

Letters

RESEARCH LETTER

Prevalence of Autism Spectrum Disorder Among Children and Adolescents in the United States from 2019 to 2020

Autism spectrum disorder (ASD) is a complicated neurodevelopmental disability with an increasing prevalence worldwide and considerable implications for individuals and their families.¹⁻³ According to the Autism and Developmental Disabilities Monitoring Network, the prevalence of ASD in children aged 8 years was 2.30% in 2018, which was similar to the prevalence of 2.47% in 2014 to 2016 reported by Xu et al.^{2,4} The aim of the study was to estimate the ASD prevalence among children and adolescents in the US in 2019 and 2020.

Methods | We conducted a cross-sectional study using data from the National Health Interview Survey (NHIS), which collects information through household interviews using multistage stratified sampling.⁵ We used NHIS data from 2019 and 2020 because the questionnaire was redesigned in 2019. Information about ASD diagnosed by a physician or other health care professional was reported by a parent or guardian. The conditional sample child response rate was 90.53% in 2019 and 87.38% in 2020.

The Guangdong Pharmaceutical University Academic Review Board deemed the study exempt from review because only deidentified data were used. All respondents provided

informed verbal consent before participation. The study followed the STROBE reporting guideline.

The weighted prevalence of ASD among children and adolescents in the US aged 3 to 17 years in 2019 and 2020 was calculated using survey weights, strata, and primary sampling units created by the National Center for Health Statistics to allow for national estimates according to NHIS analytic guidelines (<https://www.cdc.gov/nchs/nhis/methods.htm>). The trends in the prevalence from 2014 to 2020 were also examined. All statistical analyses were performed using SAS, version 9.4 (SAS Institute, Inc). Two-sided $P < .05$ was considered to be statistically significant.

Results | Of 12 554 individuals aged 3 to 17 years (6430 [51.22%] boys, 6124 [48.78%] girls), 410 were reported to have a diagnosis of ASD in 2019 and 2020. The prevalence of ASD was 2.79% (95% CI, 2.34%-3.24%) in 2019, 3.49% (95% CI, 2.82%-4.15%) in 2020, and 3.14% (95% CI, 2.73%-3.54%) in 2019 and 2020 overall. A significant difference in prevalence was observed between sexes (4.64% [95% CI, 3.99%-5.29%] in boys vs 1.56% [95% CI, 1.16%-1.97%] in girls; $P < .001$) and in family income to poverty ratio (<1.00, 4.89% [95% CI, 3.44%-6.34%]; 1.00-1.99, 2.71% [95% CI, 1.93%-3.49%]; 2.00-3.99, 3.20% [95% CI, 2.54%-3.85%]; and ≥ 4.00 , 2.45% [95% CI, 1.86%-3.04%]; $P < .001$) (Table). The weighted prevalence of ASD increased from 2.24% (95% CI, 1.89%-2.59%) in 2014 to 3.49% (95% CI, 2.82%-4.15%) in 2020 (P for trend = .31) (Figure).

Table. Prevalence of ASD in Children and Adolescents in the US^a

Characteristic	2019			2020			2019-2020		
	No. with ASD/total No. ^b	ASD, % (95% CI) ^c	<i>P</i> value ^d	No. with ASD/total No. ^b	ASD, % (95% CI) ^c	<i>P</i> value ^d	No. with ASD/total No. ^b	ASD, % (95% CI) ^c	<i>P</i> value ^d
Overall	237/7684	2.79 (2.34-3.24)	NA	173/4870	3.49 (2.82-4.15)	NA	410/12 554	3.14 (2.73-3.54)	NA
Age, mean (SD), y	10.55 (4.39)	NA	NA	10.65 (4.40)	NA	NA	10.59 (4.39)	NA	NA
3-11 y	129/4117	3.05 (2.39-3.70)	.16	89/2545	3.21 (2.36-4.05)	.33	218/6662	3.13 (2.60-3.66)	.96
12-17 y	108/3567	2.41 (1.83-3.00)		84/2325	3.88 (2.79-4.97)		192/5892	3.15 (2.52-3.78)	
Sex									
Male	189/3949	4.29 (3.51-5.07)	<.001	131/2481	4.98 (3.94-6.03)	<.001	320/6430	4.64 (3.99-5.29)	<.001
Female	48/3735	1.23 (0.80-1.66)		42/2389	1.90 (1.23-2.58)		90/6124	1.56 (1.16-1.97)	
Race and ethnicity ^e									
Hispanic	50/1833	2.54 (1.67-3.41)	.32	40/1146	3.22 (2.03-4.41)	.27	90/2979	2.88 (2.13-3.63)	.75
Non-Hispanic Black	24/896	2.08 (1.10-3.07)		19/484	5.22 (2.25-8.19)		43/1380	3.64 (2.07-5.21)	
Non-Hispanic White	139/4059	3.16 (2.50-3.81)		94/2653	3.18 (2.42-3.93)		233/6712	3.17 (2.66-3.67)	
Other ^f	24/896	2.45 (1.26-3.63)		20/587	3.55 (1.76-5.35)		44/1483	2.97 (1.91-4.04)	

(continued)

Table. Prevalence of ASD in Children and Adolescents in the US^a (continued)

Characteristic	2019			2020			2019-2020		
	No. with ASD/total No. ^b	ASD, % (95% CI) ^c	P value ^d	No. with ASD/total No. ^b	ASD, % (95% CI) ^c	P value ^d	No. with ASD/total No. ^b	ASD, % (95% CI) ^c	P value ^d
Highest level of educational attainment of family members									
<High school	15/527	2.38 (0.79-3.98)	.87	8/284	2.76 (0.09-5.43)	.78	23/811	2.56 (1.08-4.03)	.69
High school	38/1212	2.82 (1.79-3.86)		30/646	3.91 (2.16-5.66)		68/1858	3.33 (2.38-4.29)	
≥College	184/5936	2.83 (2.30-3.36)		135/3938	3.48 (2.75-4.20)		319/9874	3.16 (2.71-3.61)	
Missing data	0/9	NA	NA	0/2	NA	NA	0/11	NA	NA
Family income to poverty ratio ^g									
<1 [Reference]	47/1045	3.74 (2.38-5.10)	.07	32/526	6.21 (3.53-8.90)	.008	79/1571	4.89 (3.44-6.34)	<.001
1.00-1.99	54/1624	2.82 (1.97-3.68)		31/967	2.60 (1.32-3.88)		85/2591	2.71 (1.93-3.49)	
2.00-3.99	78/2406	2.95 (2.16-3.74)		57/1518	3.45 (2.38-4.52)		135/3924	3.20 (2.54-3.85)	
≥4.00	58/2609	2.03 (1.37-2.69)		53/1859	2.86 (1.89-3.82)		111/4468	2.45 (1.86-3.04)	

Abbreviations: ASD, autism spectrum disorder; NA, not applicable.

^a Data were obtained from the 2019 to 2020 National Health Interview Survey, a nationally representative survey of nonhospitalized civilians that monitors the health of the US population through data collection and analysis on a broad range of health topics.

^b Unweighted number of participants.

^c Prevalence estimates were weighted.

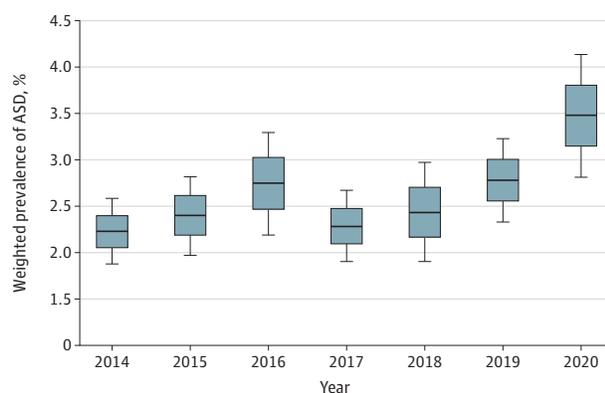
^d P values were estimated for the difference in prevalence by strata.

^e Race and ethnicity were self-reported and classified based on the 1997 Office of Management and Budget standards.

^f Other races and ethnicities included non-Hispanic American Indian or Alaska Native individual only, non-Hispanic American Indian or Alaska Native and any other group, non-Hispanic Asian individual only, and other single and multiple races, or declined to respond, no response, or unknown.

^g The ratio is the total family income divided by the poverty threshold.

Figure. Trend in Prevalence of Autism Spectrum Disorder (ASD) in Children and Adolescents in the US From 2014 to 2020



The number of participants (n = 57 392) was 11 082 in 2014, 10 183 in 2015, 9237 in 2016, 7397 in 2017, 6939 in 2018, 7684 in 2019, and 4870 in 2020. The weighted prevalence of ASD was 2.24% (95% CI, 1.89%-2.59%) in 2014, 2.41% (95% CI, 1.98%-2.84%) in 2015, 2.76% (95% CI, 2.20%-3.31%) in 2016, 2.29% (95% CI, 1.91%-2.68%) in 2017, 2.44% (95% CI, 1.91%-2.98%) in 2018, 2.79% (95% CI, 2.34%-3.24%) in 2019, and 3.49% (95% CI, 2.82%-4.15%) in 2020 (P for trend = .31).

Discussion | Using nationally representative data in the US, the estimated ASD prevalence was 3.14% among children and adolescents in the US in 2019 and 2020. This finding was higher than the reported prevalence from the NHIS in

2014 to 2016 (2.47%),² Autism and Developmental Disabilities Monitoring Network in 2018 (2.30%),⁴ and National Survey of Children's Health in 2016 (2.50%).³ The estimated prevalence was also higher than that reported in other countries and geographical areas in previous years. Chiarotti and Venerosi⁶ reviewed ASD prevalence estimates published since 2014, which ranged from 0.42% to 3.13% in Europe, 0.11% to 1.53% in the Middle East, and 1.41% to 2.52% in Australia. The prevalence of ASD is higher in boys than in girls, and a significant difference was found in children with different family economic status in this study. We found the prevalence of ASD increased from 2014 to 2016, decreased from 2016 to 2017, and then increased again from 2017 to 2020.

A limitation of this study was that information provided by parents or guardians may be affected by recall bias. Given that ASD is a lifelong disease in most children, future research needs to focus on understanding risk factors for and causes of ASD.

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