Sex and Ethnicity Disparities in Autism Diagnosis: Population-Level Findings from Linked Health and Education Data

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Author Contributions

ES: conceptualisation, visualisation, methodology, formal analysis, writing – original draft, writing – review and editing. RE: methodology, formal analysis, writing – original draft, writing - review and editing. MaW: supervision, writing – review and editing. FM: conceptualisation, supervision. LG: conceptualisation, supervision, writing - review and editing. MeW: conceptualisation, supervision, writing - review and editing. MMW: conceptualisation, funding acquisition, supervision, writing - review and editing.

Statements and Declarations

Ethical Considerations

Ethical approval was granted by the University of Leeds School of Psychology ethics committee (PSCETHS-1381).

Consent to Participate

Connected Bradford has ethical approval for the access and processing of data without consent (IRAS ref: 239924, CAG ref: 18/CAG/0091 and REC ref: 23/YH/0109).

Consent for Publication

Not applicable.

Declaration of Conflicting Interests

No conflicts of interest.

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Data Availability

Data can be accessed via a successful application (https://bradfordresearch.nhs.uk/connected-wy/governance-and-ethics/).

Abstract

There is limited robust population-level evidence on the widely reported disparities in autism diagnosis by sex and ethnicity. Universal measures of school readiness, particularly the domains measuring social and emotional development, have been proposed as early indicators of developmental need, but whether the disparities in formal diagnoses across demographic groups are reflected in these population-level measures remains unclear. This study examined how sex, ethnicity, and their intersection were associated with the frequency and timing of childhood autism diagnoses and whether school readiness measures were associated with subsequent diagnosis across demographic groups. Linked health and education records for 55,054 children from a Northwest District of England were analysed using Poisson regression. Children from minoritised ethnic backgrounds and females were less like to receive an autism diagnosis and experienced significantly longer times to diagnosis than males and White British children. South Asian heritage females showed the greatest disadvantage. These patterns were not reflected across distributions of school readiness scores, suggesting diagnostic disparities by sex and ethnicity may reflect structural inequalities within identification pathways rather than true differences in underlying need. Developmental differences are evident and measurable by age five across demographics, highlighting the opportunity for earlier identification and support.

Lay Abstract

Autism affects how people communicate, interact, and experience the world. Identifying autism early can help children and families access support sooner and improve health, learning, and wellbeing. Qualitative research shows that ethnic minority groups and females are exposed to delays in receiving a diagnosis. Using linked health and education records for 55,054 children in Bradford District, West Yorkshire, England, we examined who receives an autism diagnosis and when they receive it. To investigate whether any variation in diagnosis rates between demographic groups could reflect true differences in underlying need, we examined whether these patterns are evident in universal measures of child development and school readiness at age 5 years. Females and children from minoritised ethnicities were less likely to receive an autism diagnosis and experienced longer waits for diagnosis than their White British male peers. These inequalities were greatest for South Asian heritage females. Not reaching a good level of development overall and receiving low scores across the measures of social and emotional development were strong markers of autism diagnosis. These associations were even stronger for South Asian heritage children. These findings suggest that even when South Asian heritage children show early developmental differences that are strongly associated with autism, they remain substantially less likely to receive an autism diagnosis than White British children. They also demonstrate that the developmental differences associated with autism are already evident at age 5 years, indicating that more could and should be done to identify children who could benefit from earlier assessment and support.

Key Words: Autism; Inequalities; Early Identification; School Readiness; Ethnicity, Sex differences.

Introduction

Autism prevalence and early identification

Autism is a heterogenous neurodevelopmental disorder characterised by differences in social interaction, communication, and sensory processing (American Psychiatric Association, 2013). In the 20 years up to 2018, the prevalence of autism in the UK grew eight-fold (Russell et al., 2022) and is now estimated to affect more than 1 in 100 people, after accounting for underdiagnosis (O'Nions et al., 2023). This increase reflects both growing awareness of autism as well as the requirement of a formal diagnosis in order to access support (Mon-Williams & Wood, 2023).

Children frequently experience long waiting times for autism assessment and delayed access to specialist services (Male et al., 2023; Wigham et al., 2022). Unidentified and unmet development needs have been associated with poorer academic attainment, reduced employment opportunities, increased mental and physical health difficulties, and greater reliance on health and social care services (Hirota & King, 2023; McDougal et al., 2020). The families of these children may experience increased caregiving responsibilities, financial pressures, and reduced participation in the labour market. Together, these challenges come at a substantial societal and economic cost. In contrast, early access to appropriate support is linked with improved quality of life, social wellbeing, and academic attainment (Mandy et al., 2022; Okoye et al., 2023). Thus, identifying and meeting development needs earlier could result in substantial, long-term public savings (Knapp et al., 2024). The existing evidence clearly highlights the importance of timely and equitable identification of autism.

Structural inequalities

Sex-based inequalities

It has been well documented that, even when accounting for level of need, females are more likely to be undiagnosed, misdiagnosed, or diagnosed later than males (Cook et al., 2024; Geelhand et al., 2019; Russell et al., 2021). However, population-level evidence examining demographic differences in autism diagnosis from administrative data remains limited. Existing global and UK estimates suggest a male-to-female autism diagnosis ratio of 3:1 (Russell et al., 2021; Yang et al., 2023), although substantial regional variation is evident across England, with estimated ratios ranging from 2:1 to 13:1 (Roman-Urrestarazu et al., 2021). Females without externalised behavioural difficulties appear to be at particular risk of missed or delayed recognition as the internalised presentations of autism that are more common among females are much harder to detect using current diagnostic criteria (Duvekot et al., 2017; Hull et al., 2020). Biases within assessment tools and the historical emphasis on male presentations of autism in clinical training and wider society may contribute to these disparities, although these represent only some of the clinical, social, and structural influences shaping diagnostic pathways (Brickhill et al., 2023; Chapman et al., 2022; Kalb et al., 2022).

Despite growing awareness, large population-level UK studies that simultaneously examine both likelihood and timing of autism diagnosis by sex remain limited. Existing research has primarily explored age-based inequalities and regional variation in male-to-female ratios, showing that females are more frequently diagnosed during adolescence compared to early childhood (O'Nions et al., 2023; Russell et al., 2021). Similarly, a recent US study found that

females were diagnosed significantly later than males, however, it did not examine whether sex difference also exist in likelihood of diagnosis (McQuaid et al., 2024).

Ethnicity-based inequalities

International research has revealed that minoritised ethnicities are more likely to experience language barriers, stigma, and are more likely to face discrimination, blame, and dismissal by clinicians when seeking a diagnosis (Kalb et al., 2022; Lindsay et al., 2024; Lovelace et al., 2018; Pham & Charles, 2023). Evidence within the UK is relatively limited, however, a recent narrative review revealed that despite appearing to have more severe forms of autism compared to the majority population, children from minoritised ethnic groups are less likely to be identified, referred, or diagnosed (Tromans et al., 2021). Consistent with these findings, evidence from the Born in Bradford cohort study showed that children with mothers of a Pakistani heritage were approximately 70% less likely to receive an autism diagnosis compared to children with White British mothers (Kelly et al., 2017). Another large-scale UK study reported the highest diagnosis rates were observed for Black students, but that most of this association was mediated by social disadvantage (Roman-Urrestarazu et al., 2021). These findings underscore the need for further population-level research with diverse UK populations.

Intersectionality

Children with multiple characteristics associated with inequality may experience compounded disadvantages throughout autism diagnostic and care pathways (Weiss et al., 2024). In the US, females from minoritised ethnic groups, particularly Asian and Black ethnicities, experience substantially longer delays in access to autism care pathways (Goldblum et al., 2023). However, UK evidence on intersectionality is limited, highlighting a crucial gap in understanding how sex and ethnicity compound to influence autism identification within the UK population.

Potential role of school readiness data

Reducing inequalities in autism diagnosis requires practical and feasible approaches to identifying children who may benefit from earlier identification and support. One promising approach is the use of routinely collected ‘school readiness’ measures, which are available internationally. In England, teachers complete the Early Years Foundation Stage Profile (EYFSP) for all children aged 4-5 years old in state-funded schools, providing a standardised assessment of development across seven domains encompassing both the academic and non-academic skills needed to engage with learning (Department for Education, 2024; Guhn et al., 2011).

Prior studies have explored the feasibility of using EYFSP data, alongside other metrics and clinical judgement, to support the identification of children with autism within school settings (Wright et al., 2021). Evidence from the Born in Bradford birth cohort study revealed that children who did not meet an expected level of development in the EYFSP were significantly more likely to receive an autism diagnosis (Wright et al., 2019). Children who fell below the average on a five-item EYFSP sub-score reflecting autism-related developmental domains were approximately 50 times more likely to have an autism diagnosis.

Building on these published findings, the current study set out to examine whether school readiness scores from the EYFSP varied between demographic groups. Unlike formal autism diagnosis pathways, which are subject to the inequalities and biases discussed above, the EYFSP gives a population-wide indication of early development. If variations in formal diagnosis

rates between demographic groups reflect true differences in underlying need, we would expect this to be reflected in the EYFSP scoring.

Rationale, aims, and objectives

Persistent inequalities in autism identification by sex and ethnicity, and the possibility that these disadvantages compound through their intersection, remain under-researched at the population level within the UK. Furthermore, the extent to which demographic differences in diagnosis rates reflect true differences in underlying need, and whether routinely collected school readiness measures could support the identification of children at increased likelihood of autism diagnosis remain unclear. Addressing these evidence gaps is essential to improve equitable access to timely support.

This study aimed to examine disparities in both prevalence and timing of childhood autism diagnoses by sex, ethnicity and their intersection, for a large population in England. It also investigated whether school readiness, as measured using the EYFSP, provides insights into underlying need across demographic groups, and signals the opportunity to identify unmet needs earlier.

This study addressed the following research questions:

1. Are there population-level disparities in the likelihood of receiving an autism diagnosis by sex and ethnicity, and do these characteristics intersect to compound inequalities?
2. Does the timing of autism diagnosis differ by sex and ethnicity?
3. To what extent are demographic disparities in autism diagnoses reflected in universal measures of early development?

Methods

Study design, participants, and setting

This secondary data analysis used the Connected Bradford dataset, a repository of linked public service data for all citizens in the Bradford district (Sohal et al., 2022). Bradford is a District in West Yorkshire, UK, characterised by a young population, and wide socioeconomic and health inequalities. Unlike many UK populations, Bradford comprises large White British and South Asian communities, providing a unique opportunity to investigate ethnic and intersectional inequalities with adequate statistical power (Kelly et al., 2017).

The study sample was constructed by linking child-level education records with corresponding data from NHS primary care for all individuals within the database for whom both data from the EYFSP aged 5 years and primary care records up to age 18 were available (N = 55,537). This sample covered six annual birth cohorts, labelled according to the year in which the child received an EYFSP assessment. Fewer than 1% of records (0.87%) had missing values for ethnicity and/or sex and so these records were removed. The final sample consisted of 55,054 children.

Variables

Autism Diagnoses

A list of clinical diagnosis codes (Clinical Terms Version 3) that correspond to an autism diagnosis in primary care records was agreed with a clinician (provided in full in Appendix A). In our sample, autism diagnosis was coded as a binary outcome where the presence of an autism code in the individual's primary care record was coded as 'true' and the absence of an autism code was coded as 'false'. Date of diagnosis was taken as the first date that a relevant code was recorded in the healthcare system.

Sex and Ethnicity

Sex was coded as a binary indicator (male/female) according to children's education records.

In line with previous literature involving the Connected Bradford cohort (Warburton et al. 2026), ethnicity was coded as a factor with three levels: White British, South Asian, and Other. This approach reflects the ethnic makeup of the Bradford District: in the current sample, 51% of children are from White British ethnicities and 37% are from South Asian heritages, leaving little statistical power to make meaningful comparisons of autism rates among 'other' ethnicities.

School readiness

In England, the EYFSP is the school readiness assessment used by teachers to measure a child's development at age 4-5 years of age. In the version of the EYFSP used here (pre-2012/2013 academic year), a good level of development (GLD) is a binary threshold which is reached/not reached according to whether a child scores 6 or more in each of the three personal, social, and emotional (PSE) development questions, and each of the four communication, language, and literacy questions. To reach a GLD, children must also have a total score (derived from all 13 questions across six learning areas) of 78 or more.

The developmental domains assessed by the EYFSP are not equally relevant to the challenges faced by autistic children. To ensure that the GLD threshold was not simply identifying children

whose needs are more characteristic of other developmental conditions, we examined scoring patterns in the PSE domain, which is more closely aligned with social-emotional differences associated with autism. Each child was assigned a combined PSE score from the sum of their scores for 'dispositions and attitudes', 'social development' and 'emotional development', ranging from 0 to 27 (Mean: 19.9). In line with previous research (Wright et al., 2019), children were classified as having 'Low PSE' scores where their scores fell more than 1 standard deviation below the mean.

Statistical analyses

All analyses were conducted in R (version 2024.12.0; Posit Team, 2024). Researchers considered $p < .05$ indicative of statistical significance throughout.

Descriptive statistics were plotted to visualise trends across demographics and cohorts. Unadjusted group differences in autism diagnoses were compared using Pearson's chi-squared tests. Adjusted Poisson regression models with robust standard errors (obtained using the sandwich covariance estimator (HC0) via R packages `sandwich` and `lmtest`) were used to estimate the relative risk of autism diagnosis according to sex and ethnicity, both as main effects and with the inclusion of interaction terms. This modified Poisson approach is recommended for binary outcomes when directly estimating risk ratios as it provides interpretable effect estimates while the robust variance estimator accounts for violation of the Poisson variance assumption (Zou, 2004; George et al., 2020).

We next investigated the direct effect of not reaching a GLD and whether this interacted with the other independent variables. Finally, a binary indicator of whether individuals received a low score on the PSE domain of the EYFSP was modelled, and the interactions with demographic characteristics explored. Predicted probabilities and pairwise comparisons were then examined to reveal significant associations.

The authors recognise that the terminology 'risk ratio' can reflect deficit-based frameworks of neurodivergence, and importantly, as we are expressly examining 'risk' of non-identification of need, using this terminology in the current context may be misleading. In this manuscript, while we are reporting risk ratios as the statistical model outputs, we have interpreted these findings in terms of the *likelihood* of receiving a diagnosis.

Results

Sample characteristics

Cohort sample sizes are similar across years, with a slight increase in each subsequent cohort (**Table 1**).

Table 1: Cohort counts and sample proportions

Cohort	N	Percentage of Sample
2007	8,458	15.36
2008	8,651	15.71
2009	9,056	16.45
2010	9,484	17.23
2011	9,686	17.59
2012	9,719	17.65

Note: Cohort labels reflect year of EYFSP assessment.

The sample characteristics were stratified by autism diagnosis, and Chi-squared tests confirmed highly significant differences in the proportions of each group who received an autism diagnoses (**Table 2**).

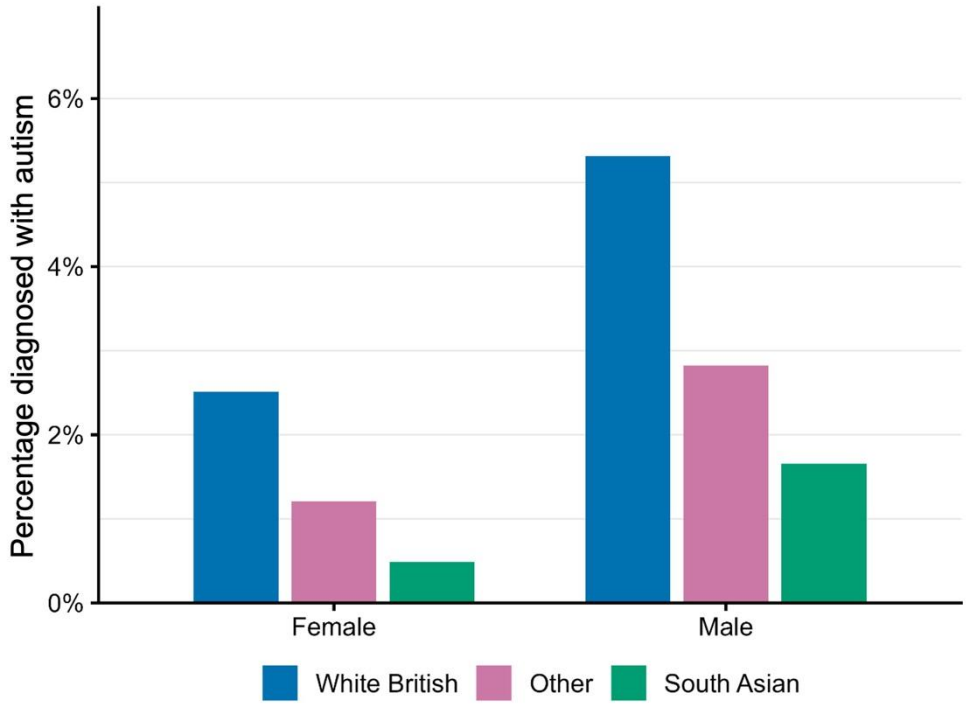
Table 2: Sample characteristics by autism diagnosis

	Total N	Autism N (%)	No Autism N	Pearsons Chi-squared p-value
	55,054	1,465 (2.66)	53,589 (97.34)	
Ethnicity				<.001
White British	28,007	1,110 (3.96)	26,897	
South Asian	20,531	222 (1.08)	20,309	
Other	6,516	133 (2.04)	6,383	
Sex				<.001
Male	28,302	1,038 (3.67)	27,264	
Female	26,752	427 (1.60)	26,325	
GLD				<.001
Reached	27,081	401 (1.48)	26,680	
Not Reached	27,973	1,064 (3.80)	26,909	
Low PSE score				<.001
False	47,088	824 (1.75)	46,264	
True	8,146	642 (7.88)	7,504	

Intersectional demographic differences in the prevalence of autism diagnosis by age 18 were further examined by stratifying by sex and ethnicity. **Figure 1** reveals a higher cumulative incidence of autism diagnosis for males across all ethnic groups. Across both sexes, White British children showed a higher cumulative incidence of autism diagnosis compared with South Asian heritage and Other ethnicity children.

Among females, White British children were diagnosed at 5.2 times the rate of South Asian heritage children, and 2.1 times the rate of Other ethnicity children. Among males, White British children were diagnosed at 3.2 times the rate of South Asian heritage children, and 1.9 times the rate of Other ethnicity children.

Figure 1: Percentage of children in each sex * ethnicity cohort diagnosed with autism by age 18 years



Longitudinal Trends in Autism Diagnoses Across Sex and Ethnicity

The percentage of children with an autism diagnosis recorded between birth and 18 years as a function of sex and ethnicity were plotted by cohort (**Figure 2**) and age (**Figure 3**). Among White British children, diagnosis rates increased notably across cohorts. In contrast, a smaller increase is observed in the proportion of South Asian heritage children with a diagnosis.

Figure 2: Cohort trends in the percentage of children diagnosed with autism, stratified by sex and ethnicity

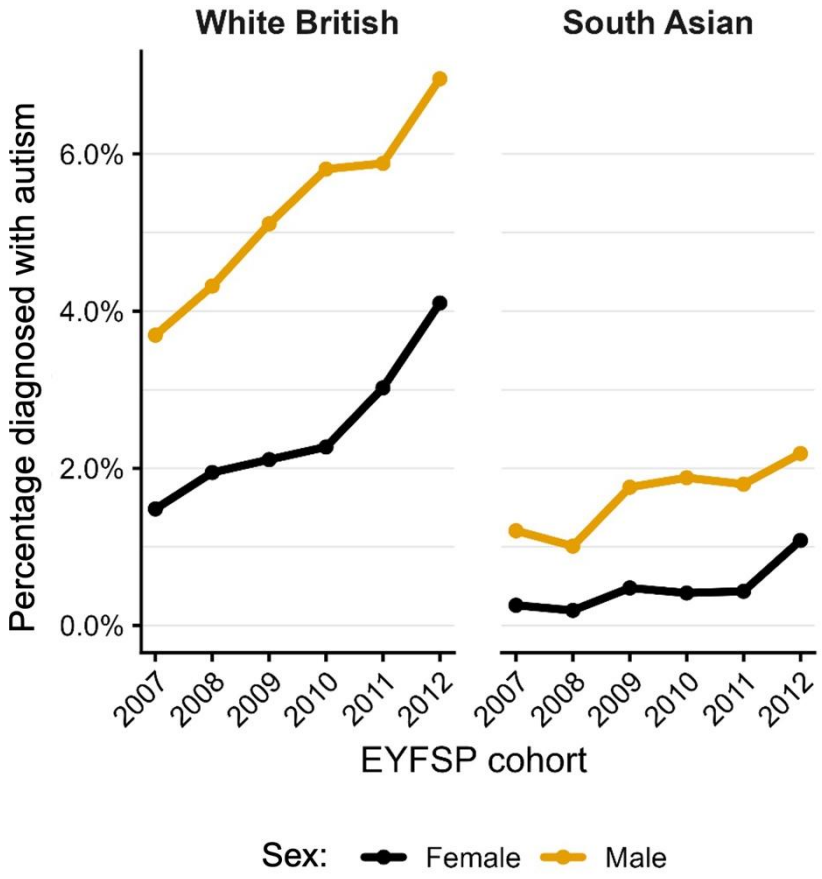
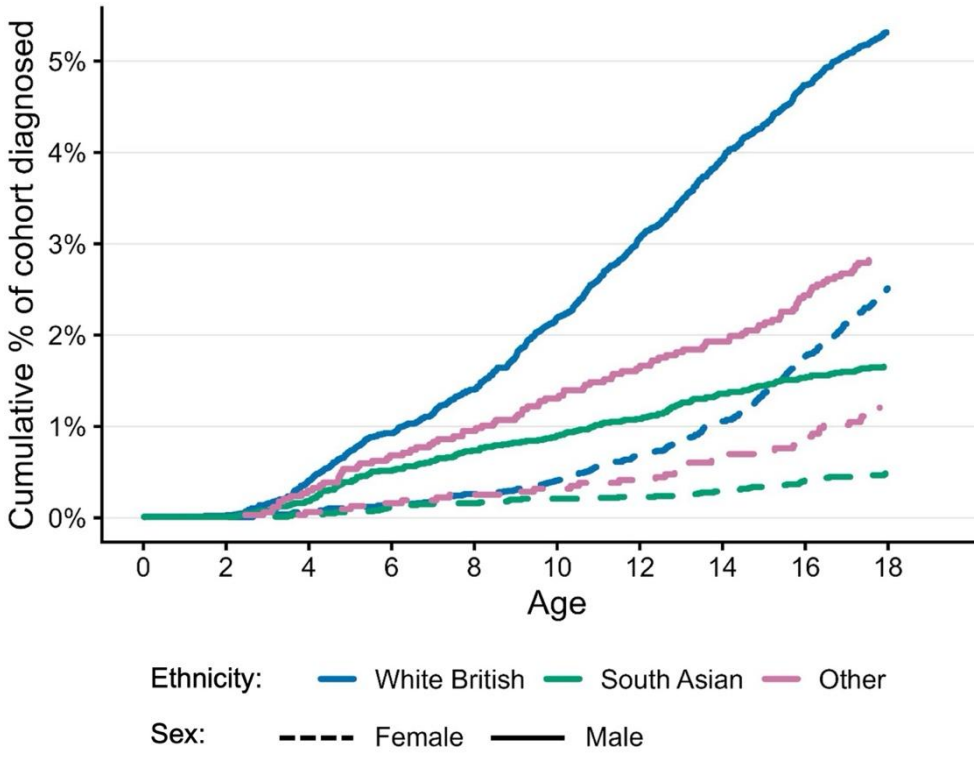


Figure 3 shows autism diagnoses by age and reveals a notable catch up effect as the rate of diagnosis among females increases in adolescence, especially for White British females. This pattern is reinforced by the change in ratio of male-to-female cumulative autism diagnosis between the ages of 5 and 18, from 7:1 to as low as 2:1 for White British and Other ethnicities (see Appendix D for figure). This narrowing of the diagnosis ratio with increasing age is consistent with females receiving diagnoses later than males.

Figure 3: Cumulative autism diagnoses by age, stratified by sex and ethnicity



Likelihood of Autism Diagnosis Across Sex and Ethnicity

Table 3 shows the regression outputs for the associations between the demographic characteristics and autism diagnosis by age 18 years, as well as the interaction effects of sex and ethnicity.

Table 3: Main effects of sex, ethnicity and cohort on likelihood of autism diagnosis, plus interactions between sex and ethnicity

Term	Risk Ratio	95% Confidence Interval		*p*-value
		Lower	Upper	
Intercept	0.04	0.03	0.04	
Female	0.44	0.39	0.49	<.001
South Asian	0.27	0.24	0.31	<.001
Other	0.50	0.42	0.59	<.001
Cohort 2008	1.18	0.95	1.47	.128
Cohort 2009	1.42	1.16	1.75	.001
Cohort 2010	1.61	1.32	1.96	<.001
Cohort 2011	1.78	1.46	2.16	<.001
Cohort 2012	2.19	1.82	2.65	<.001
Female*South Asian	0.62	0.44	0.88	.006
Female *Other	0.91	0.61	1.35	.632

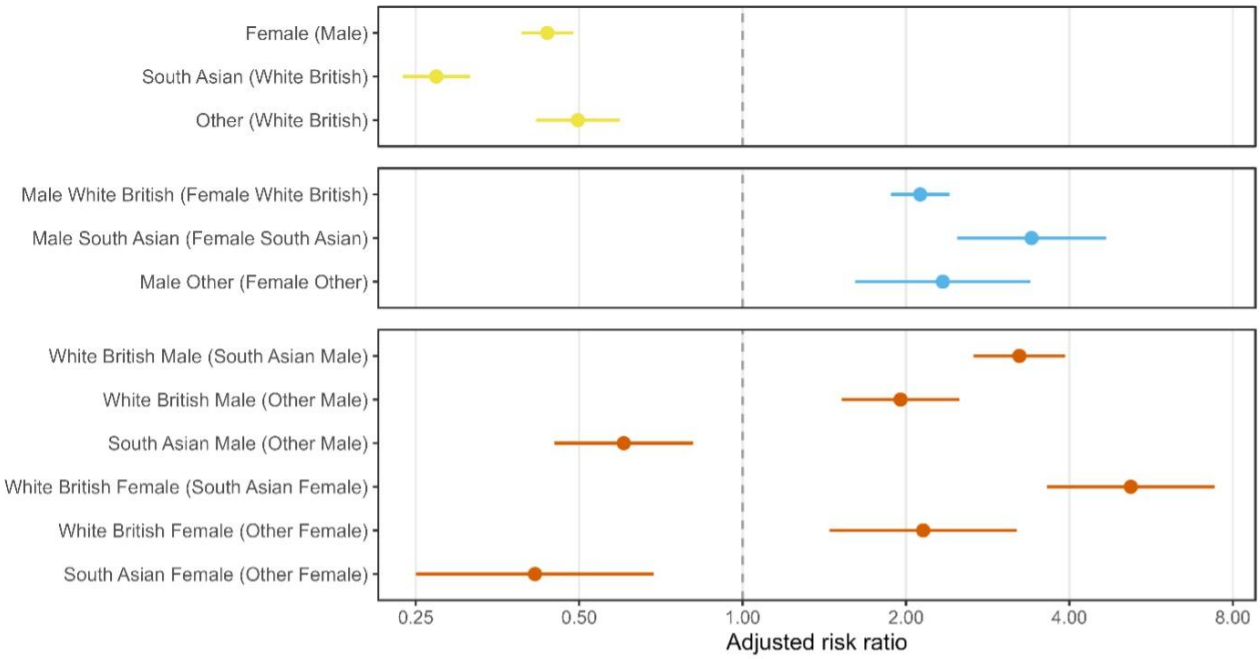
Note: Reference categories were Sex: Male; Ethnicity: White British; Cohort: 2007.

Autism diagnosis prevalence across the whole sample increased across successive cohorts: by the 2012 cohort, a diagnosis was around twice as likely than for the 2007 cohort (Risk Ratio (RR) 2.19, 95% Confidence Interval (CI) 1.82-2.65, p<.001). In the main effects model, White British females were 56% less likely to receive an autism diagnosis compared to White British males (RR 0.44, 95% CI 0.39–0.49, *p*<.001). A similar effect was observed for males from the Other ethnic backgrounds, who compared to White British males were 50% less likely to receive a diagnosis (RR 0.50, 95% CI 0.42–0.59, *p*<.001). This disparity was even larger for South Asian heritage males, who were 73% less likely to receive a diagnosis than their White British peers (RR 0.27, 95% CI 0.24–0.31, *p*<.001).

These main effects were largely unchanged by the addition of the interaction terms between sex and ethnicity. The interaction between sex and Other ethnicities was non-significant, however there was a significant interaction between sex and South Asian heritage (RR 0.62, 95% CI 0.44–0.88, *p*=.006), indicating that being female *and* being from a South Asian heritage was associated with even greater disadvantage than would be expected from simply multiplying the two main effects. The combined effect reveals that South Asian heritage females were approximately 91% less likely to receive an autism diagnosis than their White British male peers (RR = 0.47 * 0.31 * 0.62 = 0.09).

These significant interactions were confirmed through a cross-group pairwise comparison displayed in **Figure 4**. It can be clearly seen that the main effects of being Female or of non-White British heritage was associated with a reduced likelihood of receiving a diagnosis, and that being male across all ethnic groups is associated with an increased likelihood of diagnosis. The most pronounced interaction effect between sex and ethnicity was that White British males were approximately 11 times as likely to receive an autism diagnosis compared with South Asian heritage females, after adjusting for cohort differences (RR 11.00, *p*<.001). The pairwise comparisons and predicted probabilities are reported in full in Appendix F.

Figure 4: Adjusted pairwise risk ratios (95% confidence intervals) for autism diagnosis by sex and ethnicity

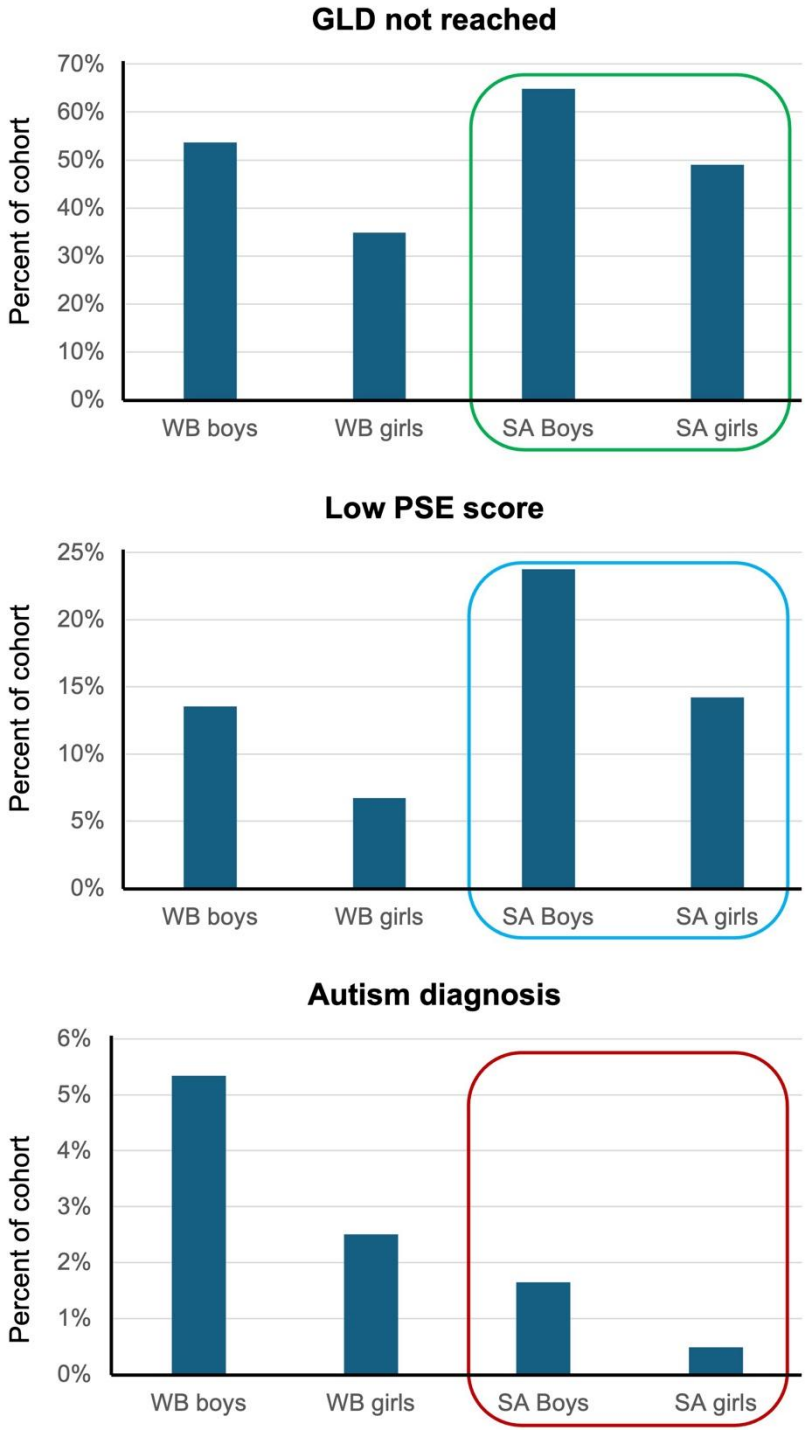


Note: A value of 1 represents no effect on the outcome.

School Readiness and Autism Diagnosis

A comparison of the development needs identified by EYFSP scores across demographic groups and the prevalence of an autism diagnosis revealed contradictory trends. **Figure 5** shows the proportion of children in each demographic cohort who did not reach a GLD aged 5 years, who received low scores on the PSE domain, and who went on to receive a diagnosis of autism. The relative proportions of South Asian children identified by the EYFSP as not having reached a GLD (green) and as receiving low scores across the PSE items (blue) indicate comparable or greater levels of need than those observed among White British children, yet these patterns are not reflected in the formal autism diagnosis rates (red).

Figure 5: Proportions of each demographic cohort (sex * ethnicity) that did not reach a GLD aged 5 years, received low scores in the PSE domain, and that received an autism diagnosis by age 18



The inclusion of GLD in the main effects model improved model fit (lowered AIC by 328) and reduced residual deviance (**Table 4**). Not reaching a GLD was associated with almost a three-fold increase in the likelihood of receiving an autism diagnosis by age 18 years (RR 2.80, 95% CI 2.50-3.13, *p*<.001) and this effect was consistent across cohorts (interaction with cohort tested separately and all p >.1). The main effects of sex, ethnicity and cohort were largely unchanged; a small reduction in the effect of being female was observed (from 56% less likely to 48% less likely; Appendix G) likely due to a higher proportion of females reaching a GLD than males.

Interaction terms (full outputs for interaction models available in Appendix H) revealed a smaller association between not reaching a GLD and later autism diagnosis for females compared to males (**Table 4**; RR 0.70, 95% CI 0.55-0.88, *p*=.003). Post-hoc pairwise comparisons showed that males who did not meet a GLD were four times as likely to receive a diagnosis (RR 4.03, 95% CI 3.18-5.11), while females who did not reach a GLD were around twice as likely to receive a diagnosis (RR 2.78, 95% CI 2.17-3.55).

Table 4: Main effect of not reaching a Good Level of Development (GLD) on likelihood of autism diagnosis, with interactions between GLD and sex, and GLD and ethnicity

Term	Risk Ratio	95% Confidence Interval		*p*-value
		Lower	Upper	
GLD not reached	2.62	2.34	2.93	<.001
GLD not reached *Female	0.68	0.54	0.87	.002
GLD not reached *South Asian	2.30	1.48	3.57	<.001
GLD not reached *Other	0.84	0.55	1.26	.393

Notes: GLD = good level of development. Reference categories were GLD: reached, Cohort: 2007, Sex: Male, and Ethnicity: White British.

As before, interaction terms for Other ethnicities were non-significant, however the effect of not reaching a GLD was significantly stronger among South Asian heritage children. The combined effect of being from a South Asian heritage and not reaching a GLD was associated with more than 6 times the likelihood of a diagnosis (RR 6.42, 95% CI 4.18-9.86). Despite this, the low baseline prevalence of formal autism diagnosis among South Asian heritage children means that South Asian males who *did not* reach a GLD aged 5 years were still 25% less likely to receive an autism diagnosis than White British males who *did* reach a GLD. To investigate this further, we next examined whether the underlying pattern of personal, social and emotional (PSE) development differ between demographic groups.

In line with previous research, receiving low scores in the PSE domain had an even larger association with later autism diagnosis (RR 5.11, 95% CI 4.63-5.65, p<.001) than not reaching a GLD (**Table 5**), and as with GLD this was consistent across all cohorts (p>.1). The effect of a low PSE score on autism diagnosis was significantly weaker for females than for males (RR 0.74, 95% CI 0.58-0.94, p=.013). In contrast, a low PSE score is associated with almost a 10-fold increase in likelihood of an autism diagnosis for South Asian heritage children compared to White British children (RR 2.11, 95% CI 1.55-2.88, p<.001).

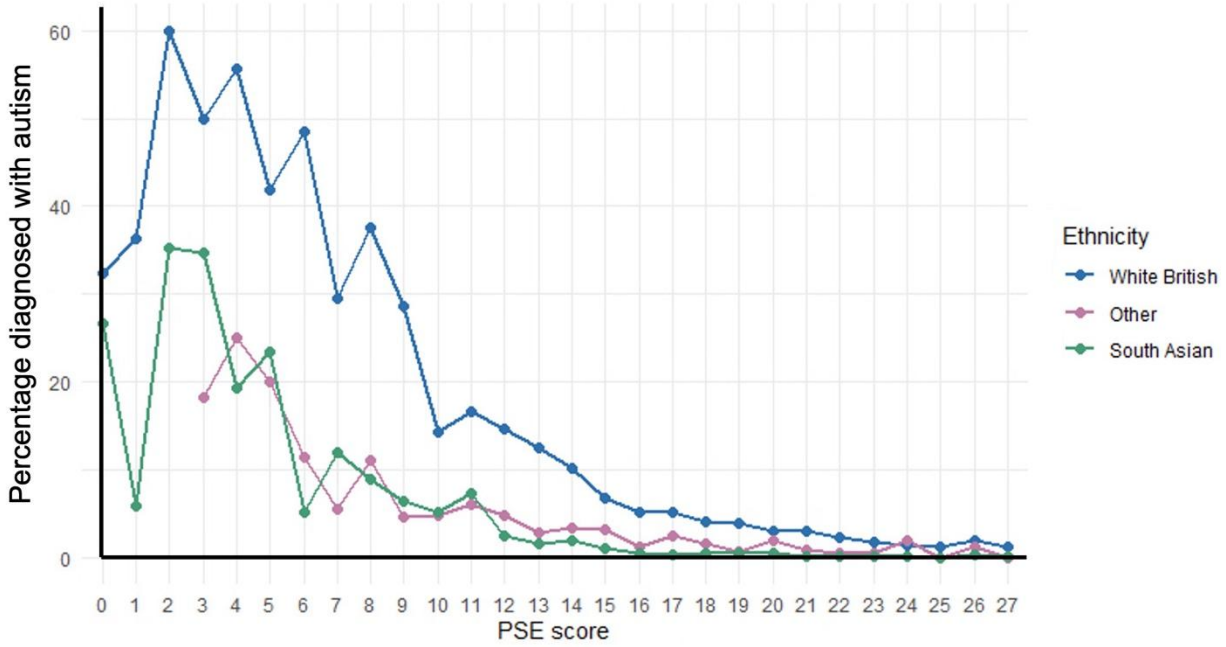
Table 5: Main effect of low scores in the Personal, Social and Emotional (PSE) items of the EYFSP, and interactions between low PSE scores and sex, and low PSE scores and ethnicity

Term	Risk Ratio	95% Confidence Interval		*p*-value
		Lower	Upper	
Low PSE	5.11	4.63	5.65	<.001
Low PSE *Female	0.74	0.58	0.94	.013
Low PSE *South Asian	2.11	1.55	2.88	<.001
Low PSE *Other	0.83	0.58	1.18	.289

Notes: PSE = Personal social and emotional development. Reference categories were Low PSE: False, Sex: Male, and Ethnicity: White British.

However, among children with similarly low PSE scores, South Asian heritage children are still around 71% less likely to receive an autism diagnosis than White British children. This can be seen is **Figure 6**, which shows the rates of autism diagnosis across PSE domain scores for each ethnic group. A similar effect was observed for females, who compared to males with the same scores were less likely to receive a diagnosis of autism.

Figure 6: Autism diagnosis rates across PSE score, stratified by ethnicity (observations representing <10 individuals suppressed)



Discussion

This study identified substantial disparities in the likelihood and timing of childhood autism diagnosis according to sex and ethnicity. Importantly, these disparities were not reflected in the universal measures of early development collected at school entry. Together these findings suggest that observed differences in autism diagnosis are more likely to reflect inequalities and biases in identification pathways rather than true differences in underlying developmental need.

Children from South Asian or other ethnic heritages were significantly less likely to receive a formal autism diagnosis compared to White British children. Similarly, being female was associated with lower likelihood of a diagnosis compared to males. We also revealed evidence of a catch-up effect, with male-to-female ratios in diagnosis falling from 7:1 to 2:1 by age 18, consistent with females receiving diagnoses later than males. This provides strong evidence towards diagnostic disparities reflecting limited recognition of the female autistic phenotype, masking, and biased assessment processes rather than true prevalence differences (Chapman et al., 2022; Hull et al., 2020; Kalb et al., 2022).

Evidence of an interaction effect between sex and ethnicity revealed that being of a South Asian heritage and female represented the largest disadvantage, reducing the likelihood of receiving a formal diagnosis by 91%, compared to White British males. This aligns with international evidence that ethnic minority females face substantial barriers and significant delays within autism pathways (Goldblum et al., 2023; McQuaid et al., 2024; Weiss et al., 2024). The current findings extend this work by demonstrating that these intersectional disparities are also pronounced among South Asian heritage females within a large UK population-level cohort.

We compared patterns of formal autism diagnosis to the universal assessment of school readiness in the form of the EYFSP, both as the overall 'good level of development' measure, and scores in the social domain, which has previously been linked with autism diagnosis. In line with previous research (Wright et al., 2019), across the sample as a whole these indicators were strongly associated with later autism diagnosis, however, contrasting patterns were observed across sex and ethnicity. Whilst female children were more likely to reach a good level of development, and to score higher in the social domain of the EYFSP than their male peers, children from South Asian heritages received lower scores across all domains compared to White British children.

The observed pattern of females scoring higher in the EYFSP is consistent with evidence that girls are more likely to engage in masking behaviours and tend towards more internalised presentations of autism that can make it harder to detect using current assessment tools and diagnostic criteria (Duvekot et al., 2017; Hull et al., 2020; Nelson & Lichwa, 2025). Among children who score the same in the PSE domain, girls were still less likely than boys to receive a diagnosis of autism, consistent with extensive evidence that even when level of need is accounted for girls are likely to be undiagnosed or diagnosed later than boys (Cook et al., 2024; Geelhand et al., 2019; Russell et al., 2021). This pattern may also be attributed to limited understanding of the female autistic phenotype, and the use of assessment tools that have been developed and validated primarily with male samples (Chapman et al., 2022; Hull et al., 2020; Kalb et al., 2022).

In contrast, higher proportions of South Asian heritage children did not reach a GLD and scored in the bottom 16% for the PSE domain, compared to their White British counterparts. Despite these indicators being associated with up to a 10-fold increase in likelihood of an autism

diagnosis, South Asian heritage children showing these early indicators of developmental need remained less likely to receive a formal diagnosis than White British children who met an expected level of development. This is consistent with other studies reporting lower diagnosis rates among minoritised ethnicities (Kelly et al., 2017; Tromans et al., 2021). Potential explanations include lower referral rates, culturally biased assessment practices, stigma surrounding developmental conditions, and barriers linked to speaking English as an additional language (Dababnah et al., 2022; Hall-Lande et al., 2021; Kalb et al., 2022; Lindsay et al., 2024; Pham & Charles, 2023). As has been observed for females, children from minoritised ethnicities who do receive a formal diagnosis tend to present with more pronounced support needs (Abdullahi et al., 2019; Beccerra et al., 2014; Fombonne & Zuckerman, 2021) suggesting that a higher threshold for recognition or referral may exist before these children access diagnostic assessment.

Collectively, these findings suggest that there are population-level disparities in the likelihood of receiving an autism diagnosis by sex and ethnicity, and that these characteristics intersect to compound the risk of missed, or delayed diagnosis. Developmental differences associated with autism are already evident by age five years, but existing diagnostic pathways are failing to identify these needs equitably across demographic groups. Although the EYFSP was not designed as an autism screening tool, previous work has demonstrated associations between universal school readiness measures and subsequent autism diagnosis. The present findings extend this literature by showing that the EYFSP reveals broadly similar – or greater – levels of developmental difficulty among ethnic groups that are substantially less likely to receive an autism diagnosis.

Strengths, Limitations, and Future Directions

This study analysed data from an internationally recognised database with a comprehensive sample of demographically diverse children across six annual cohorts, enabling a rich analysis of linked health and education data. Unlike clinical samples, these population-level administrative data are less susceptible to ascertainment bias. However, it is important to note that EYFSP scores themselves may be subject to bias, including unconscious or conscious differences in how teachers assess children from particular demographic groups (Campbell, 2015).

The current analysis considered a binary indicator of whether or not children received a formal diagnosis and therefore offers only a partial view of the inequalities across autism pathways. Future work should explore potential disparities across the full diagnostic pathway from referral to assessment, as well as experiences of post-diagnostic support, to understand how and when delays and barriers emerge for females and children from minoritised ethnic backgrounds. Qualitative work adopting an intersectional lens and centring lived experience could build on these findings to further explore the mechanisms behind these quantitative disparities.

Implications

Unidentified and unmet development needs can seriously impact quality of life for individuals and their families and carry substantial societal and economic costs. The findings presented should be of interest to clinicians, educators and policymakers seeking to address the systemic inequalities in autism diagnosis that compound disadvantage for marginalised groups.

Understanding and recognition of diverse presentations of autism must be prioritised in training for clinical and teaching professionals and better reflected in autism screening and diagnosis

protocols. Prior research has revealed the tendency for females from minority ethnic backgrounds to be excluded from autism research and diagnostic tool evaluation (Diemer et al., 2022), and the consequences of this are evident in our analysis revealing that South Asian heritage females have only 9% the likelihood of diagnosis compared to White British males.

Universal school readiness measures demonstrate that developmental differences associated with autism are already evident at school entry, particularly among demographic groups that remain under-represented in diagnostic pathways, demonstrating the opportunity for earlier identification and support for these children. While this study focuses on the UK's school readiness framework, similar approaches may be applicable in other countries that use holistic early-years assessments.

Conclusion

This study provides robust population-level evidence that substantial sex- and ethnicity-based inequalities exist in both the likelihood and timing of autism diagnosis. Females and children from minoritised ethnic backgrounds, particularly South Asian heritage females, were considerably less likely to receive a formal autism diagnosis, despite displaying comparable – or greater – levels of developmental need within universal school readiness assessments. These findings suggest that observed differences in diagnosis are more likely to reflect structural inequalities in identification pathways than true differences in underlying need.

Ensuring that autism assessment pathways better reflect the diversity of autism presentations and making better use of routinely collected development indicators during the early years, represent important opportunities to reduce inequalities in diagnosis and improve access to timely support for autistic children and their families.

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Supplemental Material

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Model 3C	Low PSE*ethnicity interaction

Appendix A

Autism Clinical Code List

Table A1

Clinical codes (Clinical Terms Version 3) used to search primary healthcare data for an autism diagnosis.

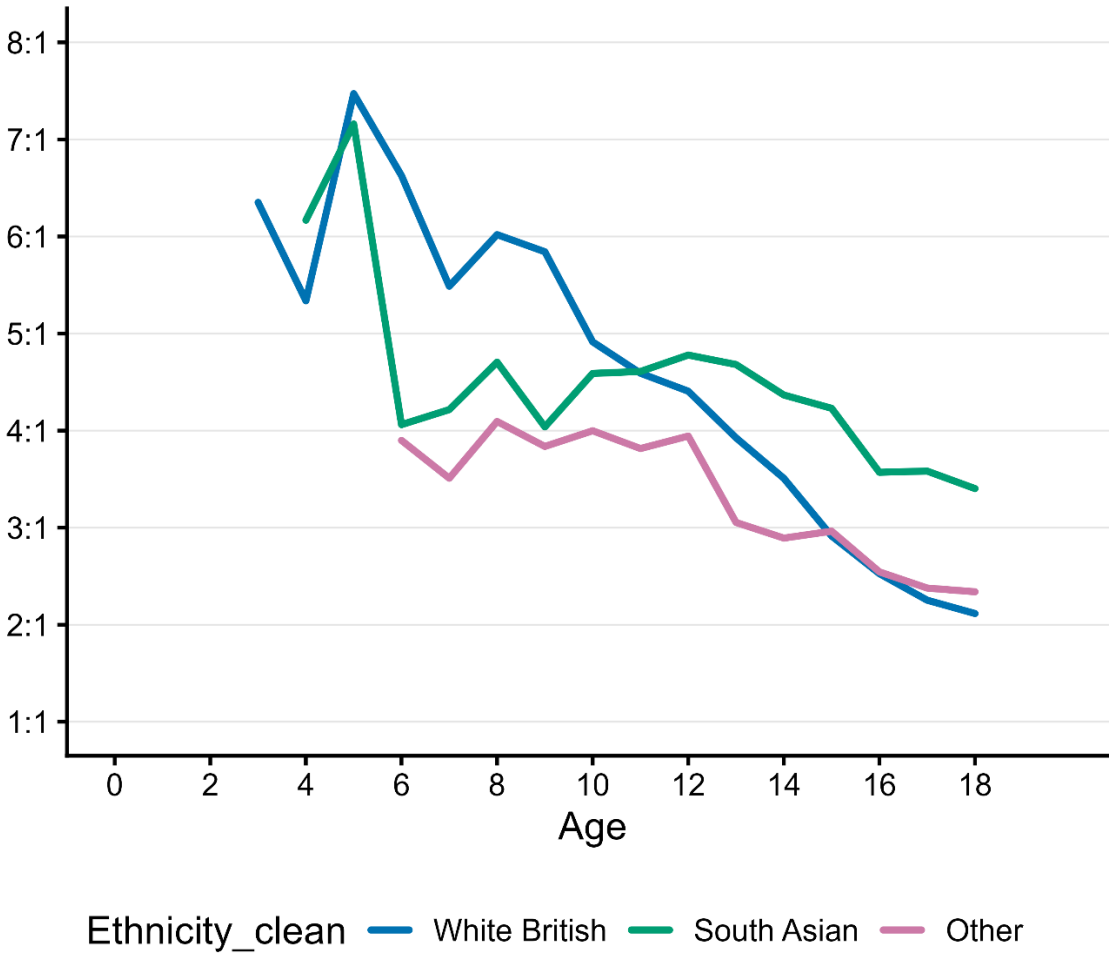
Code	Description
X00TM	Autistic spectrum disorder
X00TP	Asperger syndrome
X00TN	Atypical autism
Y2917	Autistic spectrum disorder - Autism checklist
Y2916	Autistic spectrum disorder - Gluten-casein intolerance checklist
XE2v2	Childhood autism
E1400	Active infantile autism
E140z	Infantile autism NOS
E1401	Residual infantile autism
E141.	Childhood disintegrative disorder
E1410	Active disintegrative psychoses
E141z	Disintegrative psychosis NOS
E1411	Residual disintegrative psychoses
Ub1Ts	Idiot savant
XaesO	Pathological demand avoidance
XE1aA	Other childhood disintegrative disorder
Eu84y	Other pervasive developmental disorders
Eu84z	Pervasive developmental disorder, unspecified

Appendix B

Male to Female Autism Diagnosis Ratios Across Childhood

Figure B1

Ratio of Cumulative Male to Female Autism Diagnoses by Age



Notes: Cases where there were less than 5 observations were not plotted to improve estimate reliability.

Appendix C

Autism Diagnosis Interaction Model Output

Table C1

Results of the Interaction Models of the Association Between Sex, Ethnicity and Autism Diagnosis

Model	Term	Risk Ratio	95% Confidence Interval		*p*-value
			Lower	Upper	
Interaction Model 1B	Intercept	0.03	0.03	0.04	
	Female	0.47	0.42	0.53	<.001
	South Asian	0.31	0.26	0.36	<.001
	Other	0.51	0.41	0.63	<.001
	Female*South Asian	0.62	0.44	0.88	.006
	Female *Other	0.91	0.61	1.35	.632

Notes: The reference group was male sex, and White British ethnicity.

Appendix D

Pairwise Comparisons and Predicted Probabilities of Diagnosis

Table D1

Pairwise Comparisons for Sex and Ethnicity Risk Ratios for Autism Diagnosis

Comparator	Characteristic	Risk Ratio	*p*-value
Sex differences within Ethnicity	White British	2.12	<.001
	South Asian	3.41	<.001
	Other	2.34	<.001
Ethnicity differences among males	White British vs South Asian	3.24	<.001
	White British vs Other	1.95	<.001
	South Asian vs Other	0.60	<.001
Ethnicity differences among females	White British vs South Asian	5.19	<.001
	White British vs Other	2.15	<.001
	South Asian vs Other	0.42	<.001

Notes: For sex differences within ethnicity, reference category is male.

Table D2

Predicted Probabilities of Autism Diagnosis by Sex and Ethnicity

Ethnicity	Sex	Predicted Probability (%)
White British	Male	5.12
	Female	2.41
South Asian	Male	1.58
	Female	0.47
Other	Male	2.62
	Female	1.12

Notes: Estimates from the sex and ethnicity interaction model

Appendix E

GLD Poisson Interaction Model Output With Main Effects

Table E1

Model 2B: Results of GLD Poisson Regression Interaction Models of the Association Between GLD and Autism Diagnosis by Sex

Term	Risk Ratio	95% Confidence Interval		*p*-value
		Lower	Upper	
Intercept	0.03	0.02	0.03	
No GLD	3.02	2.60	3.50	<.001
Female	0.67	0.55	0.81	<.001
South Asian	0.25	0.21	0.29	<.001
Other	0.46	0.39	0.55	<.001
No GLD*Female	0.68	0.54	0.87	.002

Notes: GLD = good level of development. The reference group was GLD reached, male sex, and White British ethnicity.

Table E2

Model 2C: Results of GLD Poisson Regression Interaction Models of the Association Between GLD and Autism Diagnosis by Ethnicity

Term	Risk Ratio	95% Confidence Interval		*p*-value
		Lower	Upper	
Intercept	0.03	0.03	0.03	
No GLD	2.45	2.16	2.77	<.001
South Asian	0.12	0.08	0.19	<.001
Other	0.53	0.37	0.76	<.001
Female	0.52	0.46	0.58	<.001
No GLD*South Asian	2.30	1.48	3.57	<.001
No GLD*Other	0.84	0.55	1.26	.393

Notes: GLD = good level of development. The reference group was GLD reached, male sex, and White British ethnicity.

Table E3

Results of Pairwise Comparisons from Interaction Models Between GLD and Sex, and GLD and Ethnicity

Comparator	Characteristic	Risk Ratio	Confidence interval		*p*-value
			Lower	Upper	
GLD association by ethnicity	White British	2.64	2.28	3.05	<.001
	South Asian	6.42	4.18	9.86	<.001
	Other	2.21	1.48	3.29	<.001
GLD association by sex	Male	4.03	3.18	5.11	<.001
	Female	2.78	2.17	3.55	<.001

Appendix F

PSE Poisson Interaction Model Output With Main Effects

Table F1

Model 3B: Results of Low PSE Poisson Regression Interaction Models of the Association Between Low PSE Scores (at least 1 SD below the mean) and Autism Diagnosis by Sex

Term	Risk Ratio	95% Confidence Interval		*p*-value
		Lower	Upper	
Intercept	0.03	0.03	0.04	<.001
Low PSE	5.52	4.91	6.20	<.001
Female	0.59	0.52	0.68	<.001
South Asian	0.22	0.19	0.25	<.001
Other	0.40	0.33	0.48	<.001
Low PSE*Female	0.74	0.58	0.94	.013

Notes: PSE = personal social and emotional development. The reference group was not having a low PSE score, male sex, and White British ethnicity.

Table F2

Model 3C: Results of Low PSE Poisson Regression Interaction Models of the Association Between Low PSE Scores (at least 1SD below the mean) and Autism Diagnosis by Ethnicity

Term	Risk Ratio	95% Confidence Interval		*p*-value
		Lower	Upper	
Intercept	0.04	0.03	0.04	<.001
Low PSE	4.67	4.16	5.23	<.001
South Asian	0.14	0.11	0.18	<.001
Other	0.45	0.35	0.58	<.001
Female	0.53	0.48	0.60	<.001
Low PSE*South Asian	2.11	1.55	2.88	<.001
Low PSE*Other	0.83	0.58	1.18	.288

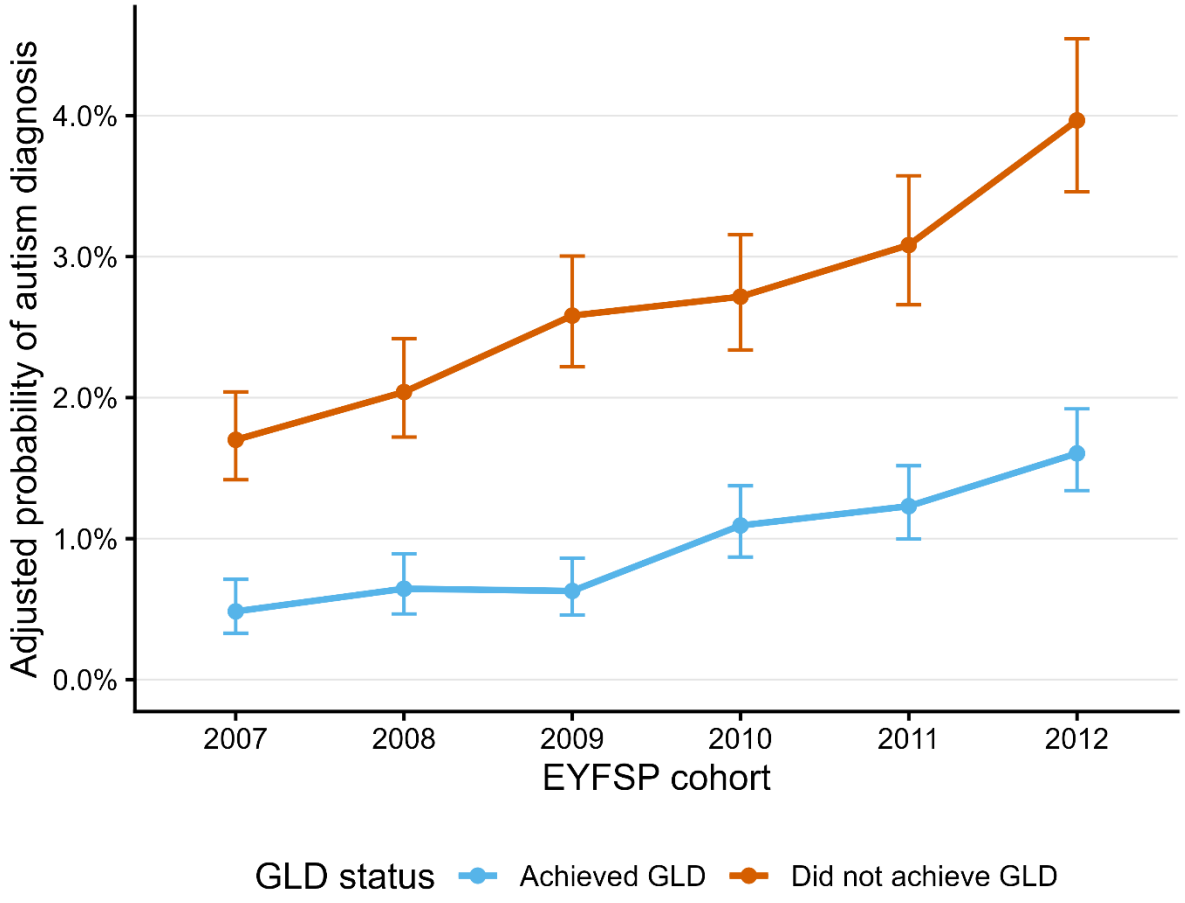
Notes: PSE = personal social and emotional development. The reference group was not having a low PSE score, male sex, and White British ethnicity.

Appendix G

Changes in GLD Status Over Time as a Function of Autism Diagnoses

Figure G1

Changes in Good Level of Development Status Across Cohorts as a Function of Autism Diagnoses



Appendix H

Predicted Probabilities of Autism Diagnosis By Sex and Ethnicity

Figure H1

Plot Showing the Predicted Probabilities of Autism Diagnoses by Sex and Ethnicity