



Sex Differences in Restricted and Repetitive Behaviors and Interests in Children with ASD



Madison Guay & Molly Helt, PhD

Department of Neuroscience, Trinity College, Hartford CT

Introduction

•Restricted and repetitive behaviors and interests (RRBIs) are behaviors characterized by high frequency, repetition, and desire for sameness in the environment (Leekam, 2011).

•The *DSM-5* and *ICD-10* divide RRBIs into 4 categories of stereomotor behaviors, rituals, restricted interests, and sensory behaviors.

•Previous studies of sex differences on RRBIs severity and typology have yielded mixed results (Allely, 2019).

– Some studies (especially those with children under the age of 6) have found no differences in RRBIs between females and males, whereas other studies (especially those with elementary school and adolescent aged participants) have found that males exhibit more RRBIs than females.

– One study looking at gender profiles, showed that females tend to show more compulsive, sameness, restricted, and self-injurious behaviors, and also have a greater overlap of ASD and obsessive-compulsive symptoms such as hoarding and trichotillomania (Antezana et al., 2018).

Study	Participant age	Caregiver Report or Observation?	Matching	RRBIs primary or secondary purpose of study?	Differences?
Andersson, Gillberg, & Miniscalco (2013)	Preschoolers (1.8-3.9 yrs)	Observation	Yes - Chronological age and developmental quotient	Looking for if girls and boys with ASD have the same profiles	No
Harrop et al. (2015)	Female mean = 35.8 months Male mean = 35.8 months	Observation	Yes - matched on ADOS severity (ADOS module, algorithm score within 1 pt)	Primary	No
Reinhardt, Wetherby, & Schatschneider (2015)	Preschoolers	Observation	No matching	Investigated early social communication and developmental functioning	No

Study	Participant age	Caregiver Report or Observation?	Matching	RRBIs primary or secondary purpose of study?	Differences?
Hiller, Young, & Weber (2014)	Mean boys age = 6.76 Mean girls age = 6.06	Observation	No matching	Aim to examine sex differences in behavioral presentation based on DSM-IV and DSM-5 criteria	Yes
Dean, Harwood, & Kasari (2017)	Elementary school Mean boys age = 7.71 Mean girls age = 7.38	Observation	Yes - age, grade, IQ, and school	Primary	Yes
Supekar & Menon (2015)	Mean girls = 9.83 yrs Mean boys = 9.83 yrs	Caregiver report	Yes - age and IQ-matched	Primary	Yes

•There may be gender-differential growth trajectories, and RRBIs may look more different in females and males as they age (Harrop et al., 2015).

•Specifically, females may become more adept at **camouflaging** with age, and their RRBIs may be missed due to their behaviors being only unusual in *intensity*, rather than *kind* (Dean, Harwood, & Kasari, 2017).

•Low agreement has been found between caregiver report and clinical observation in the RRBIs domain (Stone et al., 1994; Ventola et al., 2006) and most previous studies have only used one or the other without combining.

•Current diagnostic measures may be biased as they are primarily based on the male ASD phenotype, leading to potential inaccuracies in diagnosing females (Tillmann et al., 2018).

•The current study aims to combat limitations of previous studies by using a larger sample of n=258 children and adolescents with ASD and analyzing both clinician and caregiver reports to see if there are differences in RRBIs between females and males.

Methods

Participants

Novel analysis of data for 258 individuals (90 females), ages 3-18, collected previously as a part of an ongoing genetics study at the Connecticut Children's Medical Center (CCMC)

Measures

- DSM-5 Checklist (clinician report)
- Pervasive Developmental Disorders Behavioral Inventory (PDDBI) (caregiver report)

Results

Figure 1. Percentage of sample for whom clinicians endorsed presence of social and communication symptoms by sex: DSM-5 Checklist.

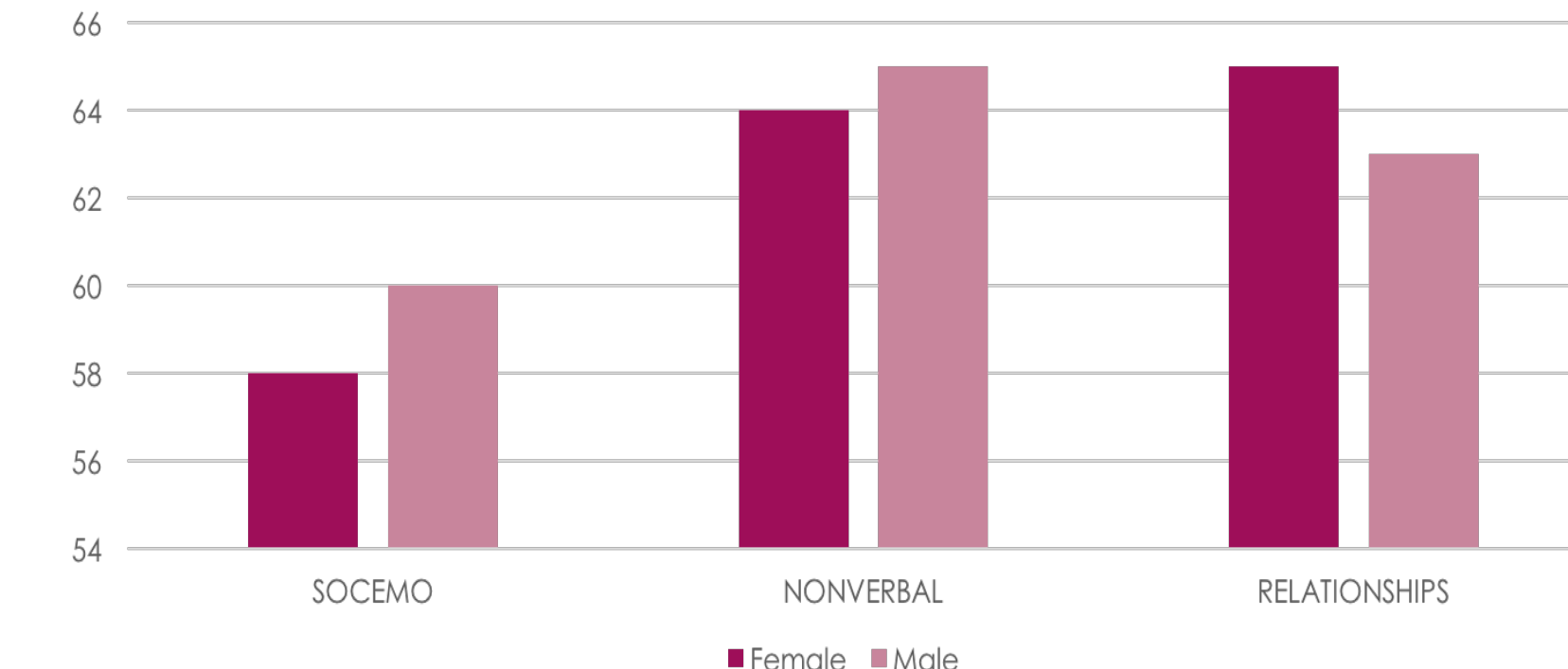


Figure 2. Percentage of sample for which clinicians endorsed presence of RRBIs symptoms by sex: DSM-5 Checklist.

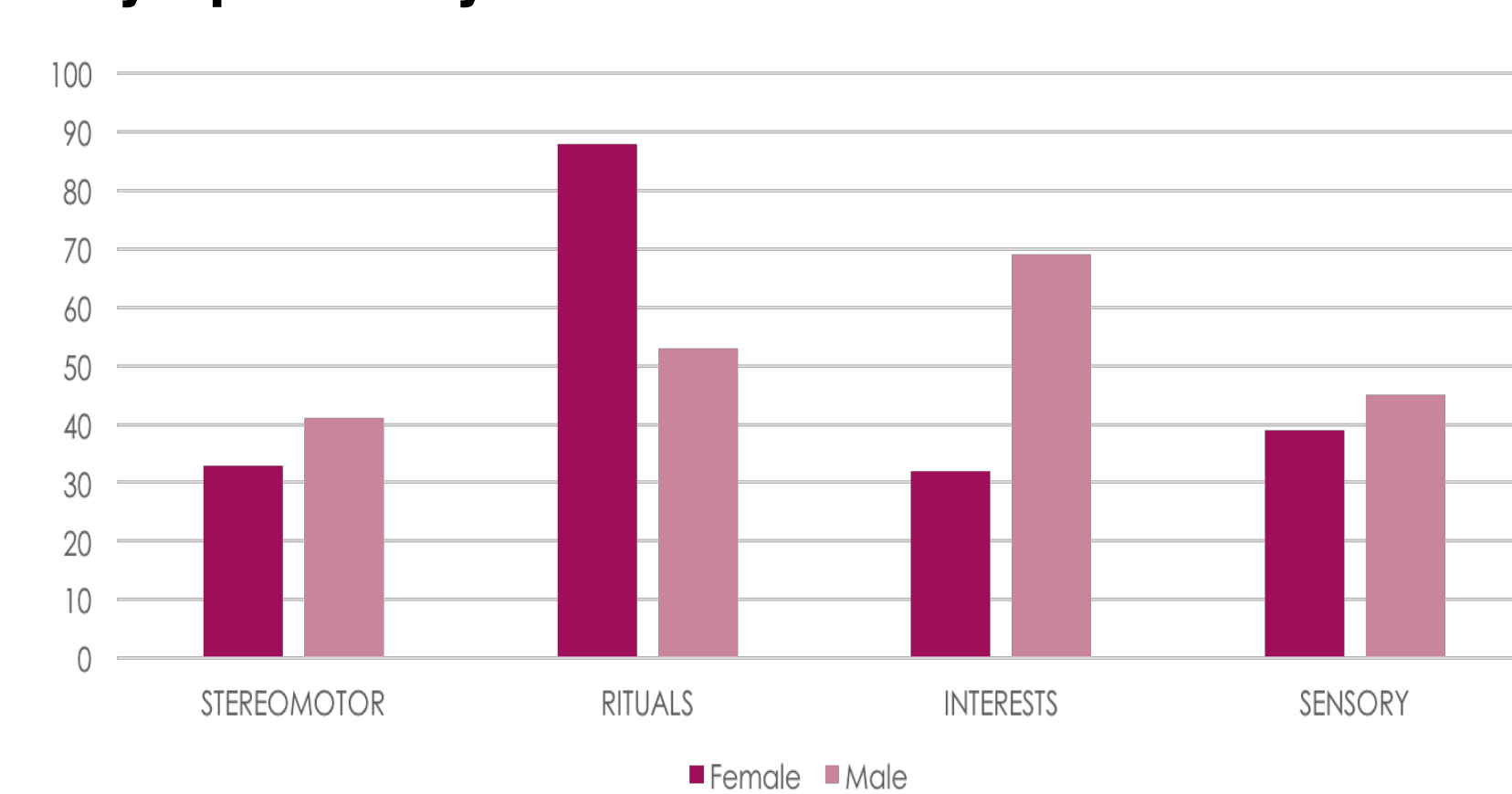
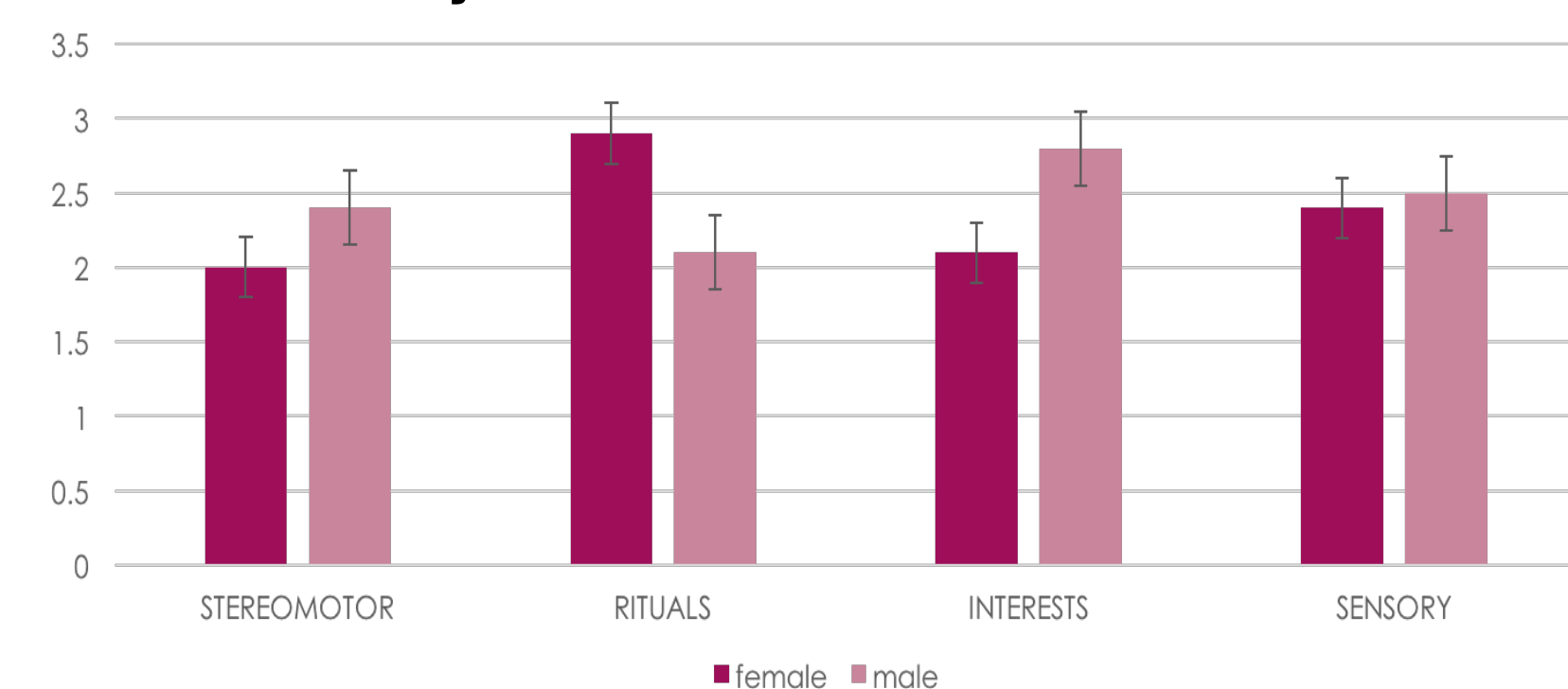


Figure 3. Mean severity score in each RRBIs symptom domain as endorsed by caregivers on PDDBI by sex.



A two way between groups multivariate analysis was performed to investigate sex differences in both clinician observed and caregiver reported symptoms. The dependent variables were the 7 (3 social, 4 RRBIs) DSM-5 symptom clusters/criteria (clinician report) and the corresponding 4 RRBIs categories from the PDDBI (caregiver report). Preliminary assumption testing was conducted to check for normality, linearity, univariate and multivariate outliers, homogeneity of variance, and multicollinearity with no serious violations noted. There was a statistically significant difference between males and females on the combined dependent variables, $F(11, 268) = 5.3, p = .013, \text{Wilk's } \lambda = .89, \text{partial } \eta^2 = .034$. An inspection of the means indicated that females showed more rituals and fewer restricted interests compared to males according to both clinician and caregiver reports (Figures 2 and 3).

Conclusions

- Results are consistent with previous reports that rituals may be more representative of a female profile (Antezana et al., 2018), and that males display greater intense interests (Knickermeier et al., 2005).
- Females in the general population show twice the rate of OCD after puberty, indicating there may be a link between OCD behaviors and female hormones. Similarly, Knickermeier et al., (2005) reported a significant correlation between fetal testosterone levels and restricted interests in males.
- Females with ASD have shown to have greater overlap of hoarding and self-injurious behaviors and are more likely to have a comorbid diagnosis of OCD (Antezana et al., 2018). In addition, many females with eating disorders have ASD traits (Huke et al., 2013). It is possible that female symptoms may be construed as symptoms of other disorders, rather than as fulfilling criteria for ASD.
- Females may learn to camouflage intense interests – as they get older, *i.e.* an interest in horses may be missed as an RRBIs in girls with ASD.
- On average, females with ASD are diagnosed over 4 years later than their male counterparts (Begeer et al., 2013). This may be, in part, because clinicians more readily have heuristics about how males with ASD present and because the instruments themselves may have some bias (for example, using examples that are behaviors more likely to be seen in males). Continued research is needed on differences in male versus female presentation in order to improve early diagnosis for females with ASD.

References

Allely, C. S. (2019). Exploring the female autism phenotype of repetitive behaviours and restricted interests (RBRIs): a systematic PRISMA review. *Advances in Autism* 5(3), 171-186.

Andersson, G. W., Gillberg, C., & Miniscalco, C. (2013). Pre-school children with suspected autism spectrum disorders: do girls and boys have the same profiles?. *Research in Developmental Disabilities*, 34(1), 413-422.

Antezana, L., Factor, R. S., Condy, E. E., Strega, M. V., Scarpa, A., & Richey, J. A. (2018). Gender differences in restricted and repetitive behaviors and interests in youth with autism. *Autism Research*.

Begeer, S., Mandell, D., Wijnker-Holmes, B., Venderbosch, S., Rem, D., Stekelenburg, F., Koot, H.M. (2013). Sex Differences in the Timing of Identification Among Children and Adults with Autism Spectrum Disorders. *J Autism Dev Disord*, 43(5), 1151-6.

Dean, M., Harwood, R., & Kasari, C. (2017). The art of camouflage: Gender differences in the social behaviors of girls and boys with autism spectrum disorder. *Autism*, 21(6), 678-689.

Harrop, C., Gulsrud, A., & Kasari, C. (2015). Does gender moderate core deficits in ASD? An investigation into restricted and repetitive behaviors in girls and boys with ASD. *Journal of Autism and Developmental Disorders*, 45(11), 3644-3655.

Hiller, R. M., Young, R. L., & Weber, N. (2014). Sex differences in autism spectrum disorder based on DSM-5 criteria: evidence from clinician and teacher reporting. *Journal of Abnormal Child Psychology*, 42(8), 1381-1393.

Huke, V., Turk, J., Saedi, S., Kent, A., Morgan, J. F. (2013). Autism spectrum disorders in eating disorder populations: a systematic review. *Eur Eat Disord Rev*, 21(5), 345-51.

Knickermeier, R., Baron-Cohen, S., Raggatt, P., and Taylor, K. (2005). Foetal testosterone, social relationships, and restricted interests in children. *J. Child Psychol. Psychiatry* 46, 198-210.

Leekam, S. R., Prior, M. R., & Uljarevic, M. (2011). Restricted and repetitive behaviors in autism spectrum disorders: a review of research in the last decade. *Psychological Bulletin*, 137(4), 562-593.

Reinhardt, V. P., Wetherby, A. M., Schatschneider, C., & Lord, C. (2015). Examination of sex differences in a large sample of young children with autism spectrum disorder and typical development. *Journal of Autism and Developmental Disorders*, 45(3), 697-706.

Stone, W.L., Hoffman, E.L., Lewis, S.E., Ousley O.Y. (1994). Early recognition of autism. Parental reports vs clinical observation. *Arch Pediatr Adolesc Med*, 148(2), 174-9.

Supekar, K., & Menon, V. (2015). Sex differences in structural organization of motor systems and their dissociable links with repetitive/restricted behaviors in children with autism. *Molecular Autism*, 6(1), 50.

Tillmann, J., Ashwood, K., Absoud, M., et al. (2018). Evaluating sex and age differences in ADI-R and ADOS scores in a large European multi-site sample of individuals with autism spectrum disorder. *J Autism Dev Disord*, 48(7), 2490-2505.

Ventola, P.E., Kleinman, J., Pandey, J., Barton, M., Allen, S., Green, J., Robins, D., Fein, D. (2006). Agreement among four diagnostic instruments for autism spectrum disorders in toddlers. *J Autism Dev Disord*, 36(7), 839-847.

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