

# **Sex Differences in Anxiety Symptoms, Emotional Regulation, Autism Symptom Severity, and Response to School-Based Interventions in School-Aged Autistic Children: An Initial Literature Review**

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## **Abstract**

Co-occurring mental health concerns, such as anxiety, have been explored within Autistic populations. However, despite extensive research into sex differences in mental health conditions and sex differences in autism, the potential impact of sex differences on the existing relationship between autism and mental health concerns is less well understood. This initial literature review serves as a foundation for a future secondary data analysis intent on examining potential sex differences for anxiety and emotional regulation within Autistic populations, as well as sex-differences in autism symptom severity and in response to school-based interventions. Search results from PubMed and Cochrane Library were screened following the removal of duplicates to provide a focused view of the current literature pertinent this upcoming secondary data analysis. The literature suggests that there is an increased risk of anxiety in Autistic females compared to Autistic males; some potential factors influencing these findings have been discussed as well. Additional research is warranted to further establish and characterize these complex interactions, particularly in children and with a focus on better understanding what supports may serve these populations.

## **Introduction**

This literature review is written as an initial evaluation of current literature regarding potential sex-differences within school-aged Autistic children regarding anxiety, emotional regulation, autism symptom severity, and response to school-based interventions focused on anxiety or emotional regulation as common underlying factor in anxiety. To inform our conceptualization of these potential associations, this paper will also provide an

overview of literature regarding sex-differences in anxiety amongst the general populations and comparisons of anxiety prevalence in Autistic populations compared to general populations (regardless of sex). We will also explore some potential theories of why the suggested relationships may exist. This preliminary literature review serves as an early step within an upcoming secondary data analysis project, which will be described below.

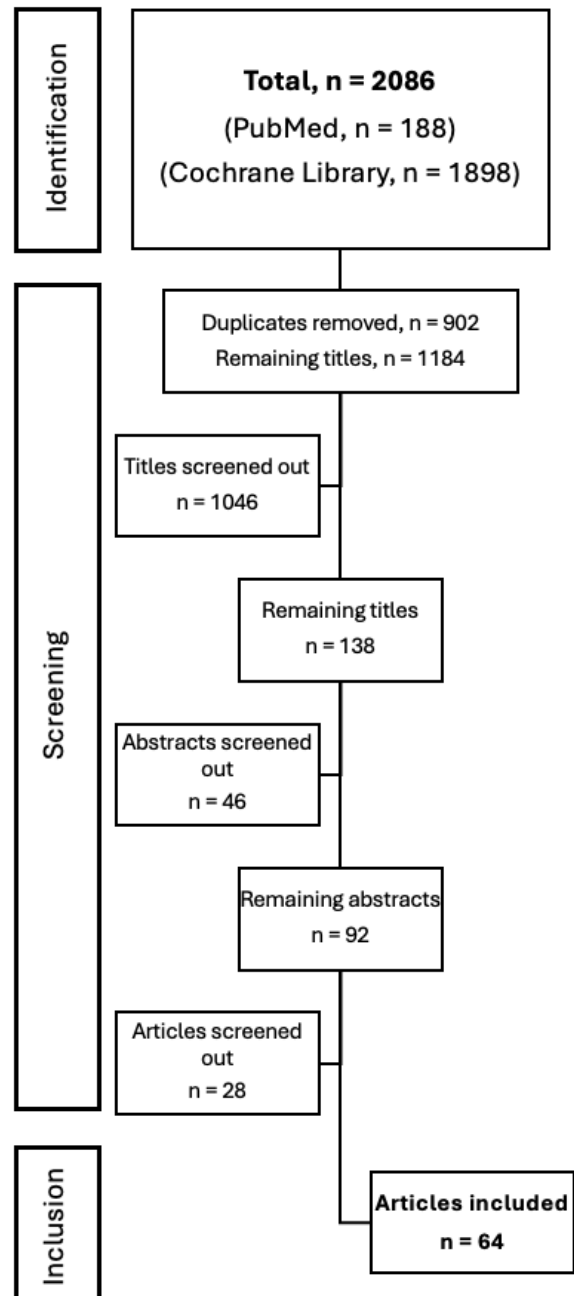
## Methodology

PubMed and Cochrane Library databases were searched for relevant articles. Within PubMed, MeSH terms were identified to capture the desired concepts for each search (Table 1). In Cochrane Library, similar process was utilized (Table 2). However, rather than MeSH terms as defined by the database, I entered a list of terms as options to represent each concept. The results were filtered to only evaluated Cochrane Review format.

The search process identified 2086 articles (PubMed,  $n = 188$ ; Cochrane Library,  $n = 1898$ ). Duplicates were removed electronically resulting in 1184 non-duplicative articles (PubMed,  $n = 178$ ; Cochrane Library,  $n = 1006$ ). I evaluated the titles of these 1184 articles to exclude articles not considered relevant. In general, articles were retained for potential information regarding the relationship between autism and anxiety, autism and emotional regulation, sex differences in autism presentation and/or severity, sex differences in anxiety and/or emotional regulation within Autistic populations, sex differences anxiety and/or emotional regulation within the general pediatric population, and cognitive behavioral therapy in pediatric populations. An additional 6 articles were removed due to publication date prior to 1980.

Through this screening process, 1046 of the 1184 articles were eliminated; 138 articles remained. The abstracts of these 138 articles were evaluated under similar criteria, and an additional 46 articles were excluded. The remaining 92 articles were evaluated more

thoroughly, and 28 were eliminated leaving 64 articles that are discussed in this review.



**Figure 1.** Flowchart reflecting the search process with numbers (n) of articles in each category.

## **Sex differences in autism severity**

Autism spectrum disorder is characterized by differences in two domains: social communication and social interaction (SC) and Restricted, repetitive patterns of behavior, interests, or activities (RRB) (<https://www.autismspeaks.org/autism-diagnostic-criteria-dsm-5>) Autism symptoms severity can be evaluated within these two domains as well.

Rynkiewicz et al found that while school-aged Autistic boys had significantly better communication skills than school-aged Autistic girls based on parent report, girls tended to use more gestures during demonstration tasks on the Autism Diagnostic Observation Schedule-Second Edition (ADOS-2). (Rynkiewicz, 2016) Compared to toddler-aged Autistic boys, toddler-aged Autistic girls demonstrated more social communication deficits on standardized observation (ADOS-2) and clinician rating, but not based on parent rating. Interestingly, in preschool-aged children, social communication deficits were notable in Autistic girls based on parent report but not based on standardized observation or clinician rating. (Ros-Demarize, 2019) This suggests the sex differences seen in social communication differences in autism may be modified by age and may vary based on source (parent vs. clinician vs. standardized evaluations). The notable impact that age may have on sex differences in autism symptoms (and consideration of severity versus phenotype) was heavily explored by Jamison et al. (Jamison, 2017) Similarly, the potential effect of source as a modifier of sex

differences in severity was highlighted by Charman et al, including self-report by adults which showed higher severity reports for female than males, which contrasted with much of their data based on parent- and clinician-reports. (Charman, 2017)

When evaluating the RRB domain, Ros-Demarize et al found that RRB ratings did not differ between males and females for either toddlers or preschoolers. When evaluating trends overtime, however, Rynkiewicz et al reported that stereotypic behaviors improved over time for boys but remained similar for girls. (Rynkiewicz, 2016) The RRB domain of autism symptoms also included sensory processing differences. Regarding misophonia and hyperacusis, Autistic females may be more impacted than Autistic males in general. (Katarikar, 2025)

There are certain potential markers in infants correlating with future autism symptoms. A study analyzing how males and females may differ in these markers did not find sex differences within any of the three markers studies; however, they did find that the markers were predictive of future autism diagnosis only in boys, not girls. (Bedford, 2010)

In a study of adults with intellectual disability, Cohen et al found that Autistic people demonstrated more self-directed aggression, but this effect was strongest for adult Autistic females. (Cohen, 2010)

Additional studies support the hypothesis that autism severity is higher in females than males. (Bitsika, 2019; Rahaman, 2021) Still,

other studies have come to differing conclusions regarding sex differences in autism. (Constantino, 2003; Franceschini, 2021; Hodge, 2025; Mussey, 2017; Wiggins, 2009) For example, a 2017 study by Mussey et al found small to no sex differences in variables of age of diagnosis, IQ score, cognitive profiles, and symptom severity within a community-based population of Autistic children and adults. (Mussey, 2017) Hodge et al reported higher levels of severity in Autistic individuals assigned male at birth while noting no significant sex difference in adaptive scores. (Hodge, 2025) A 2009 study by Wiggins et al, found that Autistic males were more likely to experience developmental regression and at a younger age. They also noted that Autistic children with documented developmental regression were more likely to have cognitive impairment. (Wiggins, 2009)

In a population of over 200 Autistic students attending special schools in Singapore, there were no gender differences found to be associated with autism severity scores. (Magiati, 2016). On the topic of adaptive functioning (rather than specific autism severity), this same study found no sex differences as did a study spanning Autistic participants ages. (Tillmann, 2019)

## **Etiologies and consequences of sex differences in autism**

Sex differences in autism phenotype have been noted. These differences may be influenced by biological differences (Masi, Ocaoglu 2018; Schumann, 2010), cognitive differences, (Stevenson, 2018; Van Eylen,

2018), research bias (e.g. historical under-representation of females in autism research) and/or sociocultural differences. (Franceschini, 2021) Interestingly, a study of children ten years after being born prematurely (before 28 weeks gestational age) found that while the ratio of boys:girls with autism spectrum disorder still showed higher prevalence in boys, the ratio was smaller (male prevalence more similar to female prevalence) when compared to that same ratio within the general population. This finding could be explained by a variety of factors (some based on true differences and others based on potential biases). (Kuban, 2016)

Importantly, sex differences in autism phenotypes may contribute to delay in diagnosis for females compared to males. (Franceschini, 2021) In children with complex phrase speech, age of diagnosis was higher (older) for females than for males. However, there was no significant sex difference in age of diagnosis for children who were non-verbal or minimally verbal. (Salomone, 2016). Potential consequence of these delays is an area of ongoing research.

## **Autism and mental health**

### **ASD and Anxiety**

Kamimura-Nishimura found that 7.4% of Autistic children had co-occurring anxiety. (Kamimura-Nishimura, 2017) Another study found that over 50% of young Autistic adults met criteria for an anxiety disorder. (Lugnegard, 2011)

In a study comparing “high-functioning” Autistic adolescents to a control group,

multiple informants (parents, teachers, and self) reported higher rates of psychiatric symptoms, including anxiety in the Autistic population. (Hurtig, 2009) Perhaps not surprisingly, the correlation between parent/teacher-report and adolescent self-report was more modest in terms of anxiety/depression (internalizing symptoms) than the correlation between informants regarding symptoms such as withdrawal and social challenges which are more easily observed by others. (Hurtig, 2009) Another study focused on children with Asperger's syndrome (prior to DSM-V) found increased social anxiety in this population. (Melfsen, 2006) In a cohort of "high

## **Mental Health Treatment Use**

Another way to evaluate co-occurrence mental health concerns in Autistic populations is by comparing their utilization of mental health care relative to the general population. Boulet et al found that Autistic children were 7.8 times more likely to have been seen by a mental health professional. (Boulet, 2009) However, it is unclear what portion of this difference is attributable to co-occurring mental health conditions or symptoms as opposed to symptoms directly related to autism.

## **Sex Differences in anxiety and emotional regulation in the general population**

### **Anxiety**

Franceschini et al conducted a review suggesting that anxiety disorder prevalence is higher in females than males. Several studies have found higher prevalence and/or

incidence of worries, anxiety, and/or anxiety disorders in females compared to males (Franceschini, 2021; Silverman, 1995; Steinhausen 2019) In a study involving adults with intellectual disability, Autistic females had higher rates of anxiety or mood disorders than non-Autistic females. (Cohen, 2010)

However, a study using a parent questionnaire assessing the overall psychological well-being (PSWB) of their children which included anxiety amongst several other measures of well-being found that girls had higher PSWB and that health-related correlates most strongly associated with PSWB differed between sexes. (Ikävalko, 2018)

Several studies have evaluated dental anxiety in children and have found that girls have more dental anxiety than boys. (Tickle 2009, Peretz, 2013) Additionally, dental fear in girls is more likely to increase compared to boys. (Luoto, 2017 and Tickle, 2009). This trend was demonstrated in school-aged children (Tickle 2009) and early to middle adolescence (Luoto, 2017). While parental dental fear was associated with child dental fear in early adolescence in boys and girls, this association only remained significant in middle adolescence for girls. (Luoto, 2017) However, Murray et al found that regular attendance to dental visits and receiving invasive dental treatment was protective against dental anxiety increasing with age in both girls and boys. (Murray, 1989)

### **Emotional Regulation**

Regarding emotional regulation, Rueth et al found that "Not Hiding Emotions" as a

component of emotional awareness, which is thought to precede emotional regulation, was negatively associated with internal-dysfunctional emotional regulation in boys, but not in girls. In other words, expressing emotions may improve emotional regulation for boys more so than it does for girls. (Rueth, 2019)

### **Potential etiologies of sex differences in anxiety**

Several potential etiologies of sex discrepancies in anxiety have been explored, including impacts of potential cognitive differences (Mărcuș, 2016) and hormonal differences. (Franceschini, 2021) The prevalence of anxiety is reportedly similar in boys and girls prior to puberty; testosterone may have a protective effect against anxiety (Franceschini, 2021)

Interestingly, maternal depressive symptoms were associated with emotional disorder (representing dysphoric mood, anxiety, and obsessive-compulsiveness) in girls in a 1997 study that also suggested maternal bias (maternal depression affecting their reporting of child behavior problems) may be especially strong for adolescent boys. (Boyle, 1997)

Similarly, Gross et al found that preschool-aged boys with depressed mothers were more likely to have behavior problems and poor social competence than preschool-aged girls. (Gross 1995) While there was no significant difference in mean mental health scores between the sexes in this group (Gross 1995), the more specific item findings suggest that

boys' behavior may be more impactful on maternal depression and/or visa versa.

While there may be several variables impacting the apparent sex-differences in the association between maternal depression and child symptoms, this does present the consideration of how parent- and/or self-report of various mental health symptoms, including anxiety, may be impacted by cultural gender expectations and norms. Given many studies in the areas of autism and mental health are based on caregiver- or self-report, the potential of reporting bias, from a gender-norm perspective or otherwise, should be ever-present in interpretation of results. Interestingly, in a focus group of 10- and 11-year-olds, both males and females recognized that societal pressures impact sexes differently in that boys are “pressured to live up to a certain image, this can mean difficulties in expressing feelings”, which could lead to mental health challenges. (Roose, 2003)

Furthermore, disparities in negative life experiences between males and females, such as sexual abuse, should be considered for the role they play in mental health disparities between the sexes. A 2002 study in New Zealand found that accounting for exposure to sexual violence (which was more commonly experienced by females) reduced the disparity in internalizing symptoms (including anxiety and depression) between the sexes; however, controlling for this factor, did not eliminate the finding of increased internalizing symptoms in females entirely. (Fergusson, 2002) This suggests that while

such experiences may account for some of the difference seen, it is not the only factor.

## **Sex differences in the characteristics of anxiety**

There has been some research into how the content and/or sub-types of anxiety may differ between males and females, particularly in children.

In a study of Chinese children and adolescents, researchers used threat perception indices to evaluate anxiety toward vignettes that were based on sub-types of anxiety. Girls scored higher than boys on separation-anxiety-story-type and generalized-anxiety-story-type but not on social-anxiety-story-type. (Lu, 2007) Based on human figure drawings following anxiety scaling and structured interview, Carroll et al found that the most significant boys' fears were related to animals, safety, school, and supernatural phenomena. The most significant fears for girls were natural phenomena. (Carroll, 1999) An anxiety symptom network configuration found sex differences as well, particularly in associations between worry and school- and social-related fears. (Abend 2021)

Lastly, there is some evidence that boys may self-report more aspects of anxiety that are environmentally influenced anxiety (as opposed to genetically influenced). (Topolski, 1999)

## **Sex differences in anxiety in Autistic populations**

Studies evaluating sex differences in anxiety in Autistic populations have reported mixed results. In older adolescence and early adulthood, Uljarevic et al reported increased likelihood and severity of anxiety in Autistic females compared to Autistic males. (Uljarevic, 2020) Moore et al reported higher scores in Autistic women compared to Autistic men on the Anxiety Scale for Autism-Adults (ASA-A). (Moore, 2025) Based on the 2021 National Health Interview Survey in the United States, prevalence of anxiety was higher in children with developmental disabilities, especially among females. (Wang, 2025)

The sex differences in lifetime prevalence of several anxiety disorders in Autistic adults was comparable to the sex differences previously reported for non-Autistic adults. (Fombonne, 2020)

The previously mentioned study of 200 Autistic students attending special schools in Singapore, found no gender differences associated overall anxiety or specific anxiety subscale scores. (Magiati, 2016)

Another way anxiety symptoms may be described in the literature are as a component of “internalizing symptoms”, such as depression and anxiety (as opposed to externalizing symptoms, such as hyperactivity and behavioral problems). (Franceschini, 2021) A 2021 review article noted that Autistic males and Autistic females may display different presentations, including the finding that males tend to have more externalizing behaviors, whereas females tend to have more internalizing

behaviors. (Franceschini, 2021) However, a comparison of Greek and Finnish adolescents demonstrated that these trends may differ based on geographic population; while internalizing symptoms remained higher in girls for both countries, Finnish girls also showed higher externalizing symptoms than boys. (Kapi, 2007)

A recent study evaluated not only prevalence of emotional-behavioral concerns (EBCs, including anxiety) in Autistic children, but also trajectories of these symptoms across time in relation to autistic traits. Results suggest that for Autistic boys in middle childhood (ages 7-9), EBCs were strongly correlated with social-communication difficulties, but this association decreased as they aged into late childhood. Contrastly, Autistic girls demonstrated stable or increasing associations between autistic traits and EBCs, especially anxiety, even into late childhood. (Chen, 2025) This study did highlight the potential measurement bias whereby level of EBCs may affect how caregivers measure or report autistic traits differently. (Chen, 2025) Another trajectory focused study found that while a higher percentage of male with a diagnosis of autism at age 2 retained that diagnosis at age 4 (when compared with female counterparts), the difference was not statistically significant. (Turner, 2007)

Results from cross-sectional study did not find results to support their hypothesis that Autistic females are at particular risk of internalizing symptoms based on a 2-way interaction, but did find a 3-way interaction when the variable of developmental stage of

adolescence was considered. (Oswald, 2017) This emphasizes the reality that the potential relationships between sex, mental health, and autism are likely quite complex. (Oswald, 2017)

That being said, the sex differences in lifetime prevalence of several anxiety disorders in Autistic adults was comparable to the sex differences previously reported for non-Autistic adults. (Fombonne, 2020)

### Why does it matter?

Understanding factors that may increase risk of mental health conditions and/or autism symptom severity within Autistic populations is important because of their negative impact on quality of life. (Mason, 2018) In children, co-occurring anxiety may not be as impactful on the family as other co-occurring experiences, such as sleep difficulties, hyperactivity, or temper problems. (Petrou, 2018) Still, co-occurrence of anxiety with autism can have life-threatening impacts; over 30% of children with anxiety and autism had suicidal thoughts and over 2% have active suicidal ideation. (Wijnhoven, 2019)

## Potential etiologies of sex differences in anxiety within Autistic populations

### Camouflaging

Camouflaging or “masking” is a concept seen particularly frequently in Autistic populations whereby a person hides or changes aspects of themselves to better blend into social settings. This may occur more often in Autistic females, although not in all studies. (Riglin, 2021) That being said,



Autistic females may be more likely to be under-diagnosed, potentially in part due to increased “camouflaging” behaviors. (Franceschini, 2021)

There is evidence to suggest that camouflaging behaviors may be detrimental to the mental health of Autistic people and in the general population. (Ai, 2024; Cage 2019). Furthermore, women are more negatively impacted by this correlation and, in Autistic populations, may be more likely to camouflage when it is for “conventional” reasons (“functional purpose such as in workplace or educational contexts”). (Cage, 2019) Unfortunately, Cage et al also made the point that Autistic individual must weigh the potential wellbeing costs of bullying and social non-acceptance with the potential costs of camouflaging behaviors. (Cage, 2019)

### **Autism Symptom Severity**

Parent- and adolescent self-reports suggested a positive correlation between autism severity and anxiety levels. (Oswald, 2016) Given there is also evidence for higher symptom severity in Autistic females compared to Autistic males based on level of functioning (Mattila, 2010), it is reasonable to consider that autism symptom severity may act as a mediator in the association between anxiety and female gender in Autistic populations.

As a potential mediator of this relationship, Autistic females may have higher rates of cognitive impairment than Autistic males. (Fombonne, 2020)

However, in preliminary analyses of a variety of phenotypic markers, Hus et al did not find sex differences in word acquisition, phrase acquisition, repetitive sensory motor actions, insistence on sameness, or savant skills in data collected from Autistic adults and children. (Hus, 2007)

### **Delayed Diagnosis**

Associations between increased anxiety symptoms and female sex within Autistic populations may be mediated by age at autism diagnosis as demonstrated by Smith et al. Female sex predicted later diagnosis and later diagnosis predicted increased anxious symptoms, but female sex alone did not predict increased anxious symptoms. (Smith 2024)

### **Sex differences in response to cognitive-behavioral interventions in pediatric populations**

Barrett et al cited a prior study (Dadds, 1997) using a cognitive-behavioral intervention wherein they found that female sex (along with parental anxiety and pretreatment severity) was correlated with poor response to treatment. (Barrett, 2006) However, they noted that Lock and Barrett (2003) results using a different cognitive-behavioral intervention (“FRIENDS”) suggested that Grade 6 females had better response to treatment than Grade 9 female or boys at all ages reported. (Barrett, 2006)

### **Autism spectrum disorder and cognitive-behavioral interventions**

A 2021 review by Elliot et al explores in depth ways in which Autistic individuals may benefit from adaptations to cognitive-behavioral therapy when targeting co-occurring obsessive-compulsive disorder (OCD). These adaptations may include dedicated time to ensure that individuals can recognize and understand their emotions, additional time to ensure individuals understand how cognitions, emotions, and behaviors are connected, use of concrete language, emphasis on exposure and response prevention (ERP) components of therapy rather than the more cognitive aspects, integration of special interests, and information provided in visual formats. (Elliot, 2021)

## Future directions

### Additional Literature Review

While this initial literature review provides a foundation for future work, a more extensive review of the literature, including additional search databases, such as Web of Science, is warranted. There are a handful of articles not included in this literature review due to access issues, which can hopefully be mitigated via InterLibrary Loan. Lastly, a literature review performed by another person will reduce bias and increase the strength of this current review.

### Secondary Data Analysis

In collaboration with Dr. Judy Reaven and colleagues, I will perform a secondary data analysis using data from a current study funded by Patient-Centered Outcomes Research Institute (PCORI). The primary outcome of this study is to compare two school-based interventions targeting anxiety

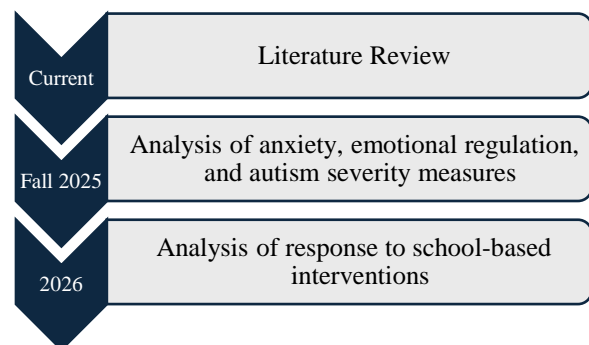
symptoms in Autistic students. Up to 200 Autistic students in Colorado and North Carolina have been randomly assigned to receive either Facing Your Fears – School Based (FYF-SB) intervention or Zones of Regulation (ZOR). FYF-SB is based on CBT strategies to target anxiety; ZOR intervention hopes to improve anxiety by targeting emotional dysregulation which often contributes to anxiety. I will evaluate sex-differences within this data based on anxiety and emotional regulation measures, autism symptoms severity, and response to the school-based interventions.

## Aims Statements

Aim #1: Describe the differences (if any) between school-aged Autistic males and Autistic females in relation to anxiety measures, emotional regulation measures, and autism symptom severity.

Aim #2: Determine if there is a difference in response to school-based interventions based on sex in school-aged Autistic children.

## Tentative Timeline



## Rationale

While there are significant bodies of literature exploring the relationships between

anxiety and female sex, anxiety and autism, and autism and female sex, the exploration of the intersectionality of all three of these variables is less well understood. Our secondary data analysis has the potential to further inform this area of important study within autism and mental health research, specifically with a relatively robust sample size of Autistic children. Our sample will include information regarding autism symptoms severity, which may be implicated in potential interactions explored. Furthermore, our data regarding sex-differences response to school-based intervention for children with autism and anxiety may help tailor future recommendations for this patient population. We are hopeful that in addition to advancing our understanding of how to best support Autistic youth, additional research into sex-differences in the relationship between mental health and autism may lead to future investigations of factors that impact these complex relationships.

## Conclusion

In conclusion, the current literature indicates increased rates of anxiety in females compared to males, as well as an increased rate of anxiety in Autistic populations compared to the general population. There are also known differences between male and female autism presentations, although this is an ongoing area of study. There has been some exploration into how sex-differences may impact the relationship between autism and co-occurring mental health concerns, such as anxiety, often suggesting that anxiety is more common in Autistic females than Autistic males. However, further research is

necessary to strengthen our understand of these complex intersectionalities and explore how this should inform clinical practice and future research, particularly within pediatric Autistic populations.

## Acknowledgements

LEND Faculty and Trainees. LEND Mentor: Sandra Friedman. Developmental-Behavioral Fellowship Program Leadership. Scholarly Project Mentor: Caitlin Middleton. Scholarly Project Co-Mentor and PI of PCORI Study: Judy Reaven. Scholarly Oversight Committee, including Valentina Postorino and Richard Boles

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