not fully integrated into peer groups, however, mainstream settings may exacerbate victimization, increase isolation and subsequent opportunities to learn and practice social skills, and negatively impact peer relationships (Rose et al., 2011).

Some research suggests that mainstream school placement is associated with increased peer rejection, fewer friendships, and increased negative peer experiences in children with special education needs (e.g., Banks, McCoy, & Frawley, 2018). Other studies have found that children and youth with disabilities educated in segregated settings are more often victimized by their peers than any other group of students (Rose et al., 2011). For youth with ASD in particular, teachers rate those children who are less socially impaired in a mainstream setting as experiencing higher levels of victimization compared to more socially impaired youth (Rowley et al., 2012). Studies specifically looking at students with ASD have found that placement in a general education or mainstream setting is associated with higher peer victimization rates than those in a special school or segregated classrooms (Sreckovic et al., 2014). While the evidence for the association between classroom placement and experiences with peers is mixed, it is clear that classroom placement is an important factor to consider when examining experiences of peer victimization in youth with ASD.

Less research has examined whether classroom placement is associated with mental health symptoms in individuals with disabilities. In one study of youth with learning disabilities, self-reported depression symptoms did not differ by classroom status but students in general education settings were rated as more depressed by guidance counselors compared to students in self-contained classrooms (Howard & Tryon, 2002). Another study of children with learning disabilities found few differences in social and emotional outcomes based on classroom placement but differences that were found favored students in more inclusive environments (Wiener & Tardif, 2004). Given the robust association between peer victimization and mental health symptoms in youth with ASD, it is possible that classroom placement may indirectly be associated with mental health outcomes by increasing (or decreasing) the likelihood of negative experience with peers. Thus, classroom placement will be tested as a potential covariate in the current study.

Limitations of Previous Research

The extremely high prevalence of psychiatric comorbidities in youth with ASD and the significant impact these comorbidities likely have on care and quality of life are concerning. A number of limitations in the current body of literature pose significant barriers to understanding this phenomenon. First, few studies focus exclusively on adolescents, often grouping both children and adolescents or adolescents and adults into the same study. Using mixed-aged samples ignores the specific social, emotional, and cognitive capacities that emerge during adolescence. Second, research has focused primarily on the prevalence, identification, and assessment of comorbidities in this population, ignoring potential risk and protective factors associated with these psychiatric

comorbidities for youth with ASD. While these issues are important first steps and have suggested future avenues for both research and clinical work in individuals with ASD, development of targeted interventions will require a deeper understanding of the mechanisms through which mental health problems emerge specific to adolescence.

In addition to the prevalence, identification, and assessment of psychiatric comorbidities, the first generation of research focuses heavily on individual and disability related characteristics associated with psychiatric comorbidities. This initial wave of research reflects a narrow theoretical perspective, targeting individual characteristics that are not readily modifiable (i.e., IQ, symptom severity, age) and does not account for other factors that may act as risk and/or protective mechanisms for youth with ASD. The limited theoretical perspective in the existing literature has resulted in significant variability in methods and interpretation of results across studies, further hampering the translation of research into effective mental health care for youth with ASD. Calls for more comprehensive models that draw from specific theoretical frameworks is not new (e.g., Cridland et al., 2014); however, evidence suggests that this has yet to be taken up as common practice, particularly in relation to how family factors are associated with outcomes for individuals with ASD (Greenlee, Winter, & Diehl, 2018).

Finally, despite the recognition that families are critical in the daily functioning of youth with disabilities, including those with ASD, there is a significant underrepresentation of studies of how family factors relate to mental health outcomes for youth with ASD. Compared to families of neurotypical or families of children with other chronic illnesses, only a small percentage of published literature has focused on families of individuals with developmental disabilities. From 2012-2014, 110 articles were

published on family life in autism spectrum disorder compared to over 3,000 articles focused on the individual (Dykens, 2015). Furthermore, the majority of identified articles focused on parent risk factors that contribute to child outcomes such as maternal coping and mental health, family demographics and quality of life, economic resources, marital relationships, and child factors. While the role of the family in mental health outcomes is accepted as critical for neurotypical youth, less is known regarding the role of family factors and processes in psychiatric comorbidities for youth with ASD.

Statement of the Problem

Given increases in the prevalence of ASD, particularly in those without intellectual disability, and the negative impact psychiatric comorbidities can have on the development of individuals with ASD, further research is critical. There is a need for developmentally informed, theoretically grounded research into the potential risk and protective factors specific to youth with ASD. This study addresses several limitations in the existing literature (1) by focusing on the developmental period of adolescence to explore the unique factors relevant specifically to the context of adolescence, and by (2) addressing theoretical limitations by employing a comprehensive, systems-based theoretical framework to (3) test a process-oriented model of the mental health of adolescents with ASD.

Drawing from both ecological and systems theories, the Family Ecology Framework provides a guiding model to better understand the role of multiple contexts of adolescents' lives on their mental health outcomes. While the model proposes a number of potential contexts that act as indirect pathways through which disability related

characteristics impact youth adjustment, the role of peer and family context may be particularly relevant to youth with ASD and is the focus of the current study.

Although research has utilized individual components of the FEF, we could find no study that examined the conditional indirect pathway proposed by the FEF in its entirety. In line with the FEF, the current study examines adolescents' mental health as

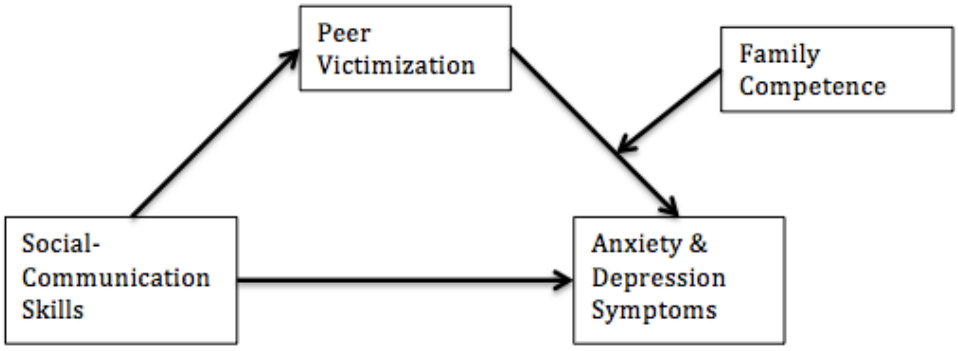

Figure 1. Hypothesized conditional indirect effects model

the outcome in a process model relating youth adjustment to key individual, peer, and family factors. The theoretical basis for this model suggests that negative peer experiences act as the mechanisms through which disability characteristics such as social functioning impacts depression and anxiety symptoms. Furthermore, this study tests the family environment as a protective factor, buffering against the stress of peer victimization and altering the association between these negative peer experiences and mental health outcomes for youth with ASD (Figure 1).

Study Hypotheses

This study takes a developmental, contextual approach to the investigation of associations between individual, peer, and family factors and mental health symptoms among adolescent with ASD. There are two primary objectives:

1. To examine the indirect effect of peer victimization on the association between individual characteristics (i.e., social-communication skills) and mental health symptoms (Figure 1).

    Hypothesis 1.1: It is expected that a significant indirect effect of peer victimization on associations between social-communication skills and anxiety symptoms will be present. We anticipate that poorer social-communication skills will be associated with more peer victimization, which will then be associated with higher anxiety symptoms.

    Hypothesis 1.2: It is expected that a significant indirect effect of peer victimization on associations between social-communication skills and depression symptoms will be present. We anticipate that poorer social-communication skills will be associated with more peer victimization, which will then be associated with higher depression symptoms.

2. To test the conditional effect of family competence on the indirect effect of peer victimization on the association between individual characteristics and mental health problems (Figure 1).

    Hypothesis 2.1: It is anticipated that there will be a significant conditional effect present for anxiety symptoms of youth with ASD. Specifically, we expect family competence to buffer against the positive association between peer victimization and anxiety symptoms such that the indirect effect of peer victimization on the association between social-communication skills and anxiety symptoms will be present for youth whose families exhibit low levels of family competence but not for youth whose families are highly competent.

Hypothesis 2.2: It is anticipated that there will be a significant conditional effect present for depression symptoms of youth with ASD. Specifically, we expect family competence to buffer against the positive association between peer victimization and depression symptoms such that the indirect effect of peer victimization on the association between social-communication skills and depression symptoms will be present for youth whose families exhibit low levels of family competence but not for youth whose families highly competent.

Method

Overall Research Approach

The current study employs a cross-sectional design in which primary caregivers (PCs) and adolescents completed a series of surveys online via computer, tablet, or smartphone as part of a larger study. The use of internet- and survey-based data collection procedures were chosen to (1) maximize sample size, (2) include adolescent-report of key study variables (i.e., peer victimization), and (3) provide a more generalizable sample that includes families from across the United States. The research approach aimed to collect a large sample of families while maintaining methodological rigor and validity. On average, PCs took 36.30 minutes and adolescents took 17.21 minutes to complete the study, although the time range was quite wide (PC_{max} = 797 minutes; $adolescent_{max}$ = 708 minutes) because participants were not required to complete the survey in a single sitting. Adolescents completed a battery of self-report measures that included experiences of peer victimization, and primary caregivers completed a set of

surveys that included demographic information, social-communication skills, family competence, and adolescent mental health symptoms.

Study Procedures

Participants were recruited for a larger study, the Teens and Parents (TAP) study, funded through an Autism Speaks Weatherstone Predoctoral Fellowship. The TAP study aims to examine the impact of peer and family related factors as they relate to mental health outcomes for youth with ASD. Eligible families were recruited through the Interactive Autism Network (IAN), and online advertisement on the Autism Speaks website (https://science.grants.autismspeaks.org/participate-in-research). The Interactive Autism Network is an online network linking the autism community with research opportunities that has been clinically validated and verified by a review of parent- and profession-provided medical records (Daniels et al., 2012; Lee et al., 2010). Individuals in the IAN research registry must have received a professional diagnosis of ASD or be the parent of a child with a diagnosis of ASD in order to participate. IAN recruitment services identified families that met TAP study criteria and sent them an IRB-approved email with information about the study and a link to the study surveys. A follow-up reminder email was sent 5, 13, and 23 days after the initial invitation to those who did not click on either the "interested" or "not interested" link in the original email.

Through a pre-enrollment screening on REDCap, potential participants were identified as meeting the TAP study's inclusion criteria prior to being enrolled. To meet inclusion criteria for the TAP study, participants had to be the primary caregiver/legal guardian an adolescent ages 13-17 with an existing diagnosis of ASD (DSM-V criteria) or Autistic Disorder, Asperger's Disorder, and Pervasive Developmental Disorder Not

Otherwise Specified (PDD-NOS; DSM-IV-TR criteria). The PC and the adolescent needed to live together, speak English, and have sufficient reading skills (as self- and PC-reported) to complete the study procedures independently. Individuals were excluded if they had a comorbid intellectual disability (IQ below 70 or are considered to be non-verbal) or a genetic disorder such as Fragile X Syndrome or Downs Syndrome. These exclusion criteria were chosen for two primary reasons. First, we specifically asked PCs to allow the adolescent to complete questionnaires independently so as to not bias responses about potentially sensitive topics (i.e., bullying, mental health symptoms, etc.). This required adolescents to be able to work on the computer, read, and comprehend directions and questions without significant parental guidance. Second, exploring factors specific to comorbid genetic conditions associated with mental health outcomes was considered to be beyond the scope of the TAP study.

The TAP study was approved by the Virginia Commonwealth University Institutional Review Board. All data was collected online via REDCap (a secure web-based database system). After completing the screening survey, eligible PCs were prompted to continue to the study consent page. Electronic consent (e-consent), documented electronically via REDCap, was specifically designed for consenting and assenting participants off-site using computer based consent rather than traditional paper documentation. Prior to completing assessments, PCs were asked to read the document and indicate via check boxes whether they agreed to participate and whether their adolescent could participate. Once all PC measures were completed, PCs were prompted to submit the surveys and the adolescent portion of the study began. Prior to completing assessment, adolescents were asked to read an electronic assent document and indicate

via a check box that they agreed to participate in the study. PC measures were collected if they consented to participate but their adolescent did not assent to participate. The PC and adolescent each received a $10 e-gift card to Amazon.com for their time.

Sample Population

An a priori power analysis was conducted to determine the estimated sample size for data analysis. For moderated mediation hypotheses using bias-corrected bootstrapping, Preacher, Rucker, and Hayes (2007) suggest a sample size of over 500 individuals to detect a small (0.14) effect, which is the conservative approach to effect size estimation recommended when little research has been done to guide selection. Budgetary and time constraints prohibited the collection of data from 500 parent-adolescent dyads. As such, this study tested for medium size conditional indirect effects with an expected power of 0.80, which requires a minimum sample size of 149 (Fritz & Mackinnon, 2007). Based on this information, efforts were made to recruit an additional 10% of the minimum participants needed with the aim to enroll a total sample of 163 parent-adolescent dyads to account for missing and incomplete data.

Three hundred and eighty PCs consented to participate in and completed the online eligibility questionnaire. Of those who completed the eligibility survey, 72 did not meet eligibility criteria and where excluded from the study (see Table 1 for details on screen failures). A total of 278 primary caregivers consented to participate in the TAP study and 215 PCs completed all study procedures. One hundred and eighty-nine adolescents assented to participate in the study and 167 completed the study. The teens that did not assent to participate did not differ in age, sex, or placement in a special education classroom.

Table 1

Descriptive Information on Rates of Screen Failures for the TAP Study

Eligibility Criteria	Yes		No	
	n	Percent	*n*	Percent
Teen with ASD 13-17 years old	376	99.5	**1**	**0.3**
Female Caregiver	374	99.2	**3**	**0.8**
Legal Guardian	375	99.5	**2**	**0.5**
Intellectual Disability	**63**	**16.7**	314	83.3
Genetic Condition	**3**	**0.8**	375	99.2
Does teen read?	374	98.9	**4**	**1.1**
Does teen use computer?	372	99.2	**3**	**0.8**

**Note*. Bolded values indicate exclusion criteria for TAP met.

compared to those who agreed to participate in the study. In addition, there were no differences in age or sex between those who completed and those who did not complete the study. A chi-square difference test revealed that placement in a special education classroom did differ significantly between those adolescents who completed the study and those who did not [X^2 (1) = 12.12, $p < .001$].

Prior to data analysis, the data was screened for inconsistencies in reporting of ASD diagnostic information. PCs responded to four open-ended questions ('When did your teen receive the ASD diagnosis', 'What is the adolescent's diagnosis', 'Who gave the ASD diagnosis', and 'Where did your teen receive the ASD diagnosis') on the demographic survey. Almost all families were able to provide some level of detail regarding where or who provided the ASD diagnosis; however, one set of responses stood out as inconsistent with other reports. This particular primary caregiver reported "many" as the primary diagnosis, "multiplayer's all above" as the person giving the ASD diagnosis, and "all above" as the location for diagnostic procedures. While we were

unable to confirm ASD diagnosis as part of the current study, these responses were determined to be noticeably different from other participants' descriptions and this family was removed from all data analysis. Thus, the final sample included 167 caregiver-adolescent dyads.

Most of the adolescents (M = 14.87, SD = 1.28) were male (73.7%), Caucasian (80%), and placed in a general setting at school (73.7%). Female primary caregivers (M = 44.58, SD = 6.07) all identified as biological or adoptive mothers and most PCs (74.3%) were married and living with their spouse. The most common diagnosis reported was Autism Spectrum Disorder (34.4%), followed by Autism (22.9%) and Asperger's Syndrome (21.6%), PDD-NOS (11.9%), and High functioning Autism (9.3%). In addition, 12.8% of caregivers reported a second adolescent diagnosis (7.5% ADHD, 2.2% anxiety, 1.3% mood problems, 1.7% other), and 5.7% of PCs listed a third diagnosis. Reports of secondary diagnoses in addition to ASD were unprompted. A description of the sample demographics can be found in Table 2.

Study Measures

PCs and adolescents were asked to independently complete a series of questionnaires on their computer, tablet, or phone. Participants were given the opportunity to save their responses and return to the survey at a later time via a code and link unique to each family.

Demographics. The PC answered a number of demographic questions about themselves (e.g., relationship to the adolescent, age, employment, education, race), their adolescent (e.g., diagnosis information, age, grade, placement in a special education classroom), and their family (e.g., family income, number of people in the household).

Special education classroom placement was a binary question (yes/no) and used as a general marker of whether or not the adolescent's primary educational setting was in a general or special education classroom.

Table 2

Caregiver and Adolescent Demographic Characteristics

Demographic Items	
Primary Caregiver & Family	
Age, *M years (SD)*	44.58(6.07)
Marital Status, *n (%)*	
Single, never married	12(7.2)
Married, living with spouse	124(74.3)
Divorced	24(14.4)
Widowed	7(4.2)
Annual Household Income, *n* (%)	
$10,000 or less	2(1.2)
$10,000 – 20,000	9(5.4)
$20,001 – 40,000	41(24.6)
$40,001 – 60,000	24(14.4)
$60,001 – 80,000	29(17.4)
$80,001 – 100,000	20(12.0)
$100,001 and greater	40(24.0)
Missing (*n*=2, 1.2%)	
Education, *n (%)*	
High school degree	15(9.0)
Associates or technical school	18(10.8)
Some college	35(21.0)
College degree	60(35.9)
Master's degree	30(18.0)
Doctorate or Medical Doctor	9(5.4)
Missing (*n*=4, 9.8%)	
Family Size (range =2-7 people), *M (SD)*	3.93(1.09)
Child	
Age, *M years (SD)*	14.87(1.28)
Sex (Male), *n* (%)	123(73.7)
Race, *n* (%)	
African American	4(2.4)
White/Caucasian	135(80.0)
American Indian or Alaskan Native	1(0.6)
Native Hawaiian or other Pacific Islander	1(0.6)
Mixed/Multiple endorsed	17(10.2)
Other	9(5.4)
Special education classroom, (Yes), *n* (%)	44(26.3)
Grade in School, *n* (%)	
6th grade	3(1.8)
7th grade	14(8.4)
8th grade	37(22.2)

9th grade	35(21.0)
10th grade	32(19.2)
11th grade	27(16.2)
12th grade	12(7.2)
Missing (*n*=7, 4.2%)	

Social Responsiveness Scale (SRS). The SRS (Constantino & Gruber, 2012) is a widely used caregiver-report measure that provides an assessment of the children and adolescents' social functioning. Several validation studies of the SRS have been completed and highlight the measure as a valid and reliable tool in children and adolescents with ASD (Constantino, Davis, Todd, Schindler, & Gross, 2003; Constantino & Todd, 2005). Caregivers rate 65-items on a scale of 1 ('not true') to 4 ('almost always true') regarding the adolescent's behavior in the past six months. The SRS includes a number of subscales including social cognition, social communication, social awareness, social motivation, and restricted and repetitive behaviors. In addition, a social communication and interaction (SCI) score can be calculated along with a total score. The SCI was used in the current study as the independent variable (Cronbach's $\alpha = 0.93$) and the restricted and repetitive behaviors (RRBs) subscale was used as a covariate (Cronbach's $\alpha = 0.86$). Higher scores on the SCI reflect more problems with, or more deficits in social-communication behaviors associated with ASD.

Peer Experience Questionnaire – Revised (PEQ-R). Adolescents reported their recent experiences of peer victimization using the PEQ-R (Prinstein, Boergers, & Vernberg, 2001). Youth indicated how often they experienced each event recently on a five-point scale from 'never' to 'a few times a week'. The mean of the items was used as a total victimization score in the present study (Cronbach's $\alpha = 0.87$). The PEQ has been

used in other studies of youth with ASD with success and has demonstrated good psychometric properties (Storch et al., 2012).

Self-Report of Family Inventory (SFI). The SFI (Beavers & Hampson, 2000) is a self-report measure of overall family competence. Based on the Beavers Systems Model of family functioning, high levels of competency within the family are associated with the family's ability to adapt in the face of stressful situations. The current study uses the Health/Competence subscale of the SFI to assess global family competence. PCs rated how well 18-items fit their family on a four point Likert scale (1 = 'yes, fits our family well' to 5 = 'no, does not fit our family'). Negatively worded items (e.g., 'When things go wrong, we blame each other') were reverse scored prior to scale calculation. As is common with the SFI, a mean score was calculated to yield an overall score of family competence for this study. Items are coded such that higher scores reflect greater family competence. Validation studies using the SFI have found it to be a reliable and valid self-report measure of the family environment (Hamilton & Carr, 2016).

The SFI has not been used in samples of families with an individual with ASD. Thus, a confirmatory factor analysis was conducted for the Health/Competence subscale to verify the single-factor structure of the subscale and provide empirical evidence for the use of the 18-item subscale suggested by the scale authors. For the current sample, all items were consistently correlated with each other and loaded onto a single factor with coefficients of 0.43 or higher with the exception of two items ('family members go their own way most of the time', and 'one adult in this family has a favorite child'). Those two items were removed from the subscale. The mean score from the remaining 16 items (Cronbach's $\alpha = 0.93$) was used for all analyses. To ensure that removing the two items

did not alter results, all models were run using the mean score of all 18 items of the SFI to verify that the patterns of results did not change.

Revised Children's Anxiety and Depression Scale – Short Version (RCADS). The RCADS (Ebesutani et al., 2011, 2012) measures the frequency of anxiety and mood symptoms in children and adolescents. The 25-item short version was used for the current study and has been used in previous research of youth with ASD (e.g., Sterling et al., 2015). PCs responded to each statement by indicating how often each item happens to their adolescent, ranging from 0 ('never') to 3 ('always'). The mean of the 15 anxiety items (e.g., 'My child worries when he/she thinks he/she has done poorly at something'; Cronbach's $\alpha = 0.91$) and the mean of the 10 depression items (e.g., 'My child feels sad or empty'; Cronbach's $\alpha = 0.81$) were used to create a total anxiety and a total depression score. These were used as the dependent variables in the current study.

Data Analysis

Data cleaning and analyses were conducted in SPSS 24 (IBM, 2017). The three independent variables (social communication, peer victimization, and family competence) were assessed for univariate and multivariate outliers. Using Mahalanobis Distance and a critical value of 16.266 ($df = 3$), one case was identified as a significant multivariate outlier and removed from analyses ($N = 166$). Multicolinearity was assessed using bivariate correlations, Tolerance, and VIF values. The absolute value of all correlation coefficients was less than 0.30 and Tolerance values (greater than 0.80) and VIF values (1.036 to 2.795) were in the acceptable range (Tabachnick & Fidell, 2019), indicating no issues with multicollinearity among independent variables. Prior to hypothesis testing, bivariate correlations between anxiety and depression symptoms and

potential covariates (adolescent age, sex, RRBs, and special education classroom placement) guided the selection for inclusion of control variables. For special education classroom placement, follow-up analyses (*t*-tests and regression) were conducted to test associations with the dependent variables as well as intervening variables (i.e., peer victimization).

The hypothesized indirect pathways (Figure 1) were tested separately for anxiety and depression symptoms using model 4 in the PROCESS 3.0 macro (Hayes, 2013) for SPSS. Relevant covariates were included based on results from covariate testing (see below). Using 5000 bootstraps with replacement, the bias corrected 95% confidence intervals were used to determine the presence of significant indirect pathways. The standardized coefficient, standard error, and significance value for each pathway are reported. The hypothesized conditional indirect effect was tested using model 14 in the PROCESS 3.0 macro (Hayes, 2013) for SPSS. Using 5000 bootstraps with replacement, the bias corrected 95% confidence intervals were used to determine the presence of significant indirect pathways. The standardized coefficients, standard errors, and significance value for each pathway are reported. In addition, the index of the conditional indirect effect of family competence on the association between peer victimization and each mental health outcome is reported, along with visual representations of the regions of significance for each model. In the case of a statistically significant conditional indirect effect, a visual inspection of the plotted interaction is presented to assist in interpretation of the data.

Results

Covariate testing

Bivariate correlations between potential covariates - adolescent age, sex, special education classroom status, and restricted and repetitive behaviors (RRBs) - and the dependent variables of interest (depression and anxiety) can be found in Table 3.

Table 3

Bivariate and Point-Biserial Correlations between Potential Covariates and Outcome Variables

Variable	1	2	3	4
(1) Adolescent Age	----			
(2) Adolescent Sex	-.14	-----		
(3) Special Education Classroom	-.06	n/a	-----	
(4) SRS – Restricted and Repetitive Behaviors	-.09	-.02	.01	-----
(5) RCADS - Depression	.19*	-.21**	-.14	.53**
(6) RCADS – Anxiety	.18*	-.23**	-.13	.50**
(7) Peer Victimization	-.003	-.03	.25**	.02

Note. * = $p < .05$; ** $p < .01$; SRS = Social Responsiveness Scale; RCADS = Revised Child Anxiety and Depression Scale.

Adolescent age, sex, and RRBs were significantly associated with both anxiety and depression and were included as covariates in all models. Special education classroom status was not significantly correlated with the dependent variables (association with depression symptoms, $p = 0.06$); however, there was a significant association between special education classroom placement and experiences of peer victimization such that students in a special education setting experienced significantly more bullying ($M = 1.50$, $SD = 0.69$) compared to those in a general education setting [$M = 1.22$, $SD = 0.34$; $t(50.81) = -2.51$, $p = 0.02$]. In addition, a series of hierarchical regressions suggested that, above and beyond youth age, sex, and RRBs, special education classroom placement

significantly predicted experiences of peer victimization [$F(4, 157) = 2.81$, $p = 0.03$, $R^2 = 0.07$, $\Delta R^2 = 0.06$, $p = 0.001$], anxiety [$F(5, 156) = 20.24$, $p < 0.001$, $R^2 = 0.39$, $\Delta R^2 = 0.02$, $p = 0.03$] and depression symptoms [$F(5, 156) = 21.18$, $p < 0.001$, $R^2 = 0.40$, $\Delta R^2 = 0.02$, $p = 0.01$]. This suggests that special education classroom placement may be a confounding variable (MacKinnon & Luecken, 2008) and therefore it was included as a covariate in all statistical models.

Descriptive statistics

Descriptive statistics for study variables and bivariate correlations among study variables are reported in Table 4. As can be seen in Table 4, peer victimization (PV) was skewed and kurtotic per standards outlined by Tabachnick & Fidell (2019).

Table 4

Bivariate Correlations and Descriptive Statistics for Social Communication, Peer Victimization, Family Competence, and Mental Health Outcomes

Variable	1	2	3	4	5
(1) SRS – Social Communication Index	----				
(2) Peer Victimization	.16†	-----			
(3) Family Competence	-.24**	-.25**	-----		
(4) RCADS - Depression	.55**	.13	-.16*	-----	
(5) RCADS – Anxiety	.58**	.15♀	-.14♀	.79**	------
M	80.95	1.30	3.98	11.19	13.14
SD	22.63	0.47	0.66	5.56	9.11
Minimum-Maximum value	23-141	1-3.67	1.69-5	0-26	0-36
Skewness	-0.09	2.44	-0.73	0.04	0.73
Kurtosis	-0.24	7.27	0.15	-0.65	-0.31

Note. * = $p < .05$; ** $p < .01$; † = p = .05

A data transformation was considered to account for skewness and kurtosis in the peer victimization variable; however, transformations can hinder interpretation of results (Tabachnick & Fidell, 2019) and the study's planned analyses (i.e., bootstrapping with replacement) can account for issues with normality (Pek, Wong, & Wong, 2018). To confirm that the skewed and kurtotic nature of the PV variable was not study results, analyses were duplicated with a log transformed PV variable. There was no change in the pattern of results. Thus, the non-transformed variable was used in the present study. Exploration of frequencies and a histogram of the peer victimization variable revealed that a little under half (46.7%) of the adolescents reported no experiences of peer victimization and two adolescents (1.2%) scored three standard deviations above the mean. Rates of peer victimization in the current sample (Table 5) were similar to other reports of peer victimization in teens with ASD using the same measure (e.g., Ung et al., 2016). With the exception of anxiety symptoms and family competence (r = -0.13, p = 0.11), all study variables were significantly correlated after controlling for sex, age, RRBs, and special education classroom placement (Table 6).

Per recommendations of the measure authors (Ebesutani et al., 2012), the raw scores from the RCADS were used in all analyses; however, the RCADS also provides clinical cutoff scores as an indicator of the severity of youth symptoms. Once raw scores are converted into T-scores, the severity of depression and anxiety symptoms can be compared to peers in the same grade and the same sex. T-scores between 65 and 69 represent an elevated risk for clinical symptoms and a T-score above 70 suggests clinically significant symptoms. In the current sample, 52.3% of parents reported

Table 5

Prevalence of Peer Victimization Experiences in the Current Sample (N = 166)

Peer Victimization Item	Prevalence (%)
Hit, kicked, or pushed me in a mean way	5.4
Threatened to hurt or beat me up	9.0
Chased me like he or she was really trying to hurt me	3.6
Grabbed, held, or touched me in a way I didn't like	8.4
Left me out of what he or she was doing	34.9
Left me out of an activity or conversation I really wanted to be included in	27.9
Did not invite me to a party or other social event even though he or she knew I wanted to go	21.0
Would not sit near me at lunch or in class	15.0
Did not talk to me on purpose	27.6
Teased or made fun of when I tried to hang out with other teens	15.0
Said mean things to me when I tried to be their friend	17.4
Made fun or teased me when I talked to them	19.2

Note. Prevalence indicates the percentage of subjects who indicated any experience with an item; Overall prevalence of endorsing any experience of peer victimization was 53.3%

Table 6

Partial Correlations between Social Communication, Peer Victimization, Family Competence, and Mental Health Outcomes after Controlling for Study Covariates

Variable	1	2	3	4	5
(1) SRS – Social Communication Index	----				
(2) Peer Victimization	.23**	-----			
(3) Family Competence	-.32***	-.24**	-----		
(4) RCADS - Depression	.30***	.21**	-.16*	-----	
(5) RCADS – Anxiety	.37***	.22**	-.13	.66***	------

Note. SRS = Social Responsiveness Scale; RCADS = Revised Child Anxiety and Depression Scale; * p < .05; ** p < .01; *** p < .001

clinically significant depression symptoms in their adolescents and 35.1% reported clinically significant anxiety symptoms.

Hypothesis 1: Simple Indirect Effect Models

Two models (separate models for anxiety and depression) assessed the indirect effect of PV on the association between individual characteristics (i.e., social-communication skills) and mental health symptoms. Covariates for each model included adolescent sex, age, RRBs, and special education placement. In addition to coefficients and 95% confidence intervals for the indirect effect, the completely standardized indirect effect was used as a measure of effect size (Hayes, 2013).

Anxiety Symptoms. The overall model was statistically significant [$F(6, 155) = 22.26$, $p < .001$] and accounted for a significant amount of variance in adolescent anxiety symptoms ($R^2 = 0.46$). Individual coefficients can be found in Table 7 (see also Figure 4).

There was a significant direct effect (c') of social communication skills on anxiety symptoms (*B* = 0.172, *SE* = 0.039, 95% CI = [0.096, 0.248]); however, the indirect effect (ab) was also significant (*B* = 0.017, *SE* = 0.009, 95% CI = [0.004, 0.041], ES = 0.033), suggesting that more problems with social communication skills is associated with higher anxiety symptoms through more experiences of peer victimization in verbally fluent teens with ASD.

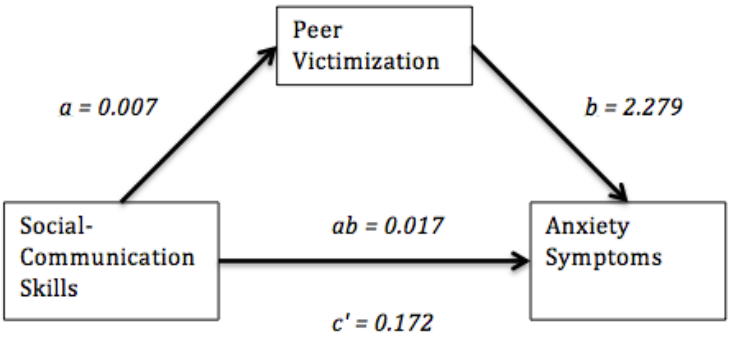

Figure 4. Indirect path from social-communication skills to anxiety symptoms through peer victimization.

Table 7

Indirect Effect Model for Anxiety Symptoms

	M (Peer Victimization)					*Y* (Anxiety Symptoms)				
Predictor		Coeff.	*SE*	*p*	95% CI		Coeff.	*SE*	*p*	95% CI
X (SCI)	*a*	0.007	0.003	**.003**	**0.003, 0.012**	*c'*	0.172	0.039	**< .001**	**0.096, 0.248**
M (PV)		---	---	---		*b*	2.279	1.204	0.06	-0.099, 4.657
	i_1	.848	0.453	0.06	-0.046, 1.743	i_2	-30.668	6.888	**< .001**	**-44.274, -17.063**
Age		0.008	0.028	0.77	-0.048, 0.064		1.423	0.427	**.001**	**0.580, 2.267**
Sex		-0.007	0.082	0.93	-0.169, 0.155		4.034	1.234	**< .001**	**1.597, 6.471**
RRB		-0.017	0.008	**0.04**	**-0.034, -0.007**		0.271	0.127	**0.03**	**0.021, 0.521**
Spec. Edu.		0.278	0.082	**< .001**	**0.117, 0.440**		-2.515	1.276	*.05*	*-5.035, 0.006*

Note. SCI = Social Communication Index; PV = Peer Victimization; Coeff. = Coefficient; Spec. Edu. = Special Education Classroom; all coefficients are unstandardized.

Depression symptoms. The overall model was statistically significant [$F(6, 155) = 20.90$, $p < .001$] and accounted for a significant amount of variance in adolescent depression symptoms ($R^2 = 0.45$). Individual coefficients can be found in Table 8 (see also Figure 5). There was a significant direct effect (c') of social communication skills on depression symptoms (*B* =

0.083, *SE* = 0.024, 95% CI = [0.037, 0.130]); however, the indirect effect (ab) was also significant (*B* = 0.011, *SE* = 0.007, 95% CI = [0.004, 0.027], ES = 0.034), suggesting that more problems with social communication skills was associated with higher depression symptoms through more experiences of peer victimization in verbally- fluent teens with ASD.

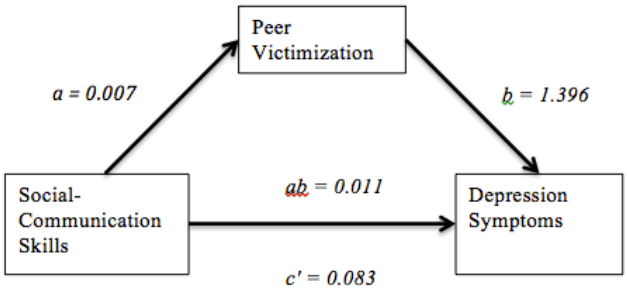

Figure 5. Indirect path from social-communications skills to depression symptoms through peer victimization.

Table 8

Indirect Effect Model for Depression Symptoms

		M (Peer Victimization)					*Y* (Depression Symptoms)			
Predictor		Coeff.	*SE*	*p*	95% CI		Coeff.	*SE*	*p*	95% CI
X (SCI)	*a*	0.007	0.003	**0.003**	**0.003, 0.012**	*c'*	0.083	0.024	**< .001**	**0.036, 0.130**
M (PV)		---	---	---		*b*	1.396	0.746	0.06	-0.079, 2.87
	i_1	0.848	0.453	0.06	-0.46, 1.743	i_2	-15.523	3.269	**< .001**	**-23.956, -7.09**
Age		0.008	0.028	0.77	-0.048, 0.064		0.905	0.265	**< .001**	**0.382, 1.428**
Sex		-0.007	0.082	0.93	-0.169, 0.155		2.058	0.765	**0.008**	**0.547, 3.569**
RRB		-0.017	0.008	**0.04**	**-0.034, -0.001**		0.238	0.079	**0.003**	**0.083, 0.393**
Spec. Edu.		0.278	0.082	**< .001**	**0.117, 0.440**		-1.854	0.791	**0.02**	**-3.416, -0.292**

Note. SCI = Social Communication Index; PV = Peer Victimization; Coeff. = Coefficient; SE = Standard Error; CI = Confidence interval; Spec. Edu. = Special Education Classroom; all coefficients are unstandardized.

Hypothesis 2: Conditional Indirect Effect Models

Two models (separate models for anxiety and depression) assessed the potential conditional effects of family competence on the indirect effect of social communication skills on

adolescent mental health symptoms through experiences of PV[1]. Independent variables were mean centered prior to analysis. Covariates for each model included adolescent sex, age, RRBs, and placement in a special education classroom.

Anxiety Symptoms. The overall model was statistically significant [$F(8, 153) = 16.67$, $p < .001$] and accounted for a significant amount of variance in adolescent anxiety symptoms ($R^2 = 0.47$). Individual coefficients can be found in Table 9. The confidence interval for the interaction term (PV x SFI) contained zero and was interpreted as not statistically significant ($B = 1.55$, $SE = 1.74$, 95% CI = [-1.88, 4.99]). In addition, the confidence interval for the index of moderated mediation contained zero ($B = 0.012$, $SE = 0.012$, 95% CI = [-0.009, 0.038]), suggesting that the data did not support the hypothesized conditional indirect effect model for anxiety symptoms. A visual representation of the 95% confidence bands for this model can be seen in Figure 6 (Appendix A). Due to the non-significant conditional indirect effect, the simple slopes results (Table 9) were not plotted for interpretation.

Depression symptoms. The overall model was statistically significant [$F(8, 153) = 15.979$, $p < .001$] and accounted for a significant amount of variance in adolescent depression symptoms ($R^2 = 0.46$). Individual coefficients can be found in Table 10. The confidence interval for the interaction term (PV x SFI) contained zero and was interpreted as not statistically significant ($B = 1.361$, $SE = 1.073$, 95% CI = [-0.758, 3.480]). In addition, the confidence interval for the index of moderated mediation contained zero ($B = 0.010$, $SE = 0.008$, 95% CI = [-0.025, 0.030]), suggesting that the data did not support the hypothesized conditional indirect effect model for depression symptoms. A visual representation of the 95% confidence bands for

[1] To ensure that removing two items from the SFI did not alter results, all models were re-run using the mean score of all 18 items of the SFI; the patters of results did not change.

this model can be seen in Figure 7 (Appendix A). Due to the non-significant conditional indirect effect, the simple slopes results (Table 10) were not plotted for interpretation.

Table 9

Conditional Indirect Effects for Anxiety Symptoms

Predictor	B	SE	*p*	*95% CI*
Constant	-.456	0.453	0.14	-1.351, 0.439
SCI	**0.007**	**0.003**	**0.003**	**0.003, 0.012**
Age	0.008	0.028	0.77	-0.048, 0.064
Sex	-0.007	0.082	0.93	-0.169, 0.155
RRB	**-0.017**	**0.008**	**0.04**	**-0.034, -0.007**
Spec. Edu.	**0.278**	**0.082**	**0.001**	**0.117, 0.440**
	Dependent Variable Model			
Predictor	B	SE	*p*	*95% CI*
Constant	-27.429	6.980	0.001	-41.220, -13.639
SCI	**0.176**	**0.040**	**0.001**	**0.096, 0.255**
PV	**2.860**	**1.353**	**0.04**	**0.188, 5.533**
SFI	0.207	0.847	0.81	-1.466, 1.881
PV * SFI	1.477	1.592	0.37	-1.669, 4.623
Age	**1.399**	**0.433**	**0.002**	**0.544, 2.255**
Sex	**4.009**	**1.239**	**0.002**	**1.461, 6.457**
RRB	**0.264**	**0.433**	**0.04**	**0.008, 0.519**
Spec. Edu.	-2.421	1.284	0.06	-4.958, 0.116
	Conditional Indirect Effects			
Family Competence	Indirect Effect	SE	95% CI	
Low	0.013	0.010	-0.004, 0.037	
Average	0.021	0.011	0.006, 0.053	
High	0.029	0.017	0.005, 0.073	

Note. SCI = Social Communication Index; RRB = Restricted and repetitive behaviors; PV = Peer Victimization; SFI = family competence; SE = standard error; 95% CI = 95% confidence interval; Coeff. = Coefficient; Spec. Edu. = Special Education Classroom; all coefficients are unstandardized.

Table 10

Conditional Indirect Effect for Depression Symptoms

Predictor	B	SE	*p*	*95% CI*
Constant	-0.456	0.453	0.32	-1.350, 0.434
SCI	**0.007**	**0.003**	**0.003**	**0.003, 0.012**
Age	0.008	0.028	0.77	-0.048, 0.064
Sex	-0.007	0.082	0.93	-0.034, -0.007
RRB	**-0.017**	**0.008**	**0.04**	**-0.170, 0.155**
Spec. Edu.	**0.278**	**0.082**	**0.001**	**0.117, 0.440**
	Dependent Variable Model			
Predictor	B	SE	*p*	*95% CI*
Constant	-12.913	4.318	0.003	-21.444, -4.381
SCI	**0.079**	**0.025**	**0.002**	**0.030, 0.129**
PV	**1.716**	**0.837**	**0.04**	**0.062, 3.370**
SFI	-0.278	0.525	0.60	-1.313, 0.757
PV * SFI	1.098	0.985	0.266	-0.848, 3.045
Age	**0.854**	**0.267**	**0.002**	**0.327, 1.382**
Sex	**2.051**	**0.796**	**0.008**	**0.541, 3.561**
RRB	**0.245**	**0.080**	**0.003**	**0.087, 0.402**
Spec. Edu.	**-1.787**	**0.792**	**0.03**	**-3.352, -0.222**
	Conditional Indirect Effects			
Family Competence	Indirect Effect	SE	*95% CI*	
Low	0.007	0.007	-0.006, 0.023	
Average	0.013	0.008	0.002, 0.033	
High	0.018	0.011	0.004, 0.050	

Note. SCI = Social Communication Index; RRB = Restricted and repetitive behaviors; PV = Peer Victimization; SFI = family competence; SE = standard error; 95% CI = 95% confidence interval; Coeff. = Coefficient; Spec. Edu. = Special Education Classroom; all coefficients are unstandardized.

Discussion

Adolescents with autism spectrum disorder (ASD) are at increased risk for developing comorbid mental health problems, including depression and anxiety, compared to their neurotypical peers (Strang et al., 2012). Depression and anxiety symptoms can have wide-ranging impacts on the daily functioning of youth with ASD, and increases the risk for poor long-term outcomes (Kim et al., 2000; Leyfer et al., 2006; Matson & Nebel-Schwalm, 2007; Mattila et al., 2010). Despite research demonstrating that family (e.g., Baker et al., 2011) and

peer (e.g., Storch et al., 2012) factors are important to a number of outcomes for those with ASD, few studies have examined contextual risk and protective mechanisms for mental health outcomes in adolescents with ASD. Thus, there is significant need for research aimed at understanding the potential risk and protective factors specific to youth with ASD that can inform interventions to improve the mental health and well-being of youth with ASD (Francis, 2005).

The current study used the Family Ecology Framework (Pederson & Revenson, 2005) as a theoretical guide to conceptualize how characteristics of an individual's disability are associated with their mental health outcomes while taking into account the salient contexts (e.g., peer, family) of adolescents' lives. The primary aim was to examine associations between social communication skills, peer victimization, family competence, and mental health symptoms among adolescents with ASD. This study adds to the literature through its focus on potential mechanisms through which psychiatric comorbidities emerge specific to adolescents with ASD, the inclusion of the family context as a critical component when considering outcomes for youth with ASD, and the use of a specific theoretical model to guide the study design and interpretation of results.

Previous research has been limited, in part, by the use of mixed-age samples. The focus of the current study on adolescents with ASD adds to existing knowledge by considering the social, emotional, and cognitive capacities as well as contexts most salient to adolescents. Building on previous research that has focused on the prevalence of psychiatric comorbidities in individuals with ASD, this study moves beyond the initial step of identification of psychiatric comorbidities and highlights the peer context as a potential target for intervention specific to youth with ASD. In addition, the consideration of multiple contexts in adolescents' lives (e.g.,

peer *and* family) acknowledges the complexity of the lived experience of youth with ASD and has potential to offer a way for researchers and clinicians to consider how these contexts may act uniquely or together to influence outcomes for adolescents. Finally, the current study uses a framework based in ecological and systems theories of development to guide study hypotheses and interpretation of results. Although calls for theoretically driven research are not new (e.g., Cridland et al., 2014), little research has used a specific, contextually inclusive model or framework when exploring mental health comorbidities in individuals with ASD. The current study takes an initial step in filling that gap by using the FEF as a guiding framework with the ultimate goal of driving the translation of research into effective mental health care for youth with ASD.

Findings suggest a significant indirect effect of peer victimization on the association between social communication skills and both anxiety and depression symptoms, providing evidence in support of the first hypothesis. However, contrary to hypothesis two, the conditional indirect effect models were not supported. No moderating effects were found for family competence on the indirect effect of social communication skills on mental health symptoms through experiences of peer victimization. The remainder of the discussion will focus on the interpretation of the primary study findings, followed by a description of the potential limitations of the current study, and will finish with suggestions for areas of future research.

Individual, Peer, and Family Factors in the Current Sample

The primary goal of this study was to investigate associations between the multiple contexts of youths' lives and mental health outcomes for adolescents with ASD. The discussion and interpretation of the study findings begins with a brief description of the current sample in order to place this study within the context of the broader literature.

Psychiatric comorbidities. Rates of parent-reported clinically significant depression and anxiety symptoms in adolescents were high. Similar to other studies that have found high rates of depression in verbally-fluent individuals with ASD (Wigham et al., 2017), over one-half of the current sample met criteria for significant depression symptoms based on normed T-scores of the RCADS. Although clinically significant anxiety symptoms were lower than previous estimates (32% in the current sample vs. 42-79% in other studies; Kent & Simonoff, 2017), rates of anxiety in the current sample still suggest that youth with ASD experience mental health symptoms at higher rates than their neurotypical peers (Caamaño et al., 2013; Hudson et al., 2009). Overall, the current sample fits within the broader literature on psychiatric comorbidities in individuals with ASD and provides additional support that comorbid mental health symptoms present a significant barrier to the well-being of individuals with ASD and their families.

Peer victimization. Rates of self-reported peer victimization in the current study mirror rates found in the literature (e.g., Maino et al., 2015; Schroeder et al., 2014). Research within the last ten years has found rates of peer victimization in adolescents with ASD to range from 47% to 77% (Cappadoccia et al., 2012; Sterzing et al., 2012). In the current sample, 53.3% of adolescents reported experiencing at least one instance of peer victimization in the past week. Being left out of an activity or conversation, not being invited to a social event, and being ignored on purpose were the most commonly reported instances of victimization (21.0-34.9%). More overt or physical forms of victimization (i.e., hit, kicked or punched; physically threatened) occurred but with less frequency (3.6-9.0%). Overall, these findings add to the growing literature suggesting peer victimization is a primary concern for the well-being of youth with ASD.

More problems with social communication skills were associated with more peer victimization in this sample. While these findings are similar to some previous studies in high-

functioning youth with ASD (Adams et al., 2014; Cappadocia et al., 2012; Sterzing et al., 2010), others have found a negative association or no association at all (Rowley et al., 2012; Storch et al., 2012). Integration of the current study findings within the broader literature is a challenge because studies vary widely in sample size and methods used to assess peer victimization. For instance, other research describing a positive association between peer victimization and social-communication deficits has used mixed-age samples [e.g., 5-21 years (Cappadocia et al., 2012) and 10-18 years (Adams et al., 2014)] that are not consistent with samples from studies reporting negativd or no associations [10-12 years (Rowley et al., 2012); 11-14 years (Storch et al., 2012)]. Ages of the sample in the current study (13-17 years) most resemble those in Sterzing and colleagues' (2012) study of a large sample of 13-17 year olds with ASD; however, experiences of peer victimization were characterized by two yes/no questions and reported by caregivers, limiting comparison and subsequent interpretation of the findings. Generally, results from the current study support previously reported positive associations between social-communication deficits and experiences of peer victimization, but more research is needed to better understand this correlation.

Family competence. On average, PCs reported that descriptions of healthy, competent families fit their families well (M = 4.02, Max = 5.00). Family competence was associated with better social-communication skills, fewer experiences of peer victimization, and fewer depression symptoms (Table 4). Although no other studies to our knowledge have used the SFI competence subscale in youth with ASD, research in other pediatric populations (e.g., sickle cell disease) has found similar negative associations between family competence and internalizing problems (Kell, Kliewer, Erickson, & Ohene-Frempong, 1998). While the cross-sectional correlation reported in the current study supports the association between the family environment

and youth adjustment, the direction of effect cannot be inferred. It is possible that the negative correlation found in the current study between family competence and depression symptoms, for instance, could be an indicator of the impact of comorbidities on the family as opposed to a marker for how the family impacts psychiatric comorbidities as hypothesized in this study. There is substantial support in the literature for this direction of effect (i.e., child to family outcomes; Karst & Van Hecke, 2012) and more research is needed to explicate the potential bidirectional association amongst these variables. Ultimately, findings of the current study add to the emerging literature highlighting the important role of the family for outcomes of those with ASD (Greenlee et al., 2018).

Hypothesis 1: Simple Indirect Effects

Peer victimization (PV) has been linked to a number of poor adjustment outcomes in youth with ASD ranging from anxiety and depression symptoms to increased risk for suicidal ideation (Cappadocia, Weiss, & Pepler, 2012; Shtayermman, 2007; Sterzing et al., 2012; Storch et al., 2012; Ung et al., 2016; Zablotsky et al., 2013). Little research to date has focused on the peer context as a mechanism through which disability characteristics such as social communication skills may be linked to internalizing symptoms in youth with ASD. The current study offers preliminary evidence for the utility of process-oriented models in psychiatric comorbidities among adolescents with ASD. Findings provide empirical support that underscores the need for longitudinal evaluations to determine the predictors and outcomes of mental health problems in this population. Results support the indirect pathway proposed by the FEF that an individual's peer context acts as an important mechanism linking disability characteristics to youth outcomes (Figure 2). For both anxiety and depression symptoms, more PC-reported problems with social communication skills was associated with more depression and anxiety

symptoms directly as well as indirectly through more experiences of peer victimization. In other words, in this sample of verbally-fluent adolescents with ASD, those who demonstrated more deficits in social communication (e.g., social awareness, social cognition, social motivation) also experienced higher anxiety and depression symptoms via more experiences of peer victimization. These associations were found above and beyond the effects of adolescent age, sex, RRBs, and classroom placement.

Additional longitudinal research is needed to understand the direction of effects amongst these variables and to fully test the process-oriented model proposed by the FEF. The cross-sectional nature of the current study precludes any statements on causality and the placement of peer victimization as the mediating mechanism was theoretical as opposed to temporal. While the current study tested a model in which negative experiences with peers act as a risk factor for mental health comorbidities, it could also be that adolescents with ASD who have depression and/or anxiety symptoms may be at increased risk for peer victimization. For example, evidence in neurotypical early adolescents suggests that depression symptoms *lead to* increased experiences of PV but PV does not *lead to* increased depression symptoms (Kochel, Ladd, & Rudolph, 2012; Tran, Cole, & Weiss, 2012; Vaillancourt, Brittain, McDougall, & Duku, 2013). A recent study that included adolescent girls with ASD, with intellectual disability, and neurotypical youth found that internalizing symptoms at age 13 predicted peer victimization experiences at 15 but not vice versa (Tipton-Fisler, Rodriguez, Zeedyk, & Blacher, 2018). Establishing causality will be key to future research endeavors using process-oriented models like the FEF in youth with ASD.

Empirical evdience presented here points to the acute, concurrent link between negative peer experiences and increased depression and anxiety symptoms; however, it is likely that

mental health symptoms are a product of experiences occuring today as well as those that came before (i.e., history of peer victimization). For example, a recent study that followed adolescents from age 10 found that for youth with ASD, those who also reported being bullied had the highest depression symptom scores concurrently and their depression symptom trajectories remained high over the next eight years. In addition, the ASD + bully group had the worst mental health trajectories than any other study group (ASD + no bully, no ASD + bully, no ASD + no bully; Dheeraj et al., 2018), suggesting that experiences of peer victimization may put youth with ASD at increased risk for negative adjustment outcomes compared to other groups. Additional research that starts earlier (e.g., middle childhood) and follows children into adolescence may provide important information for prevention efforts aimed at reducing the risk for psychiatric comorbidities in youth with ASD.

Deficits in social functioning compromise the most persistent phenotype of ASD over the lifespan (Seltzer et al., 2004), a particular problem for verbally-fluent youth with ASD during a time when social relationships become more challenging and complex. Findings presented in this study highlight the salience of the peer context for individuals with ASD during adolescence and suggest peer relationships to be a target for interventions aimed at improving the mental health of youth with ASD. Furthermore, results suggest that models like the FEF that are grounded in ecological and systems theories of development may be useful when conceptualizing mental health comorbidities in this population.

Hypothesis 2: Conditional Indirect Effects

The hypothesized conditional indirect effect models were not statistically significant; however, it should be noted that the current study was likely underpowered to detect small effects and interpretation of findings should be considered accordingly. Power simulations done

by Preacher, Rucker, & Hayes (2007) of conditional indirect effect models using bias-corrected bootstrapping with 1000 samples found power to range from 0.182 – 0.456 for small effects in samples of 100-200 participants. Thus, the Type II error rate in the present study using 166 participants and reporting small effects (e.g., .01-.03) is likely high and impedes interpretation of the results. In other words, results cannot be interpreted as not supporting the hypothesis because there was not enough power to detect an effect (or make the appropriate inference) in the first place, given the small effects reported here. Specifically, the interaction between family competence and experiences of peer victimization was not statistically significant and interpretation of the non-significant interaction is hindered by low power and a high Type II error rate. Therefore, power parameters of the current study impede true interpretation of results; however, a number of plausible explanations other than power will be presented in the succeeding sections to stimulate discussion around future directions and implications for clinical practice moving forward. Furthermore, there are several additional limitations to the current study that may have impacted the results, which will also be discussed.

Theoretical considerations. There are a number of possibilities that can account for the null findings associated with hypothesis two. First, it is worth considering whether the FEF is applicable to youth with ASD or whether adjustments need to be made to the proposed model. The core tenants of the FEF, drawn directly from ecological and systems theories of development (e.g., Bronfenbrenner, 1986; Sameroff, 2009), are widely accepted by developmental scientists. In particular, the notion that individual characteristics are important but not sufficient to explain (mal) adjustment has influenced decades of research; however, this principle has not been as readily applied to individuals with ASD. Instead, research has focused primarily on factors situated at the individual level. A developmental approach like the one

proposed in the FEF offers an avenue to address this gap and the evidence supporting the indirect pathway suggests that contextual approaches to psychiatric comorbidities in youth with ASD shows promise. Thus, rather than discard it as a guiding framework, it is more likely that the FEF needs to be adjusted for youth with ASD.

Considering alternative pathways of effect is a potential modification to the FEF that may be relevant to this particular population. One possibility is that healthy and competent families act as a buffer earlier in the model (e.g., path a; Figure 3). Healthy families can provide a safe and secure environment for teens with ASD to talk through difficult peer interactions, learn social skills and coping strategies, and provide general social support. It may be that families are providing these key support mechanisms that take effect earlier in the proposed process, dampening the association between social communication deficits and peer victimization. Timing will be key to testing this model in the future and developmental considerations of the effects of family processes will also pay an important role.

In addition to alternative pathways, it may be that different family processes are important for youth with ASD. There is some support in the literature for the notion that children and youth with ASD may be particularly susceptible to the negative effects of certain family processes like family conflict. Kelly and colleagues (2008) found that family conflict uniquely predicted ASD symptomology directly and indirectly through increased anxiety and depression symptoms, above and beyond the effects of family cohesion. It may be that family processes like conflict are more salient for youth with ASD compared to family competence. Family conflict is often easy to identify, may include sensory stimulus (e.g., shouting), and can provoke distressing or threating physiological responses (e.g., increased heart rate, sweating, etc.). In contrast, family competence involves more subtle cues and less concrete behaviors. Thus, the potential harmful

effects of family conflict may be more meaningful to (and explain more variance in) mental health outcomes compared to the potential benefits of family competence as hypothesized in this study. This has implications for not just how we define family processes but also for how we conceptualize the effects of family processes on ASD-related outcomes. More research is needed to better conceptualize how families can best support their adolescents with ASD.

Second, it may be that this study tested the protective effects of family competence at the wrong developmental period. Beyond the need to test process-oriented models using multiple time-points, future research should consider the salience of family processes at different sensitive periods in the development of children with ASD. For example, if a stage-salient task of middle childhood is learning the skills needed to successfully interact with peers (Masten, 2014), it may be that researchers should be looking for precipitating factors during middle childhood even for outcomes we know are likely to have an adolescent onset. In other words, the benefits of family competence may be different depending on when in development the effect occurs and is examined. It is not that family competence is not important at other times, but that the protective effect of family competence is more profound (and easier to pick up on) during a developmental period in which youth are beginning to navigate peer relationships in new ways and with newly-developing skills.

Next, the null findings could suggest that the family system as a whole is not where youth with ASD look for support. Rather, it may be specific sub-system relationships that offer emotional support and act as a buffering mechanism in stressful situations such as peer victimization. For instance, there is evidence in neurotypical samples that the parent-adolescent relationship, in particular, acts as a buffer against the negative effects of stress on mental health outcomes (Hazel et al., 2014). This makes sense for youth with ASD who often rely heavily on

primary caregivers for continued support with daily living skills, school, and social and emotional functioning (Seltzer et al., 2003; Shattuck et al., 2007). It may be that positive parent-child relationships help to reduce the likelihood that adolescents with ASD will be victimized in the future. The parent-adolescent relationship also offers a place for youth to learn self-regulatory, coping, and social skills that can help them respond during challenging peer situations. Evidence in neurotypical youth points to the protective role of parent-provided emotional support and low conflict with parents on internalizing symptoms in the context of peer victimization (Sapouna & Wolke, 2013; Yeung, Leadbeater, 2009). A recent study examining trajectories of peer victimization from elementary into secondary school found that having warm and supportive relationships with parents was associated with trajectories of reduced victimization. In addition, conflict within the parent-child relationship predicted membership in trajectories characterized by high levels of peer victimization (Brendgen et al., 2016). It may be that the parent-child subsystem of the family plays a more primary role than general family competence when considering the association between peer victimization and mental health and future research should address this question in ASD populations.

Finally, the null findings may also reflect a more widespread issue within the family-based ASD literature. Given that the FEF was originally developed for adolescents with a parent with chronic illness, it may be that the theoretically proposed pathways are not applicable to an ASD context. A recent review found that the current family-based literature in ASD is driven by and based in models, methods, and assessment tools created for neurotypical populations (Greenlee et al., 2018). Embed within this approach is a comparative understanding of family processes in ASD that does not recognize the potential unique ways these families function, communicate, interact, and grow. The null findings presented here may suggest that there is

something inherently different about what makes a "competent" family in ASD, and/or that the ways we currently conceptualize and measure what a competent/healthy family looks like and how that impacts outcomes is not reflective of ASD families. It will be imperative for future family-based ASD research to understand family processes within this population in its own right and develop models that account for the needs of these families in particular.

Methodological considerations. In addition to the theoretical considerations of the null findings described above, a number of methodological factors could also be influencing the present results. First, *how* the current study measured family competence may be contributing to the null findings. We used a single, parent-report measure of family context, a methodological strategy that does not fit within the systems based approach underlying the FEF which calls for multi-informant, multi-method assessments of key study processes.

This study also used a single subscale of the SFI, a measure that has not previously been used in ASD samples, as a marker of overall family competence. All families have strengths and weaknesses and an attempt to broadly capture family competence allows for challenges in one area (i.e., communication) to be balanced out by strengths in another (i.e., cohesion). Thus, theoretically, the SFI would pick up on those families who may struggle in multiple areas of functioning and indicate the presence of risk in that family through a low score on the measure. The disadvantage of this approach, however, is that the nuances and complexities of what makes a family "competent" may be lost. This may be further compounded in the current study if the items of the SFI do not readily capture family competence in the context of ASD. For example, "we all have a say in family plans" may have different connotations for families of individuals with ASD given that parents often report a reduction in family outings, having little time for family activities, less participation in social and recreational activities as a family, and a lack of

spontaneity or flexibility surrounding family plans (Hutton & Caron, 2005; Roa & Beidel, 2009). In other words, family plans can become, in large part, dictated by the needs of the individual with ASD over all other family members. Alternatively, a single caregiver may be responsible for planning family activities in order to accommodate the needs of the individual with ASD. Either way, a parent could rate that particular item on the SFI as not representing their family well, in turn indicating "less" family competence when in reality it may be that this item does not accurately capture the phenomena of family competence for those with ASD.

Second, the null findings could represent a flaw in *who* we asked about family competence. It may be that the parents' perception of family competence is not the perception that matters. The adolescent's perception of family competence may be more important when considering the hypothesized interaction between the peer and family environments. We theorized that for youth with ASD, a competent family may act as a source of social support when youth experience stressful events such as peer victimization. Thus, the use of parent-reported family competence may not reflect the adolescent's experience of support within the family system, resulting in a non-significant interaction.

The sampling methods used in this study offer another avenue within which to consider the null findings, both in how the sample was drawn and the make-up of the sample. Generally, the sample consisted of average to highly competent families and the variability in ratings of family competence was minimal. Families high in distress, conflict, or under stress may have been less likely to participate in this study and may be less likely to participate in the IAN research registry. Thus, the potential for high functioning families to have self-selected into the study must be considered.

Finally, it is possible that an interactive model is not how these processes function for youth with ASD. Results indicate that given these particular measures within this particular sample, the peer and family contexts do not overlap (or interact) as expected. As such, the null findings could simply reflect a lack of interactive effects between peer and family contexts. Given that adolescence is a developmental period marked by the importance of peers, it is theoretically sound to suggest that peers play a direct role in mental health outcomes in ways that do not include the family context, particularly when considering social communication skills. This study did not test alternative statistical models to explain mental health outcomes in teens with ASD and the nulling findings indicate that future research may look at additive models, for example, as a more likely explanation.

Similarly, family competence may not act as a buffer as proposed in the FEF model when considering psychiatric comorbidities in adolescents with ASD. Deficits in developing, maintaining, and understanding relationships is a primary feature of an ASD diagnosis (APA, 2013), suggesting that it may be a challenge for individuals with ASD to take advantage of the benefits of close, supportive relationships. Thus, the protective value of healthy, competent families that act as a means of social and emotional support may be lessened in the context of ASD, at least in the ways we currently define such phenomena. It may also be that youth with ASD do benefit from healthy families or that they feel emotionally supported within family relationships but not in ways researchers and clinicians currently conceptualize. Both approaches have implications moving forward. While further replication is needed, particularly in light of certain study limitations discussed below, it may be that family-based services for psychiatric comorbidities in adolescents with ASD should not be a primary target for intervention when considering the negative effects of peer victimization on adolescent mental health symptoms.

Limitations of the Current Study

The present study extends the literature in several ways, but findings should be considered in light of the study's limitations. The high Type II error rate and underpowered nature of the study precludes definitive interpretation of the conditional indirect effect models. Limitations in the design of the study also need to be considered. Causal interpretations of the results cannot be made given the cross-sectional nature of the study. Although internet-based data collection methods allowed for inclusion of a larger sample of families from across the country than is typically included in ASD research, online-based studies may be influenced by sampling bias. In addition, the single-method design did not allow for a nuanced and thorough assessment of family processes, a key variable of interest to this study. Internet-based data collection also precluded confirmation of the adolescent's ASD diagnosis, relying solely on parent-report of diagnostic information and ASD symptomatology such as social-communication deficits.

While careful consideration and selection of reporters was undertaken during study design, the heavy use of primary caregiver (PC) reports could result in reporter bias, and findings should be interpreted with caution. Research has suggested that deficits in social-communication, recognizing and labeling emotions, and perspective taking may hinder the identification and self-report of emotional responses for individuals with ASD, suggesting that self-report measures of mental health should be interpreted with caution (Mazefsky et al., 2011). This is particularly important in a study aimed at understanding mental health symptoms and was a primary reason why caregiver report was used in the current study. However, there are limitations to using proxy reports (e.g., PC mental health, stress, etc.) in general as well as within an ASD samples. For example, both neurotypical youth and adolescents with ASD may display depression and/or

anxiety symptoms in some contexts (e.g., at school) but not in others (at home), with some empirical support that parents of adolescents with ASD may be missing signs of emotional distress otherwise identified by youth and teachers (Hurtig et al., 2009). In contrast, reports also indicate that high-functioning adolescents with ASD may underreport mental health symptoms compared to parent and clinician assessment (e.g., Lopata et al., 2010; White, Schry, & Maddox, 2012). Additional research aimed at understanding the factors underlying discrepancies between parent- and adolescent-report of mental health symptoms is warranted; however, questions regarding the validity of adolescent-reports and discrepancies with parent-reported symptoms are beyond the scope of the current study.

In addition to selection of reporter, measurement choice is another potential limitation of the current study. Questionnaires were chosen based on psychometric properties, previous use of the survey in ASD populations and in adolescents, and feasibility for internet-based data collection. The previously-reported psychometric properties of all measures used in this study were sound and all measures had been previously used in ASD populations with the exception of the family competence measure (SFI). As discussed previously, the items used to create the family competence subscale of the SFI may not reflect the lived experience of families with an adolescent with ASD, impacting the results of the study. In addition, the question assessing special education classroom status was binary (i.e., yes/no response) and did not capture the potentially complex educational needs of youth with ASD. A more thorough evaluation of educational services - such as considering specific accommodations with the classroom, whether the youth is in a mixed classroom setting (e.g., removed from general education for one subject), etc. - may contribute information to understanding the association between experiences of peer victimization, school context, and mental health outcomes.

Similarly, there is some evidence in the literature that frequently used peer victimization questionnaires, including the PEQ-R used in the current study, may not be an accurate representation of the experiences of adolescents with ASD. A recent qualitative study by Fisher and Taylor (2016) found that although a majority of their sample reported experiencing peer victimization, the examples adolescents with ASD used when describing these experiences were often different from those most commonly identified in questionnaires. For example, adolescents described instances of physical bullying as being poked, bit, and having items on their person manipulated (e.g., tying shoe laces together). The descriptions of physical victimization on the PEQ-R include "hit, kicked, or pushed", "chased me", "grabbed, held, or touched me", and "threatened to hurt or beat me up". If an adolescent in the current sample experienced physical bullying in a manner similar to those reported in the Fisher & Taylor (2016) study, they may not have endorsed any physical victimization as described by the PEQ-R.

Second, the sample used in the current study limits generalizability of findings and interpretation should be adjusted accordingly. Primary caregivers were primarily Caucasian, middle-class, well-educated mothers, and adolescents were primarily Caucasian boys. Individuals with comorbid intellectual disabilities were screened out of the current study and adolescents had to have the computer and readings skills to independently complete the surveys. Thus, the sample primarily consisted of white, teenage boys with ASD who represent a distinct, high-functioning symptom profile from well-educated and affluent families in the United States. It is unclear, for example, whether these findings will generalize to individuals with cognitive impairment, individuals from other cultural backgrounds, or to girls with ASD. Adolescent sex was used as a covariate in the current study but it is possible that the associations amongst study variables are different for girls with ASD compared to boys. Mounting evidence suggests that the

social behaviors and challenges of girls with ASD are unique compared to boys (Dean, Harwood, & Kasari, 2017) and that the phenotypic presentation for girls is different from the classic presentation of ASD, including less rigidity and fewer repetitive behaviors, more acceptable narrow special interests, more likely to have one close friend, and less likely to present as socially aloof (Happé, 2019). This alternative phenotypic presentation has implications for girls' social functioning, how they relate to peers, and potentially their experiences of peer victimization. Additional research aimed at understanding the risk and protective factors for psychiatric comorbidities specific to adolescent girls with ASD is warranted.

Finally, although the current study attempted to address factors important for psychiatric comorbidities in youth with ASD across multiple domains, there are other variables that may also be important not just in the consideration of psychiatric comorbidities in adolescents with ASD, but within the context of peer and family relationships as well. While adolescent age, sex, and restricted and repetitive behaviors were included as covariates in the current study, it may be worth considering these variables as individual factors that could modify the association between peer victimization, family relationships, and mental health outcomes. For example, trajectories of internalizing symptoms may change over the course of adolescence, and experiences of peer victimization may be different for youth in middle school or just entering high school (13/14 years old) compared to those in their later teens. Additional variables not measured in the TAP study such as loneliness (Storch et al., 2012), executive functioning skills (Hollocks et al., 2014), positive peer relationships (Whitehouse, Durkin, Jaquet, & Ziatas, 2009), parental monitoring (Wright, 2018), and bullying/aggressive behavior of the teen (Zablotsky et al., 2013) have previously been highlighted in the literatures as important to the mental health of you with ASD and may offer alternative ways to consider the study findings.

Future Directions & Implications

The current study suggests several potential avenues for future study. The results have implications for the ways we conceptualize psychiatric comorbidities in youth with ASD as well intervention strategies for these adolescents. A number of key questions remain, such as the causal relationship between peer victimization and mental health symptoms, how the associations between social-communication skills, experiences of peer victimization, and psychiatric comorbidities change throughout childhood and into adolescence, the ways in which specific family processes impact mental health symptoms, and whether these relationships are the same for individuals across the autism spectrum. Longitudinal studies will be critical to understand the direction of effect amongst these variables. A study that follows a group of young adolescents with ASD into early adulthood would allow for true process-oriented models to be tested and will help build a body of evidence important for intervention development.

In addition to measuring key processes over time, future longitudinal studies need to include a more diverse and representative sample. For adolescents with ASD who also identify as part of a racial, ethnic, or cultural minority group, the intersection of diversity and disability may pose a particular set of social challenges, particularly in an environment like school that is designed for their White, neurotypical peers (O'Keefe & Medina, 2016). Adolescent students who inhabit this space may be at particular risk for negative outcomes given the social, emotional, and cognitive changes taking place coupled with the increasingly salient peer context and increased academic demands of middle- and high-school. O'Keefe & Medina (2016) call it the "perfect storm of disability, diversity, and adolescence". These students may be navigating feelings of isolation and exclusion associated with both their cultural and disability identities; however, research focusing on mental health outcomes in youth with ASD has yet to address this

issue. While ASD crosses social, economic, and cultural boundaries, the impact of socioeconomic disadvantage or minority racial status, for example, on outcomes for individuals with ASD is poorly understood. Researchers in the United States have both an opportunity and a responsibility to fill this gap given the diverse make-up of the country and the discriminatory and oppressive nature of our systems and policies.

Improving the generalizability of findings must also include a look to diverse samples within the autism spectrum. The heterogeneity in the phenotypic expression of ASD is vast but research on psychiatric comorbidities in youth with ASD has focused primarily on verbally-fluent boys, or children and youth considered to be "high-functioning". While differences in communication abilities is certainly a challenge for the research community, our findings to date tend to be limited to a distinct ASD symptom profile and not generalizable across the spectrum or to girls and women with ASD. The development and implementation of evidence-based practices for psychiatric comorbidities in adolescents with ASD will require more gender-balance samples and the inclusion of youth from across the spectrum in future research.

Results from the current study suggest that future research aimed at testing alternative models to explain the associations between social-communication skills, peer victimization, family competence, and psychopathology in youth with ASD is warranted. For instance, models that aim to understand for whom and under what circumstances peer victimization is associated with mental health outcomes will be important for intervention development. Research in neurotypical youth suggests that the impact of peer victimization is greater when combined with other vulnerabilities (McDougall & Vaillancourt, 2015). A diathesis-stress model of psychiatric comorbidities would point to features of ASD as potential factors that confer risk for psychopathology, but only in the context of stress exposure (Kushner, 2015). In other words, the

effects of poor social-communication skills on mental health outcomes would be most prominent when youth are in high-stress environments such as pervasive or ongoing peer victimization. Alternatively, a social-push model could be applied, implicating social-communication skills as a protective factor but only in the context of low stress exposure. In this model, social-communication skills would be associated with lower mental health problems in the absence of high family conflict or negative peer experiences (Kushner, 2015). Research designed to test these developmental models could enhance our understanding of psychiatric comorbidities in youth with ASD and further the field by pointing to specific contexts for prevention and intervention efforts.

The primary finding of this study suggests that peer victimization may act as a mediating mechanism through which social-communication skills impact anxiety and depression symptoms in youth with ASD. Results offer further evidence that peer victimization is an important part of the peer context for cognitively non-impaired adolescents with ASD. Additional research is needed to gain a deeper understanding of what peer victimization looks like in this population as well as the causes and consequences of negative peer experiences. For instance, the most prevalent examples of victimization in the current sample reflected experiences of perceived exclusion (e.g., "Left me out of what he or she was doing", and "Left me out of an activity or conversation I really wanted to be included in"). It may be, particularly for high-functioning youth with ASD, that perceived exclusion by peers plays an important role in mental health outcomes. Understanding the process of exclusion for youth with ASD as well as factors that may foster social inclusion may be an important avenue for future study and be a target for peer based interventions. Future research should address the preliminary evidence that adolescents with ASD may experience peer victimization differently than is typically conceptualized (Fisher

& Taylor, 2016). Replication of these qualitative findings in a diverse sample of adolescents would move the field forward in critical ways.

In addition to a general re-conceptualization of peer victimization in youth with ASD, it will be important for future research to consider different types (e.g., relational, overt, etc.) of peer victimization and their effects on mental health outcomes, including different pathways of effect (McDougall & Vaillancourt, 2015). For example, deficits in social-communication, identification of emotions in others, theory of mind, and challenges interpreting social cues may make the identification of more subtle forms of relational or verbal peer victimization difficult for youth with ASD. One study found that adolescents with ASD reported higher levels of social and physical victimization compared to their neurotypical peers but not verbal or relational victimization (Kloosterman et al., 2013). Another study found that adolescent-reported verbal, relational, physical, and social forms of victimization may all be significantly associated with internalizing symptoms (Adams et al., 2014). Along with in-person peer victimization, advancements in technology and the rise of social media have led to online forms of victimization. Initial evidence suggests that rates of cyber bullying amongst those with disabilities are higher than in their neurotypical peers (Kowalski, Morgan, Drake-Lavelle, & Allison, 2016) and may be associated with depression symptoms in youth with ASD (Wright, 2018). Little research has explored whether and how individual forms of peer victimization may differentially play a role in mental health comorbidities and understanding these relationships could inform intervention efforts for youth with ASD.

Much of the literature on peer victimization in neurotypical youth focuses primarily on middle childhood or early adolescence, periods in which victimization occurs most frequently, is less stable, and has a significant impact on adjustment (McDougall & Vaillancourt, 2015). A

primary question moving forward will be whether mental health outcomes are more strongly tied to peer victimization within the context of the developmental period in which the experience occurs. In neurotypical samples, the association between peer victimization and depression weakens at older ages (McDougall & Vaillancourt, 2015). More specifically, research suggests that the correlation between peer victimization and aggressive behavior decreases from middle childhood into adolescence while the association between peer victimization and social withdrawal increases during middle childhood then levels off (Boivin et al., 2010). Future research should address the notion that mental health outcomes in youth with ASD may be sensitive to the timing of peer victimization experiences.

An additional next step may be in parsing out whether specific aspects of social-communication skills are important when considering negative peer experiences. Although the current study used a composite social-communication skills variable and found a significant association with peer victimization experiences, it may be that specific areas of social functioning are most responsible for that relationship. Most participants in the current sample (79.5% of males, 88.7% of females) met criteria for moderate to severe deficiencies in reciprocal social behavior based on normed t-scores of the SCI total score of the SRS. The SCI total score is made up of four subscales characterizing social awareness, communication, cognition, and motivation; high scores on one or two subscales coupled with low scores on the others would result in the same score as, for example, an adolescent with middling scores across all scales. Thus, the more general, overview approach to social-communication deficits employed in most research to date, including this study, may mask problems in specific social domains that put youth at risk for peer victimization. The state of the literature on this topic is mixed, with some evidence showing no association between specific areas of social functioning on the SRS and

peer victimization (Storch et al., 2012), and some showing deficits in communication behaviors but not social skills to be a significant predictor of peer victimization (Cappadocia et al., 2012). Importantly, both studies relied on parent report of social functioning, which provides a limited and potentially biased view of adolescents' social behavior. A more nuanced study of specific areas of social functioning (e.g., a person-centered analytic approach; observation of social behaviors) may allow for the identification of subgroups within the ASD population, and for a more detailed risk assessment and more targeted intervention.

Understanding the link between social communication deficits and experiences of peer victimization is crucial for designing and implementing interventions. Longitudinal work that examines the complex, potentially bidirectional nature of this association will be critical in developing specific points of intervention that are developmentally salient for adolescents. For instance, if difficultuies with social communication lead to more negative experiences with peers, this may in turn lead to social isolation and less frequent interaction with peers, reducing opportunities for youth to build important social skills and further increasing the likelihood of negative peer experiences (Anderson, Maye, & Lord, 2011; Shochet et al., 2016). Although it is beyond the scope of this study to test such a hypothesis due to the cross-sectional nature of the data, it will be important for future research to address the nature of the relationship between these key variables, particularly when considering prevention of mental health comorobidities in youth with ASD.

A recent review of group-based social skills interventions in adults with ASD found that group-based programs show promise for improving social knowledge and cognition, and decreasing loneliness, mood, and anxiety symptoms (Spain & Blainey, 2015). Social skills groups tailored to the developmental needs and strengths of adolescents with ASD may be a

fruitful avenue for intervention. For instance, a growing body of evidence indicates that individuals with ASD tend to show strong interest in and aptitude for using technology (Diehl et al., 2014). Technology use such as online social media platforms and interactive gaming may offer ways for adolescents with ASD to socially engage with peers in a context with structured rules and less reliance on non-verbal social information (Burke, Kraut, & Williams, 2010). Social skills groups that take advantage of technology may provide an alternative way for adolescents to develop fulfilling and supportive peer relationships, decrease feelings of loneliness and social isolation, and improve mental health outcomes. More research is needed to understand how social skills interventions and the use of technology can be leveraged as a strengths-based intervention tool for psychiatric comorbidities in youth with ASD.

Future research should also consider the role of positive peer relationships for adolescents with ASD. Research clearly shows that individuals with ASD are interested in and desire friendships; however, the quantity and quality of friendship are limited in those with ASD and may be also be qualitatively different from their neurotypical peers (e.g., Bauminger & Kasari, 2000; Bauminger at al., 2008; Petrina, Carter, & Stephenson, 2014; Rowley et al., 2012). In neurotypical adolescents, the number of friends and the degree to which friendship provides support, security, and companionship are considered important protective factors related to internalizing problems (Parker et al., 2006). Longitudinal work has shown that having high quality, stable friends reduces the impact of internalizing symptoms on long-term adjustment across adolescence (Markovic & Bowker, 2017). In youth with ASD, however, research suggests that having friendships that are limited in quality may be more of a risk factor for anxiety symptoms than having no friends at all (Mazurek & Kanne, 2010). More research is needed to understand the role of positive peer processes on psychiatric comorbidities in youth with ASD.

Positive peer experiences may also act as a point of intervention for adolescents with ASD. Peer-mediated intervention (PMI) has been established as an evidence-based social skill intervention in children with ASD (Chang & Locke, 2016), but less research has focused on the use of PMI in adolescents with ASD. Evidence in limited samples is promising, showing generalized gains in social interaction skills outside the school setting (e.g., Schmidt & Stichter, 2012). More research is needed to examine whether PMI can be leveraged as an intervention tool to minimize the effects of peer victimization through the development of positive peer relationships and increased social competence in youth with ASD.

Although beyond the aims of the current study, the school context is also important to the consideration of mental health outcomes for youth with ASD. Factors within the school context, ranging from the micro (e.g., teacher-student relationship, classroom environment) to the exosystem levels (e.g., school district or state level policies), have implications for the integration and inclusion of youth with ASD into the school environment. For example, classroom-level variables that have been identified as risk factors for involvement in bullying and victimization in neurotypical adolescents include the power distribution of the classroom environment (i.e., power centered on a few individuals instead vs. evenly distributed amongst students), social norms within a classroom, and students' perceptions of teacher attitudes toward bullying (Menesini & Salmivalli, 2017). The school context may also act as a protective factor; in a sample of adolescents with learning disabilities, Svetaz and colleagues (2001) found adolescents' feelings of connectedness to their school to be associated with lower emotional distress and fewer suicide attempts. A longitudinal study of adolescents with ASD found that the level of inclusion in their academic environment was associated with more positive adult trajectories, including fewer autism symptoms and maladaptive behaviors as well as better daily

living skills (Woodman, Smith, Greenberg, & Mailick, 2016). Future research should explore ways in which the school context may act as a developmentally salient protective factor for youth with ASD.

Calls in the literature for a more nuanced and systems-based understanding of family processes in ASD populations is not new (e.g., Cridland et al., 2014; Greenlee et al., 2018). While the present study did not find support for the hypothesized buffering effect of family competence for youth with ASD, a thorough evaluation of family processes in ASD populations is warranted. An in-depth, qualitative exploration of family processes would allow researchers to answer fundamental questions regarding the nature of these processes specific to the context of ASD. It will be important moving forward to establish a baseline understanding of family processes in ASD not in comparison to other families but with these families' needs, strengths, and challenges in mind. This is not to say that we should assume that families of individuals with ASD function differently than other families, but that understanding these processes in this population is valuable in its own right. Key informant interviews with parents and youth with ASD would provide insight into how families function, the challenges families face, and how they overcome those challenges. A qualitative approach to family processes in ASD could directly inform future measurement development, survey selection, approaches to observational family data collection and subsequent coding, and advance family theory. It will also be important to include the adolescent perspective to understand how family relationships are helpful in the context of stressful events such as peer victimization and mental health problems. The clarity of hindsight and the benefit of maturation suggest that retrospective reports from adults with ASD may be a promising approach for future study.

In addition, it will be important for future work to establish developmentally salient family processes that are important for adolescents with ASD. There is strong theoretical support pointing to the parent-adolescent relationship as a potentially key family subsystem for youth with ASD. The transition to adolescence in neurotypical children is marked by changes in parent-adolescent relationships and to established interaction patterns, which may contribute to relational conflict and poorer communication (Barker et al., 2007; Collins & Laursen, 2004). Negative parent-adolescent communication has been related to higher levels of adolescent reported stress and positive parent-adolescent communication has been found to buffer against the effects of bullying on neurotypical adolescent internalizing problems (Hartos & Power, 1997; Ledwell & King, 2015). Applied to adolescents with ASD, this would suggest that patterns of interactions within the family, particularly with the parent, may be associated with mental health comorbidities and future research should address this possibility.

In thinking about how family processes may influence outcomes for individuals with ASD, it is important to consider the broader cultural factors that shape family processes. The way in which culture influences family processes in ASD are likely complex but nonetheless important. Parents, family members, and communities make choices and act in ways they believe will best help their child with ASD; those beliefs and practices vary widely and are likely highly influenced by culture (Ravindran & Myers, 2012). This perspective suggests that the course of ASD over the lifespan is dictated by parent and family values, beliefs, and norms that are part of the culture in which the family resides. Thus, a deep understanding of family processes in the context of ASD should include culture as a part of the explanatory process. Systems-based frameworks recognize the pervasive influence of culture and there is room within these approaches to integrate cultural values, beliefs, and norms in understanding the family system

and key family processes. While largely ignored in research thus far, the influence of culture on family processes in ASD populations need to take center stage in future research and could ultimately lead to culturally relevant intervention practices.

Conclusion

Individuals with ASD face developmental challenges during adolescence both similar to and distinct from their neurotypical peers. Given the high prevalence of mental health problems such as depression and anxiety in this population (Strang et al., 2012), understanding the risk and protective factors associated with psychiatric comorbidities is key to optimizing developmental outcomes for youth with ASD. Results of the current study underscore the peer context as a potentially important mechanism linking an adolescent's social communication skills to their mental health. Ecological and systems-based models such as the FEF provide a theoretical and methodological framework for understanding psychiatric comorbidities in youth with ASD and this study suggests that such models may be of use in this population. Although this study helps fill several gaps in the current literature, more research is needed to fully explicate the associations between individual, peer, and family level factors when considering depression and anxiety comorbidities in adolescents with ASD.

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Appendix A. Extended Figures

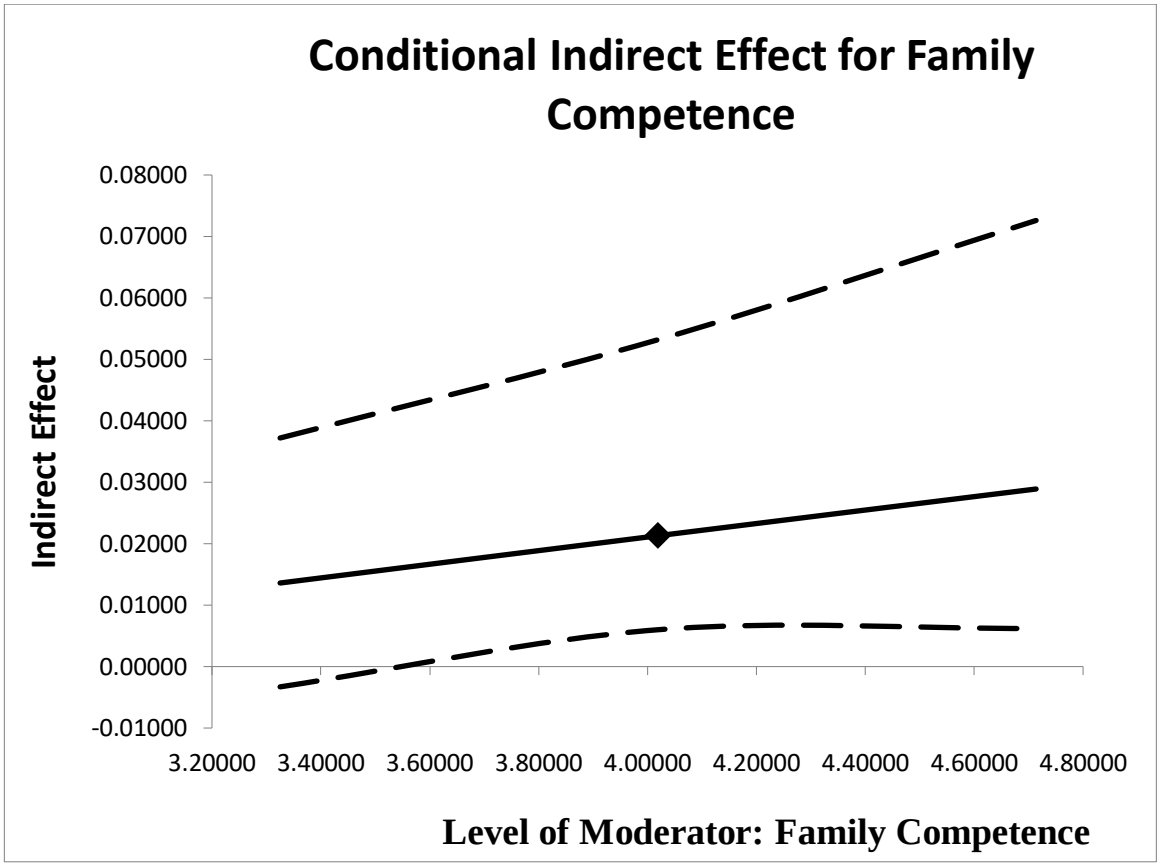

Figure 6. Visual representation of the upper and lower boundaries of the region of significance for the conditional indirect effects model for anxiety symptoms

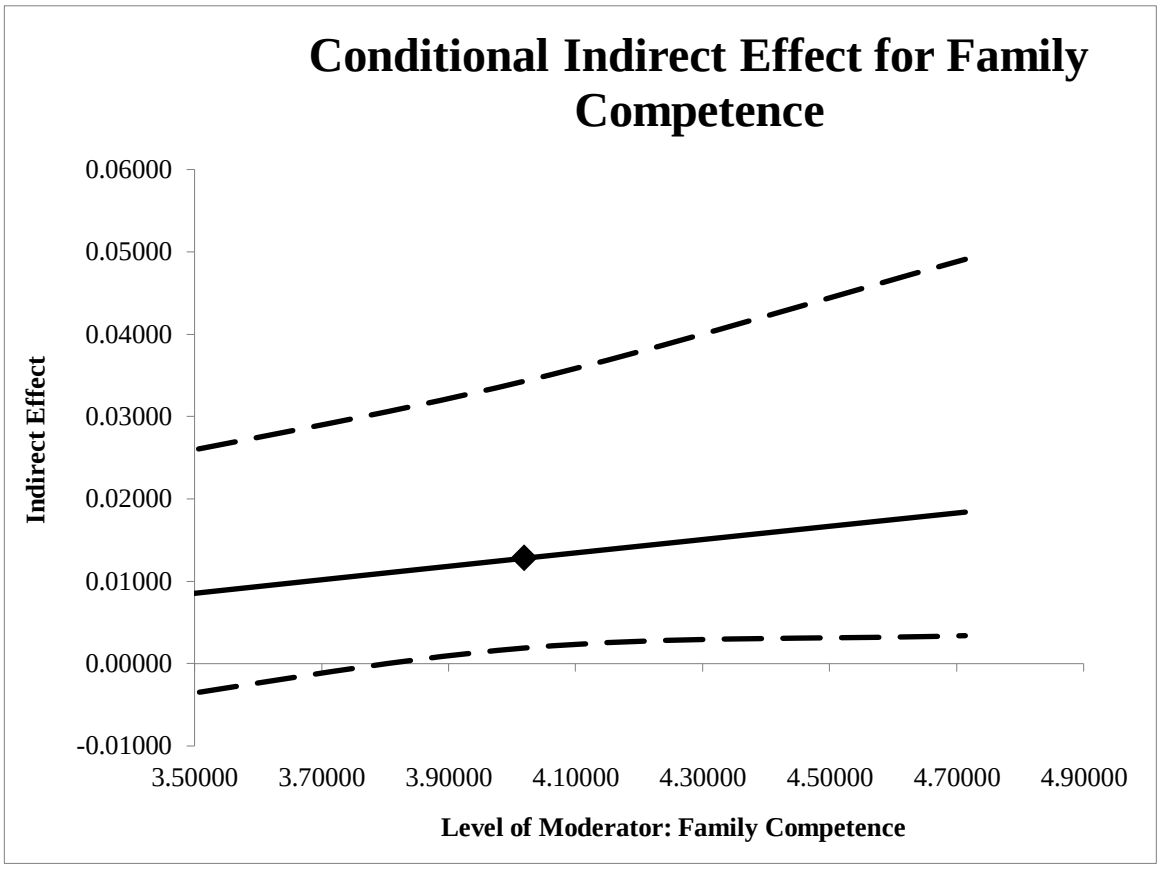

Figure 7. Visual representation of the upper and lower boundaries of the region of significance for the conditional indirect effects model for depression symptoms

Appendix B. Study Measures

Note. The SRS is a copyrighted measure and is not included in the appendix. A copy of the measure is available to committee members upon request.

You are invited to complete this pre-screening survey is to see if you might be a good fit for the Teens and Parents (TAP) research study. Dr. Marcia Winter is conducting the TAP research study at Virginia Commonwealth University. The pre-screening survey will ask general information and your teens' ASD diagnosis. Your answers give us an idea whether or not you meet some of the basic criteria for the study. Completing this screening survey does NOT obligate you to participate in the TAP research study. If your answers show that you qualify, you will receive an email with links to complete the online surveys. There may be no direct benefit to you for completing the screening survey.

Only complete the pre-screening survey if you choose to do so. You may also skip any questions or quit the survey at any time.

Your response to the survey will be kept confidential to the extent allowed by law. This survey is on Virginia Commonwealth University's web-based tool called REDCap. REDCap has features to help keep your information secure. However, as with anything involving the Internet, we can never guarantee the complete confidentiality of the information.

If you have questions about this pre-screening survey or the TAP research study, please feel free to ask. You may contact the study team at 804-828-2053 or email the study coordinator, Jessie Greenlee, at greenleejl@vcu.edu. If you have complaints, suggestions, or questions about your rights as a research volunteer, contact the Virginia Commonwealth University Office of Research at 804-827-2157.

The survey will take about 5 minutes to complete. By clicking the [submit] button below you are indicating that you understand the information and agree to begin the pre-screening survey.

<once the interested parent hits the submit button, the following screen will be displayed>

Eligibility Survey

Thank you for your interest in the TAP study! Please answer the following questions to determine whether you and your teen are eligible to participate.

1. Are you a parent or primary caregiver of an adolescent with an autism spectrum disorder who is between the age of 13 and 17?
   (Multiple Choice Response Options)
   □ Yes, I have an adolescent on the autism spectrum who is between age 13 and 17*
   □ No, I do not have an adolescent on the autism spectrum who is between age 13 and 17.

2. What is your relationship to the adolescent?
   □ Mother (adoptive, biological/birth)*
   □ Father (adoptive, biological/birth)
   □ Grandmother*
   □ Grandfather
   □ Aunt (adoptive, biological)*
   □ Uncle (adoptive, biological)
   □ Other: _____

3. Are you a primary caregiver for your adolescent?
   □ Yes*
   □ No

4. Are you the adolescent's legal guardian?
   □ Yes*
   □ No

5. Does your adolescent have an intellectual disability?
   □ Yes
   □ No*

6. Does your adolescent have a genetic condition such as Fragile X Syndrome or ?
   □ Yes
   □ No*

7. How well does your child read and comprehend?
   □ Not at all
   □ Reads and comprehends much below grade level*
   □ Reads and comprehends a little below grade level*
   □ Reads and comprehends on grade level*
   □ Reads and comprehends above grade level*

8. Does your child use a computer?
   □ Yes*
   □ No

9. Do you currently live in the United States?
   □ Yes*
   □ No

Demographic Information

ADOLESCENT INFORMATION

1. How old is your adolescent?
2. What is your adolescent's gender: male, female, other, do not want to specify
3. What is your child's race?
4. What is your child's current grade in school?
5. What kind of classroom is your child in? Inclusive, special ed, mixed, other
6. Approx. date of ASD dx
7. What is the Dx?
8. Who gave the DX?
9. Where dx?
10. Does your adolescent receive any intervention services?
    a. If yes, please describe

CAREGIVER INFORMATION

1. What is your relationship to the adolescent?
2. How old are you?
3. What is your gender: male, female, other, do not want to specify
4. What is your race?
5. What is the highest level of education you have completed?
6. What is your combined annual household income before taxes?
7. What is your current employment status?
8. What is your current marital status?
9. Who is currently living in your home (excluding yourself and the adolescent with ASD) – list relation to adolescent and ages (NO NAMES).

Self-Report Family Inventory (SFI)						
		Yes, fits our family well		**Some, fits our family**		**No, does not fit our family**
1.	Our family would rather do things together than with other people	1	2	3	4	5
2.	We all have a say in family plans	1	2	3	4	5
3.	The adults in this family understand and agree on family decisions	1	2	3	4	5
4.	There is closeness in my family but each person is allowed to be special & different	1	2	3	4	5
5.	In our home, we feel loved	1	2	3	4	5
6.	Our happiest times are at home	1	2	3	4	5
7.	The adults in this family are strong leaders	1	2	3	4	5
8.	The future looks good to our family	1	2	3	4	5
9.	We usually blame one person in the family when things aren't going right	1	2	3	4	5
10.	Family members go their own way *most* of the time	1	2	3	4	5
11.	Our family is proud of being close	1	2	3	4	5
12.	Our family is good at solving problems together	1	2	3	4	5
13.	One of the adults in this family has a favorite child	1	2	3	4	5
14.	When things go wrong, we blame each other	1	2	3	4	5
15.	Our family members would rather do things with other people than together	1	2	3	4	5
16.	Family members pay attention to each other and listen to what is said	1	2	3	4	5
17.	My family is happy most of the time	1	2	3	4	5
		My family does not function well together at all. We really need help				**My family functions well together**

18.	On a scale of 1 to 5 I would rate my family as…	1	2	3	4	5

RCADS-P – Short Version

Please put a circle around the word that shows how often each of these things happen to your child. There are no right or wrong answers.

Never Sometimes Often Always

1. My child feels sad or empty
2. My child worries when he/she thinks he/she has done poorly at something
3. My child feels afraid of being alone at home
4. Nothing is much fun for my child anymore
5. My child worries that something awful will happen to someone in the family
6. My child is afraid of being in crowded places (like shopping centers, the movies, buses, busy playgrounds)
7. My child worries what other people think of him/her
8. My child has trouble sleeping
9. My child feels scared to sleep on his/her own
10. My child has problems with his/her appetite
11. My child suddenly becomes dizzy or faint when there is no reason for this Never
12. My child has to do some things over and over again (like washing hands, cleaning, or putting things in a certain order)
13. My child has no energy for things
14. My child suddenly starts to tremble or shake when there is no reason for this
15. My child cannot think clearly
16. My child feels worthless
17. My child has to think of special thoughts (like numbers or words) to stop bad things from happening
18. My child thinks about death
19. My child feels like he/she doesn't want to move
20. My child worries that he/she will suddenly get a scared feeling when there is nothing to be afraid of
21. My child is tired a lot
22. My child feels afraid that he/she will make a fool of him/herself in front of people
23. My child has to do some things in just the right way to stop bad things from happening
24. My child feels restless
25. My child worries that something bad will happen to him/her

Peer Victimization

Instructions: How often has each of the following happened to you in the past week?

	Never	**Once or twice**	**A few times**	**About once a week**	**A few times a week**
1. A teen hit, kicked, or pushed me in a mean way					
2. A teen threatened to hurt or beat me up					
3. A teen chased me like he or she was really trying to hurt me					
4. A teen grabbed, held, or touched me in a way I didn't like					
5. A teen left me out of what he or she was doing					
6. A teen left me out of an activity or conversation that I really wanted to be included in					
7. A teen did not invite me to a party or other social event even though he or she knew that I wanted to go					
8. A teen I wanted to be with would not sit near me at lunch or in class					
9. A teen did not talk to me on purpose					
10. I got teased or made fun of when I tried to hang out with other teens					
11. Other teens said mean things to me when I tried to be their friend					
12. Other teens made fun or teased me when I talked to them					

Curriculum Vita

Jessica Lynn Greenlee was born on March 15, 1987 in Biloxi, Mississippi. She received her Bachelor of Arts in Psychology from Kenyon College, Gambier, Ohio in 2009. She worked as a project manager for a number of federal and privately funded research studies at Vanderbilt University and The University of Alabama until she joined the Developmental Psychology program at Virginia Commonwealth University in 2014. She received a Master of Science from Virginia Commonwealth University in 2016.