

# Sex and Gender-Based Diagnostic Disparities in Autism

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# Language Statement



## Autism

Denotes anyone who identifies as autistic



## Identify First Language

“Autistic Youth” and not “Youth with Autism”



## Neuro-affirming Language

Symptoms -> difficulties  
Comorbid -> co-occurring



## Neurotypical

Those who are not autistic or have another neurodevelopmental disability

# Language Statement



## Gender / Sex

Gender = gender identity

Sex = sex assigned at birth, indicated  
by assigned female at birth (AFAB)  
and assigned male at birth (AMAB)



**3 males : 1 female**



(Loomes et al., 2017)

**9 males : 1  
females** (w/o ID)

(Rivet & Matson, 2011)

**2 males : 1  
females** (w/ ID)

(Polyak et al., 2015)





# Difficulty Profiles

- Two core areas: restrictive and repetitive behaviors (**RRBs**) and social communicative difficulties (**SCD**)
- School-aged girls have lower reported rates RRBs<sub>1</sub>
- Equivalent levels of SCDs<sub>1</sub>
- Females have fewer externalizing and social problems<sub>2</sub>
- 4x more likely to be diagnosed with a past speech problem<sub>3,4</sub>
- Sex is a significant predictor of perceived atypicality; females need more significant difficulties to be perceived as atypical<sub>5</sub>

\*Based on the current Diagnostic Statistical Manual (V)

(1) Lai et al., 2011; (2) Supekar & Menon, 2015; (3) Mandy et al., 2012; (4) Stacy et al., 2014; (5) Geelhand et al., 2019





# Diagnostic Age

- Girls have been found to be **diagnosed at significantly later ages**<sub>1,2,3</sub>
- Sex differences **widen with age**
- Toddlers are not found significantly different<sub>4</sub>
- School-aged girls have lower RRBs<sub>5</sub>
- No sex differences in reports of childhood autism traits<sub>6</sub>





# Autistic Females

- Autistic females tend to appear as “shy” rather than have disruptive behaviors
- Often told they are “blunt”
- Have poor social outcomes
- Lesser rigidity present





# Camouflaging

- Autistic females appear to have better social skills due to practicing and scripting behaviors from other people
- **Camouflaging:** a social strategy to cope with social situations by hiding autistic traits and perform “neurotypical” social traits
- Is associated with worsened mental health difficulties and lower rates of diagnosis



# Intersection of Autism and Genderqueer Identities



- Research investigating themes of gender within the field of autism has been restricted to a binary scope, analyzing only the variables of “females and males” or “men and women”
- Lacks gender-diverse individuals in samples
- Transgender and gender-diverse individuals were found to be 3.03 to 6.36 times more likely to be autistic than cisgender individuals
- Reciprocally: autistic youth were found to be 7.59 times more likely to have parent-reported “gender-variance”
- Children with autism were over four times as likely to be diagnosed with gender dysphoria





# Research Ideas

- To better understand the difficulty profile of autistic females and transgender and gender diverse autistic individuals
  - Further investigation on how this impacts diagnosis and access to services



# Today's Topics:



Quantitatively Examining  
Assessments

Qualitative Examining the  
Diagnostic Process





# Why examine assessments?

- The heterogeneous nature of autism requires capturing wide range of severity
- Whether their **efficacy carries over to females** with lesser RBBs and differing difficulty profile





# The Current Study

Differing symptom profiles?

Differences in severity?

Differing latent structures?





# 1a. Methods





# Secondary data analysis

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National Database of Autism Research

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- Included the Autism Diagnostic Observation Schedule-II (Lord, 2012)

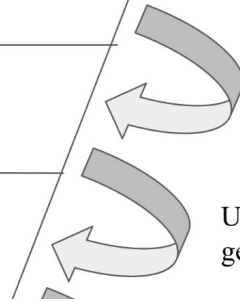


# Sample Description

National Database of Autism Research

Using Data Structures Feature to Pull Specific Variables

5687 cases



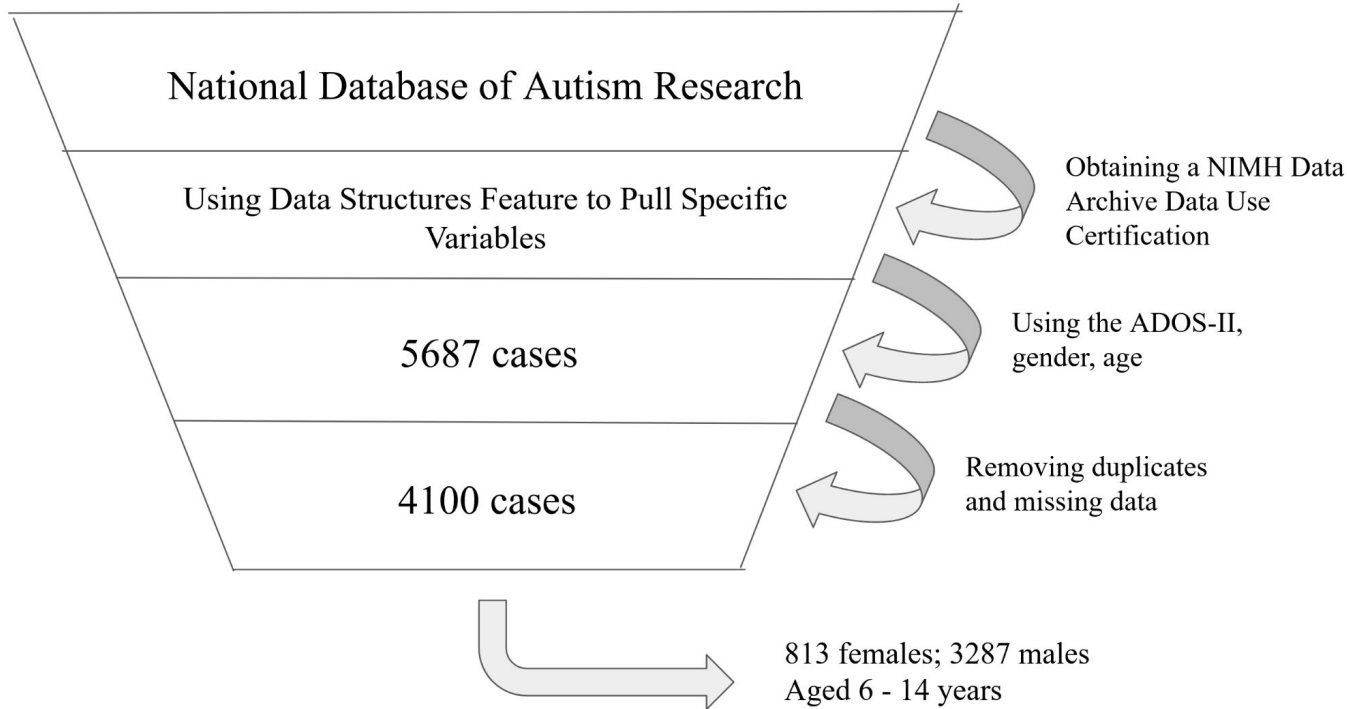
Obtaining a NIMH Data Archive Data Use Certification

Using the ADOS-II, gender, age

- Included the Autism Diagnostic Observation Schedule-II (Lord, 2012)
- 68 studies, 6 to 14 years old



# Sample Description



- Included the Autism Diagnostic Observation Schedule-II (Lord, 2012)
- 68 studies, 6 to 14 years old
- From 2009-2022



# ADOS-II (Lord et al., 2000)

- By an examiner, a series of tasks
- Four main modules
- Subsections of each module
  - Unstandardized & standardized severity scores
- Diagnostic accuracy and popularity
- Normed used male sample

**ADOS-2**

Module 2

**Phrase Speech**

Child ID: \_\_\_\_\_

Gender: Female  Male

Date of Birth: \_\_\_\_\_

Date of Evaluation: \_\_\_\_\_

Chronological Age: \_\_\_\_\_

Examiner: \_\_\_\_\_

Other Information: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

**Observation/Coding**

1. Construction Task
2. Response to Name
3. Make-Believe Play
4. Joint Interactive Play
5. Conversation
6. Response to Joint Attention
7. Demonstration Task
8. Description of a Picture
9. Telling a Story From a Book
10. Free Play
11. Birthday Party
12. Snack
13. Anticipation of a Routine With Objects
14. Bubble Play

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Copyright © 2002 by Western Psychological Services. All rights reserved. Printed in U.S.A. 0 6 7 6 5 4 3 2 1  
ADOS-2 MODULE 2





# Sample Description

## Four Modules - Descriptives:

- Module 1: 1084 individuals, ( $M_{age} = 8.4$ ) were identified from 27 studies
- Module 2: 506 individuals, ( $M_{age} = 8.5$ ) were identified from 39 studies
- Module 3: 4100 Individuals, ( $M_{age} = 9.9$ ) were identified from 68 different studies
- Module 4: Only 20 cases from 4 studies - therefore excluded from the overall severity
- Comprehensive Severity Dataset: Standardizing the scores



# 1b. RESULTS





# Multilevel Modeling

- Utilized multilevel modeling
  - Within study model: individual ADOS-II scores
  - Between study model: study characteristics
- Sex differences were significant when controlling for age
  - Females consistently scored lower than males ( $p < .05$ ) within each module for total, RRB, and SCD scores

Tien, I., et al.. (2023). Examining Diagnostic Trends and Gender Differences in the ADOS-II. Journal of Autism and Developmental Disorders.



# Multilevel Modeling

- More information is needed as to why and how this differs on this measure
- Examination via measurement invariance is required
  - Testing whether the ADOS-II measures the same underlying concept (autism-based difficulties) in the same way across sexes



# MGCFA: Analytical Plan

- Multi-group confirmatory factor analysis (MGCFA) represents a theory-driven approach to test a priori factor structure and goodness-of-fit statistics vary across specific groups
- Examine the structure of the algorithmic severity scores within the ADOS-II and whether there was any variation by gender, to supplement the primary HLM analysis results

Tien, I., et al. (2024). Gender Differences: Confirmatory Factor Analysis of the ADOS-II. *Journal of Autism and Developmental Disorders*.



# MGCFA: Results

## M1. Configural Invariance

- Examined whole dataset without differentiating sample
- Distribution of individual item responses was typical of standard ADOS-II responses
- Used several model fit statistics
- The 2-factor model was fitted well to the dataset





# MGCFA: Results

## M2. Metric Invariance

- Data might not support the same loading pattern across groups, but only with certain items
- Metric invariance model was far too restrictive
- Metric invariance was not established

## M3. Partial Invariance

- Adjusted the model to freely estimate a subgroup of items using a univariate score tests
- Two items on the RRB scale and three items on the SCD scale contributed to significantly to model fit improvement





# MGCFA: Results

Model Fit				Model difference			Comparison
Model	$\chi^2$	<u>df</u>	CFI	RMSEA [90% CI]	Adjusted $\Delta\chi^2$	<u>df</u>	
M1: Configural Invariance	1419.976	146	0.948	0.065 [0.062, 0.068]	-	-	-
M2: Metric Invariance	1499.416	158	0.945	0.064 [0.061, 0.067]	40.55	12	M1 vs M2
M3: Partial Invariance	1439.698	153	0.947	0.063 [0.061, 0.066]	10.25	7	M1 vs M3
M4: Scale Invariance	1493.651	163	0.945	0.062 [0.060, 0.065]	61.27	10	M3 vs M4

Tien, I., et al. (2024). Gender Differences: Confirmatory Factor Analysis of the ADOS-II. Journal of Autism and Developmental Disorders.

**Table 3. Partial Invariance Model Results**

		Standardized Factor Loadings (SE)				Thresholds (SE)							
		Girls		Boys		0 to 1		1 to 2					
		Girls	Boys	Girls	Boys	Girls	Boys	Girls	Boys				
RRB	A4	0.490	-	0.546	-	-0.664	(0.048)	-0.634	(0.023)	0.970	(0.052)	0.753	(0.024)
	D1	0.456	(0.093)	0.508	(0.093)	0.141	(0.044)	0.075	(0.022)	1.031	(0.054)	0.824	(0.024)
	D2	0.146	(0.151)	0.438	(0.089)	0.444	(0.046)	0.427	(0.022)	0.853	(0.050)	0.923	(0.025)
	D4	0.498	(0.210)	0.286	(0.069)	0.194	(0.044)	0.070	(0.022)	1.125	(0.056)	0.771	(0.024)
SCD	A7	0.473	-	0.482	-	-0.131	(0.044)	-0.405	(0.022)	1.041	(0.054)	0.900	(0.025)
	A8	0.464	(0.044)	0.473	(0.044)	-0.354	(0.045)	-0.403	(0.022)	0.858	(0.050)	0.701	(0.024)
	A9	0.405	(0.042)	0.413	(0.042)	0.229	(0.044)	-0.170	(0.022)	1.431	(0.065)	1.272	(0.029)
	B1	0.253	(0.091)	0.379	(0.056)	-0.492	(0.046)	-0.778	(0.024)	-	-	-	-
	B2	0.195	(0.047)	0.199	(0.047)	-0.203	(0.044)	-0.372	(0.022)	-	-	-	-
	B4	0.640	(0.081)	0.592	(0.052)	0.163	(0.044)	-0.273	(0.022)	1.312	(0.061)	0.878	(0.025)
	B7	0.703	(0.055)	0.717	(0.055)	-1.229	(0.058)	-1.485	(0.033)	1.010	(0.053)	0.790	(0.024)
	B9	0.734	(0.055)	0.749	(0.055)	-1.522	(0.069)	-1.571	(0.035)	0.970	(0.052)	0.738	(0.024)
	B10	0.578	(0.081)	0.670	(0.053)	-0.238	(0.044)	-0.571	(0.023)	0.990	(0.053)	0.735	(0.024)
	B11	0.759	(0.057)	0.775	(0.057)	-0.615	(0.047)	-0.844	(0.025)	1.052	(0.054)	0.751	(0.024)
	Factor Correlations												
	RRB	-	-										
	SCD	0.282	-	0.294	-								

Note. The residual covariances for the items A8 ~ B2, A8 ~ D4, and B2 ~ D4 are 0.416, 0.286, and 0.307 for girls and 0.611, 0.424 and 0.503 for boys, respectively. For item B2, the category 1 and 2 were collapsed to retain enough cases, resulting in one threshold.



# MGCFA: Discussion

- Partial measurement invariance was established on the ADOS-II
- Gives very little information about what, on the ADOS-II, is valuable to the diagnosis of females
- Requires a further examination into the latent structure of the measure



# LSIRM: Analytical Plan

- Using a novel technique called Latent Space Item Response Modeling (Jeon et al., 2021)
- In typical item response models, looking at how well independent items load onto factors
  - How well each item fits within these groups of factors
  - Examines the probability that someone is able to respond to that item correctly (e.g. endorsing that item)

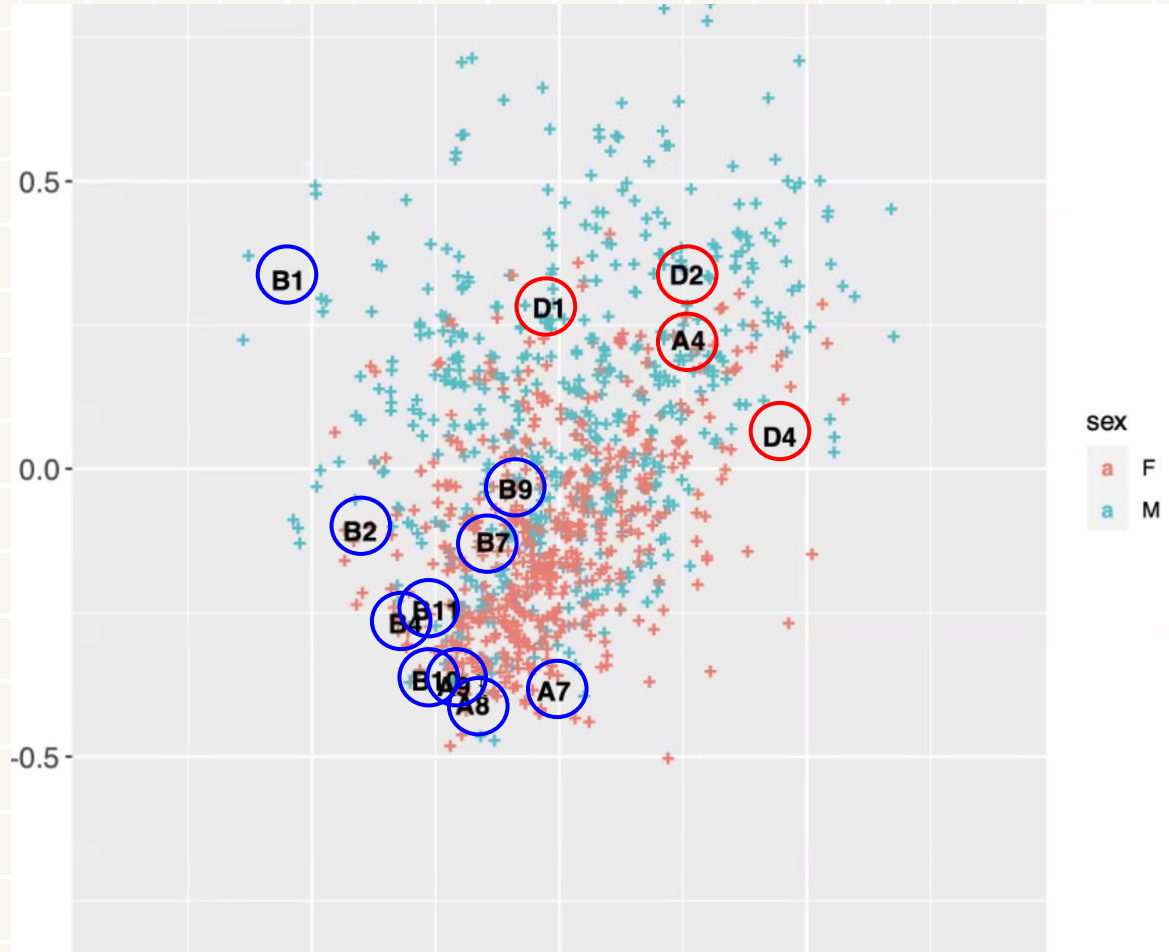
Tien, I., Luo, J., Huang, Y., Jeon, M.J. (Under Review). Visualizing Sex Differences on the ADOS-2 Using a Latent Space Item Response Model.



# LSIRM: Analytical Plan

- In classic item response models , it's assumed all items with the same difficulty have the same response probability
  - This can be easily violated
- The LSIRM allows for both the probability of a person's response and the item to be embedded within a latent space

# LSIRM Model





# Discussion

- In line with our hypotheses: males scored significantly higher than females on both RRB and SCD scores.
- Difference in psychometric structure - with the largest variation in RRBs, consistent with the literature
- Females may endorse SCD items best, suggesting the re-weighting the ADOS scoring mechanism





# Discussion

- What does this indicate?
  - The ADOS-II (and potentially other diagnostic instruments) are biased towards capturing male difficulties better than female difficulties
  - This may make it more difficult, instrument-wise, for females to be diagnosed
- There are many other reasons for missed diagnosis, too: clinician bias, self-acceptance, etc.
- Must rely on qualitative methodology to understand these other reasons





Questions?



*Qualitative Analysis: How  
does the diagnostic  
process differ by sex and  
gender?*





2a.

Methods



## Participants

- 24 autistic individuals with
  - a. a clinical diagnosis of autism (n = 16) or self identification of autism (n = 8)
- Participants identified as
  - a. non-binary, agender, or genderfluid (n = 14)
  - b. female (n = 8)
  - c. male (n = 2)

## Interviews

- Inclusion criteria for the present study included
  - a. living in the United States
  - b. being aged at least 18 years
  - c. identifying as autistic
- Semi-structured open-ended interviews
  - a. Brief 10- to 40-minute Zoom interview (M = 19.07)

## Coding Process

- Qualitatively coded using Dedoose
- Reached theoretical sufficiency
- Reflexive thematic analysis (RTA; Braun & Clarke, 2013)
  - a. Theoretically flexible method
  - b. Theories within disabilities studies, social cognition, and gender performativity

## Theories (continued) and Positionality

- Social cognitive theory of development:
  - a. Individuals effortfully behave according to their normative scripts associated with a certain identity
- Positionality Statement
  - a. Members of the research team had differing identities: cisgender, non-binary, neurodivergent, neurotypical, disabled, and non-disabled identities were used in crafting this paper.



02b.

Findings



## “Only Boys Can be Autistic”

- Male gender is inexplicably tied to the diagnostic accuracy of autistic individuals
  - a. Dates back to the original DSM description of autism
- Being socialized as a female leads to precarity and inequality in how others fail to acknowledge their autistic difficulties
- Media depiction of autism perpetuates the embodiment of a minority status

Tien, I., et al, (2025). “Only Boys can be Autistic”: A Qualitative Exploration of Gender Stereotype and Socialization on the Diagnostic Journey. *Autism in Adulthood*.

## “If I checked all the boxes, nobody really cared”

- Being labelled as “academically compelled” or “weird” rather than autistic
  - a. Experiences and struggles were weaponized as a negative attribute rather than bringing attention to their struggles
- Sensory difficulties were often explained away as “acute sensitivities”
- RRBs were used as a reason to label them as “weird” or different rather than seek an explanation/assessment

Tien, I., et al, (2025). “Only Boys can be Autistic”: A Qualitative Exploration of Gender Stereotype and Socialization on the Diagnostic Journey. *Autism in Adulthood*.

## “I was raised in service of others”

- Based off the idea of gender and social role theory
  - a. Men and women perform their assigned gender through particular behaviors
- Gender had an inherent tie to the stereotype of autism, impacting their ability to be diagnosed: an identity of being a girl/woman clashed with the identity of being autistic
  - a. Being “picky” and “emotional” were expected and overlooked
  - b. Being “in service of others”

Tien, I., et al, (2025). “Only Boys can be Autistic”: A Qualitative Exploration of Gender Stereotype and Socialization on the Diagnostic Journey. *Autism in Adulthood*.

## “I was raised in service of others”

*I was basically raised to be in service to other people... anything that wasn't in service, so all of my autistic traits were beaten out of me. . . I don't think I would have learned to build this intensely complex system of coping if I had been a boy because it's just not necessary. I would have been allowed to get angry... past the age of 10. I don't know that I would have gotten diagnosed, but I definitely think that more people would have been like, “are you sure she's okay” versus “oh, they're a little different, [so] we're just not going to invite her to a party.”*  
—Avery (they/them)

Tien, I., et al, (2025). “Only Boys can be Autistic”: A Qualitative Exploration of Gender Stereotype and Socialization on the Diagnostic Journey. *Autism in Adulthood*.

# Consequences and compensation of diagnostic failure

- Needing to mask as a form of internalizing their autistic difficulties
  - a. Masking and camouflaging was often picked up by socialization as a girl

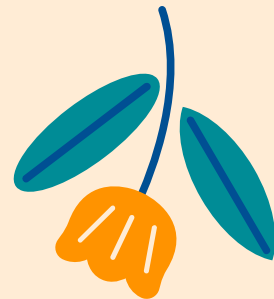
*I was AFAB and learning to internalize. I was very smart. I just barely failed my second-grade assessment because I had learned to recognize cartoon facial expressions. If the eyebrows go [down and furrowed, resembling a V] that's anger, etc. Growing up undiagnosed and unaware wasn't great for my mental health and figuring out my quirks lost its importance to the professionals once I got suicidal.— Ari (they/them)*

Tien, I., et al. (2025) "Creating a Socially Acceptable Version of Myself": A Qualitative Exploration of the Female and Nonbinary Experience of Navigating the Autism Diagnostic System. *Neurodiversity*



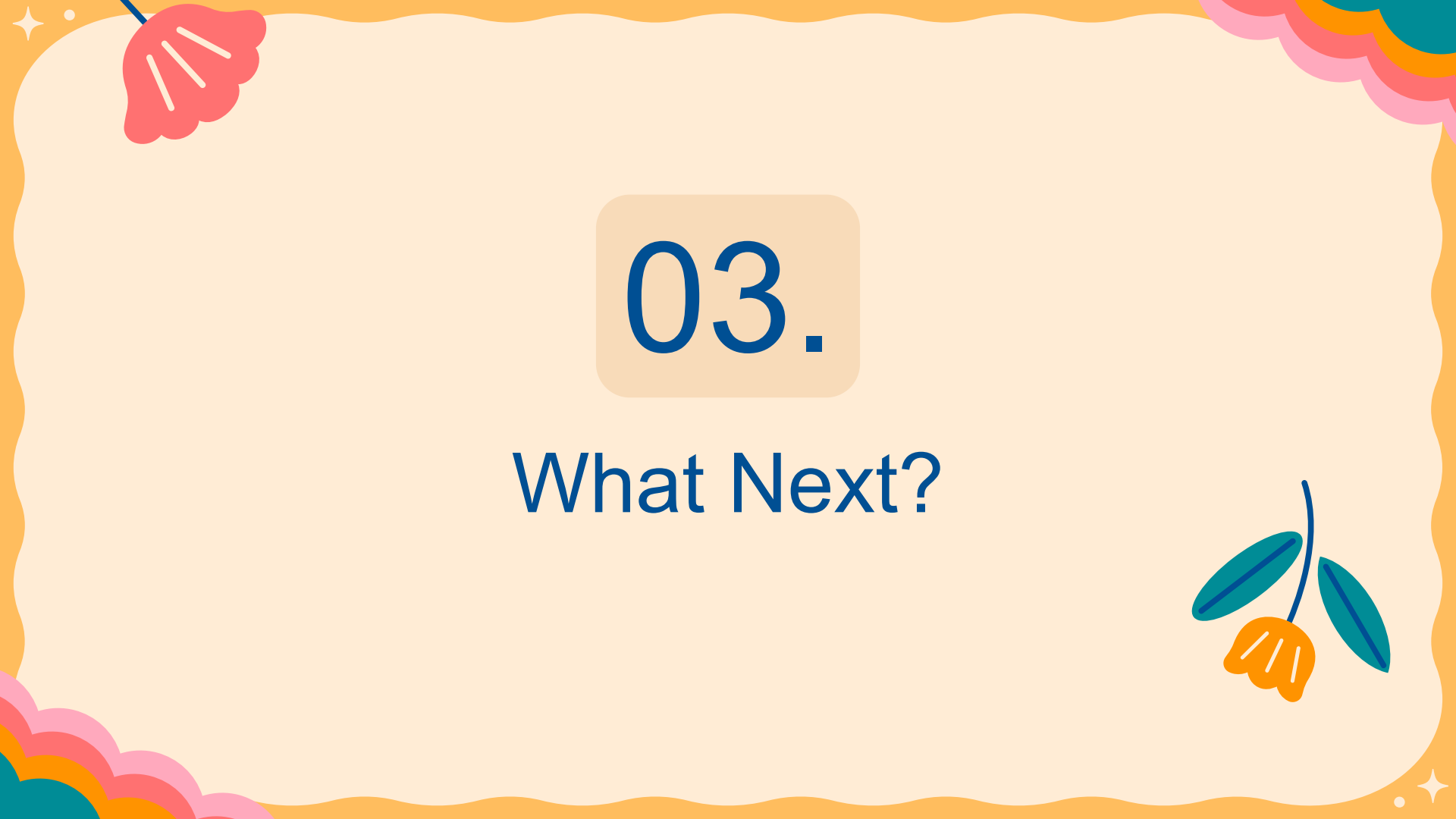

02c

# Discussion



# Findings

- These themes highlighted how the stereotype of autism being male-specific impacts the diagnosis and recognition on multiple levels
  - a. How autism's gender-based stereotype impacts how participants identify their own difficulties
  - b. Further understands the process of gender socialization for each person
  - c. Misdiagnoses leads to poorer lifelong trajectory
- Combating clinician and societal stereotypes in the diagnostic system



03.

What Next?



# Future Directions

- Understanding how diagnostic instruments can capture the specific phenotypic profiles of women and gender-diverse autistic individuals
- Whether other diagnostic instruments are biased, and creating equitable diagnostic instruments
  - Evaluating diagnostic instruments across gender identities
  - Creating instruments that evaluate the difficulties important to autistic people
- What unique difficulties are present for autistic AFAB, women, and transgender and gender diverse individuals: specifically, what mental health difficulties are more prevalent



# Thank you!

Questions?

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