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The association of autism diagnosis with socioeconomic status

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Abstract

Background: In 2007 the Centers for Disease Control and Prevention (CDC) reported a higher prevalence of autism spectrum disorder (ASD) in New Jersey, one of the wealthiest states in the United States, than in other surveillance regions.

Objective: To examine the association of socioeconomic status (SES) with ASD prevalence.

Methods: Information on eight-year-olds with ASD from four counties was abstracted from school and medical records. US Census 2000 provided population and median household income data.

Results: 586 children with ASD were identified: autism prevalence was 10.2/1000, higher in boys than girls (16 vs. 4/1000); higher in white and Asian non-Hispanics than in black non-Hispanics and Hispanics (12.5, 14.0, 9.0, and 8.5/1000, respectively); and higher (17.2/1000 (95% CI 14.0–21.1)) in tracts with median income >US$90,000 than in tracts with median income ≤US$30,000 (7.1 (95% CI 5.7–8.9)). Number of professional evaluations was higher, and age at diagnosis younger, in higher income tracts ($p < .001$), but both measures spanned a wide overlapping range in all SES levels. In multivariable models race/ethnicity did not predict ASD, but the prevalence ratio was 2.2 (95% CI 1.5–3.1) when comparing highest with lowest income tracts.

Conclusions: In the US state of New Jersey, ASD prevalence is higher in wealthier census tracts, perhaps due to differential access to pediatric and developmental services.

Keywords

Autism, ASD, prevalence of ASD, socioeconomic status, SES

An unexpectedly high prevalence of autism spectrum disorder (ASD) in was reported in 2007 by the Centers for Disease Control and Prevention (CDC) Autism and Developmental Disabilities (ADDM) network (ADDM Network Surveillance Year 2002 Principal Investigators and CDC, 2007a,b). The ADDM study examined records of eight year olds in defined geographic regions in 14 states, finding a prevalence of 1 in 150 eight-year-old children overall, but 1 in 100 in New Jersey. Reasons for the higher ASD prevalence in New Jersey were not apparent.

Autism is found worldwide, with males diagnosed at a rate four times that of females. While genetic factors play a major role in autism, no clear inheritance pattern has been identified. Numerous environmental factors, both social and physical, have been examined but not found to be consistently associated with autism (ADDM Network Surveillance Year 2002 Principal Investigators and CDC, 2007a,b; Bhasin and Schendel 2007; Fombonne, 2005) Since autism is a clinical diagnosis for which there is no reliable diagnostic marker, it is likely that conditions considered in ASD represent similar phenotypic signs and symptoms of mixed underlying etiologies, making identification of epidemiologic associations problematic, as factors that play important roles may differ by etiology.

Access to care and quality of clinical evaluations may influence the chance that a clinical diagnosis is made. Before 1980, many reports found higher prevalence of autism among families of higher socioeconomic or education status (Cox et al., 1975; Eisenberg and Kanner, 1956; Kolvin et al., 1971; Lotter, 1967; Lowe, 1966) By 1980, in the United States, child developmental and special educational services were widely available, and two studies conducted in states with universal access to developmental evaluation services

found no association with socioeconomic status (SES) (Schopler et al., 1979; Tsai et al., 1982). Wing (1980), summarizing prior studies, concluded that the apparent SES association had been artifactual, due to differential access to services. However, epidemiologic studies continue to report mixed findings on the association of ASD with SES. Bhasin and Schendel (2007) found an association of autism diagnoses with higher SES in Atlanta, Georgia. Kogan et al. (2009), reporting a rate of ASD in 110/10,000 children from a nationally representative telephone survey of parents, note that rates were higher in children from the Northeast and Midwest and lower in families where parents had lower number of years of education. Income was not reported in the Kogan study. Both papers suggested that a case-finding bias may have been at least partly responsible for the differences, due to ongoing differential access to services, differential awareness by parents and providers in different settings, and possibly differential application of diagnostic criteria. Recent European studies reported no association with SES, where access to care is presumed equal across SES strata (Arvidsson et al., 1997; Fombonne et al., 1997; Gillberg et al., 1991; Larsson et al., 2005). Most recently, using CDC-ADDM data for 2002 and 2004, Durkin et al. (2010) reported that a stronger SES gradient in ASD prevalence seen in children with a diagnosis of ASD documented in the medical record before the survey was undertaken, suggests a potential ascertainment or diagnostic bias, and the possibility of SES disparity in access to services for children with autism.

In this study, we used the data collected as part of the CDC-ADDM Network for New Jersey, to investigate whether SES is associated with prevalence of ASD within that state.

Methods and materials

Study population

All children who were eight years of age in 2000 or 2002 and living in a participating school district in one of four New Jersey counties were included in the ADDM network surveillance case ascertainment. Three of the four counties selected are in densely populated urban northwest New Jersey, where municipalities cover a range in SES strata, (Essex, Hudson, and Union Counties). A fourth county, Ocean County, was included at CDC's request, to continue ongoing surveillance in the county's Brick Township, begun by CDC 10 years prior (Bertrand et al., 2001).

Data collection

All ASD ascertainment was consistent with CDC's ADDM Network methodology, based on active, retrospective case finding and independent case determination (ADDM Network Surveillance Year 2002 Principal Investigators and CDC, 2007a,b). Details of these methods are described elsewhere (ADDM Network Surveillance Year 2002 Principal Investigators and CDC, 2007a; Rice et al., 2007) In New Jersey, children with possible ASD were ascertained from special education rosters for public schools and from clinical sites such as pediatric developmental centers. Data were abstracted from both medical and educational records.

Data abstracted for each child was chronologically organized, stripped of identifying information, and systematically reviewed according to a standard process of scoring and analysis by one of a team of developmental specialists, using *Diagnostic and Statistical Manual of Mental Disorders* (DSM)-IV-TR based criteria. The specialists determined

whether criteria for ASD were met, i.e. if abstracted data documented criteria for signs, symptoms, and behavioral characteristics consistent with ASD, regardless of whether an ASD diagnosis was documented in the school or clinical record. This method counted all children with ASD written or documented in the record, plus additional children who met CDC defined criteria for ASD.

Each case was assigned an impairment level (mild, moderate, or severe) based on available data on social, communication, behavioral, and adaptive functioning (ADDM Network Surveillance Year 2002 Principal Investigators and CDC, 2007a; Rice et al., 2007).

Data variables

Case information included: sex, race/ethnicity, census tract of residence at age eight years, diagnoses and clinical impressions, test findings, verbatim descriptions of behavior, and other findings reported in evaluation documents from developmental pediatricians, psychologists, social workers, and therapists. The number of professional evaluations abstracted by age eight years was noted. Some children had been evaluated at locations that were not participating as data collection sites. Those evaluations could be abstracted only if copies were included in records available to the study team. If an ASD diagnosis was documented in the records, age at diagnosis was recorded. Also recorded was type of ASD (autism disorder or pervasive development disorder not otherwise specified (PDD NOS)) (ADDM Network Surveillance Year 2002 Principal Investigators and CDC, 2007b).

From the US Census 2000 SF-1 files (United States Department of Commerce, 2000), we obtained the number of eight-year-olds by race/ethnicity and sex, and median household income for each census tract, in participating districts. SES of participating and non-participating school districts was compared using a measure of SES developed by the New Jersey Department of Education District Factor Groups (DFG) for School Districts (2008). Fifty-six (82%) of the school districts in the four counties participated in both years, representing 85% of the population of eight-year-olds in these counties (New Jersey Department of Education, 2011). SES of the 12 school districts that participated in only one or in neither of the two years was similar to the 56 that participated in both years. Districts that fell into the wealthiest three categories were more likely to participate in both years than the lower and middle (83% vs 65%), but this difference was not statistically significant.

Analysis

The prevalence of ASD per 1000 eight-year-olds was calculated by demographic and clinical subgroups. In the year 2000, 28,823 eight-year-old children were living in participating school districts. We used the same denominator for children ascertained with ASD in 2000 and in 2002, making the assumption that significant population shifts had not occurred. To perform our calculations we added the 2000 and 2002 cohorts of children with ASD, and so also doubled the counts from the 2000 census (total $28{,}823 \times 2 = 57{,}646$). We divided census tracts into four groups by median income in US$30,000 increments: ≤$30,000, $30,001–60,000; $60,001–90,000; >$90,000. We examined characteristics of ASD cases by income category.

Prevalence levels were compared using Poisson regression, using prevalence ratios and the 95% confidence intervals (CI) of the prevalence ratios. Because we wanted tests to be sensitive to any differences rather than just trends, differences in numbers of evaluations

and in age at ASD diagnosis between income categories were compared using a Kruskal–Wallis test, and categories that differed were identified using Wilcoxon rank sum tests for pairwise comparisons. Poisson regression was used to examine the adjusted effects of sex, race, and income on ASD prevalence. Analyses were also performed for each estimated degree of impairment.

Because numerator and denominator data are from different sources and census 2000 data was used to approximate the 2002 denominator, some cases from a census tract had no children of their race/ethnicity in the census files; these cases were excluded from the analysis, which may result in an underrepresentation of overall ASD prevalence. When performing group comparisons, any cases with missing data were excluded and therefore comparisons assume data to be missing completely at random. All testing was performed at the 5% significance level.

Results

Among eight-year-old children living in school districts that participated in both years of the survey, 592 met criteria for surveillance-defined ASD: 287 in the year 2000 cohort (born in 1992) and 305 in the year 2002 cohort (born in 1994). Six (1%) children with ASD were excluded because the 2000 US census files did not have any eight-year-olds with the race/ethnicity and census tract of the case child and the remaining 586 were analyzed. Seventy-one percent were categorized as having autism disorder and 29% as PDD NOS.

Table 1 shows the demographic characteristics of the children and prevalence per 1000 eight year olds. Prevalence among boys was four times that in girls (16.1 per 1000 (95% CI 14.7–17.6) vs 4.0 (3.3–4.8)). The prevalence ratio of boys to girls was similar in all race/ethnicity and income groups (data not shown). Prevalence was lowest in non-Hispanic black and Hispanic children (9.0 and 8.5 per 1000, respectively); and higher in non-Hispanic white and Asian children (12.5 and 14.0 per 1000, respectively).

Univariate analysis showed a consistent trend by median household income of census tract. Prevalence of ASD ranged from 7.1 per 1000 children in tracts with median income ≤$30,000 to 17.2 per 1000 in tracts with median income over $90,000. The prevalence ratio comparing the highest and lowest income census tract categories was 2.4 (95% CI 1.8–3.3). We also examined this association with the subset of children who had an ASD diagnosis noted in the record (403 (69%) of 586 children) and found the association of SES was stronger, with a prevalence ratio of 3.5 (95% CI 2.4–5.2) comparing the highest with lowest SES categories.

Table 2 shows the number of evaluations available for abstraction by median household income of census tract, and the age at diagnosis for the 70% of children whose ASD diagnosis was documented in abstracted records. Among all children, 1 to 30 evaluations were found in school and medical records. Median number of evaluations showed an increasing trend with median income of the census tract, the lowest number of evaluations (6, range 1–15) in the lowest median income tracts and the highest number (10, range 3–26) in the highest median income tracts. Among the 69% of the children with a documented ASD diagnosis, median age at diagnosis was older in the lowest compared with the highest median income census tracts (56 months, range 27–101 vs 41 months, 12–104, respectively; Wilcoxon rank sum test $p < .05$). Although the ranges of number of evaluations, and age at diagnosis for the three census tract income categories are wide and overlapping, the

Table 1 Estimated prevalence of autism in eight-year-old children, by selected demographic characteristics, 2000, four counties in New Jersey, 2000 and 2002

Characteristic	Eight year olds with ASD		Total eight year olds			
	N	%	N	%	Prevalence [a]per 1000 (95% CI)	Prevalence ratio
Total	586	100.0	57646	100.0	10.2 (9.4–11.0)	
Sex						
Girls	112	19.1	28146	48.8	4.0 (3.3–4.8)	1.0 (referent)
Boys	474	80.9	29500	51.2	16.1 (14.7–17.6)	4.0 (3.3–4.9)
Race/ethnicity						
White not Hispanic	289	49.3	23190	40.2	12.5 (11.1–14.0)	1.0 (referent)
Black not Hispanic	139	23.7	15530	26.9	9.0 (7.6–10.6)	0.7 (0.6–0.9)
Asian not Hispanic	38	6.5	2710	4.7	14.0 (10.2–19.3)	1.1 (0.8–1.6)
Other not Hispanic	1	0.2	2134	3.7	0.5 (0.1–3.3)	0.0 (0.0–0.3)
Hispanic	119	20.3	14082	24.4	8.5 (7.1–10.1)	0.7 (0.6–0.8)
Median income of census tract:[b] eight year olds with ASD by CDC definition						
≤$30000	74	12.6	10416	18.1	7.1 (5.7–8.9)	1.0 (referent)
$30001–60000	289	49.3	32088	55.7	9.0 (8.0–10.1)	1.3 (1.0–1.7)
$60001–90000	130	22.2	9728	16.9	13.4 (11.3–15.9)	1.9 (1.4–2.5)
>$90000	93	15.9	5414	9.4	17.2 (14.0–21.1)	2.4 (1.8–3.3)
Median income of census tract:[b] eight year olds with ASD documented in school or clinical record ($n = 403$)						
≤$30000	39	9.7	10416	18.1	3.7 (2.7–5.1)	1.0 (referent)
$30001–60000	195	48.4	32088	55.7	6.1 (5.3–7.0)	1.6 (1.2–2.3)
$60001–90000	98	24.3	9728	16.9	10.1 (8.3–12.3)	2.7 (1.9–3.9)
>$90000	71	17.6	5414	9.4	13.1 (10.4–16.5)	3.5 (2.4–5.2)

ASD: autism spectrum disorder, CI: confidence interval.
All dollars are US$.
[a]Prevalence calculated from among 28823 eight year olds living in participating census tracts in 2000. 28823 was doubled for the calculation, because the number of children with autism was derived from two birth cohorts, children born in 1992 and 1994, who were eight years old in 2000 and 2002, respectively. The assumption was made that the 2000 population was adequate as the denominator for 2002, i.e. that the population of eight years olds remained stable between 2000 and 2002.
[b]Median income of census tract of residence, according to year 2000 US census (US Department of Commerce, 2000).

Table 2 Number of evaluations and age at ASD diagnosis, by income category, four counties in New Jersey, 2000 and 2002

Characteristic	Income category[a]			
	≤ $30,000 N=74	$30,001–60,000 N=289	$60,001–90,000 N=130	>$90,000 N=93
Number of evaluations available for abstraction by study staff,[b] median (range)	6 (1–15)	7 (1–30)	9 (1–24)	10 (3–26)
Age (months) at earliest ASD diagnosis,[c] median (range)	56 (27–101)	55 (18–102)	53 (15–99)	41 (12–104)
Percentage of children who met study criteria for ASD, for whom documentation of ASD diagnosis was found in the record (derived from Table 1)	53%	67%	75%	76%

ASD: autism spectrum disorder.
All dollars are US$.
[a]Median income of census tract of residence, according to year 2000 US census (US Census, 2000).
[b]Number of evaluations available for abstraction at New Jersey Autism Study sites. Evaluations included those from: physical, speech, and occupational therapists; social workers; psychologists; psychiatrists; developmental pediatricians; neurologists; and other professionals. Children may have had additional evaluations that had not been copied into the school and clinical records available for review.
[c]We present age at ASD diagnosis for the 69% of children for whom an ASD diagnosis is documented in the clinical records reviewed (number by income category: ≤ US$30,000, 38 children; US$30,001–60,000, 178; US$60,001–90,000, 95; > US$90,000, 68 children). For the other 31% of children, when abstracted information was reviewed by clinical expert per Centers for Disease Control and Prevention (CDC) protocol, the child met CDC criteria for ASD.

relationship between the median income of a census tract and both the number of evaluations and age at diagnosis were statistically significant (Kruskal–Wallis test $p < .001$).

Figure 1 shows prevalence of autism by estimated degree of impairment and median household income of census tract. Prevalence of ASD with mild impairment increases with income, with prevalence of mild autism significantly higher in the top two income categories than in the lower two (from lowest to highest income, cases per 1000 (95% CI): 1.8 (1.2–2.9); 2.2 (1.8–2.8); 4.6 (3.5–6.2); 5.9 (4.2–8.4), respectively). Compared with those in census tracts with median income <$30,000, prevalence of ASD with moderate impairment is higher in each of the other income categories ($p < .05$). Prevalence of ASD with severe impairment is significantly higher in the highest income category than in each of the other categories ($p < .05$) but other categories did not differ significantly from each other (from lowest to highest income, cases per 1000 (95% CI): 2.6 (1.8–3.8); 2.5 (2.0–3.1); 2.0 (1.3–3.1); 5.2 (3.6–7.5), respectively).

Table 3 shows results of multivariable analysis examining ASD prevalence by sex, race/ethnicity and SES. When adjusted for income, ASD prevalence did not differ by race/ethnicity. Children in census tracts at the two highest median income levels ($60,001–90,000, and >$90,000) had significantly higher ASD prevalence than children in census tracts at the lowest income (<$30,000); adjusted prevalence ratios were 1.7 (95% CI 1.2–2.3) comparing the second highest income category ($60,001–90,000) with the lowest

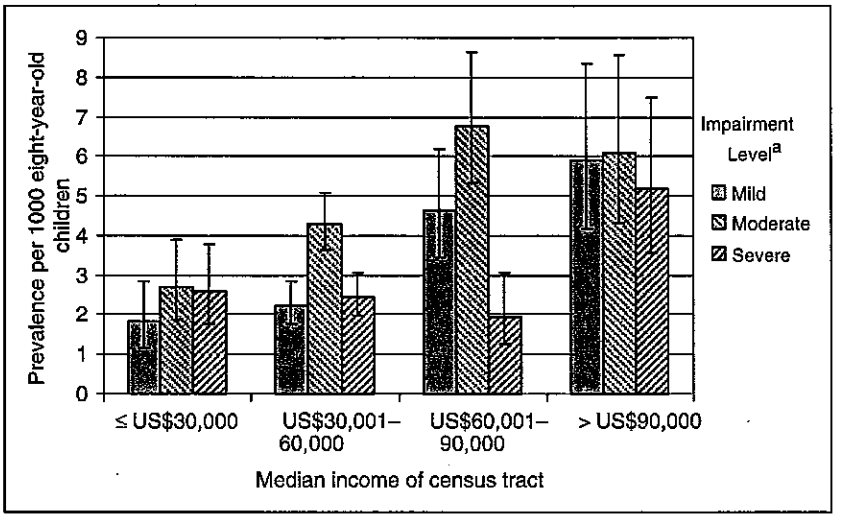

Figure 1 Prevalence of autism per 1000 eight-year-old children, by estimated degree of impairment and median household income of census tract of residence, four counties in New Jersey, 2000 and 2002. Error bars represent 95% confidence intervals.All dollars are US$.

[a]Degree of impairment associated with autistic spectrum disorder (ASD) is a subjective rating based on judgment of the clinician reviewer of the child's overall level of impairment, at (or as close as possible to) age eight, associated with an ASD using all of the data available in the abstracted records. The rating summarizes the child's social, communication, behavioral, and adaptive functioning related to core and associated symptoms of an ASD. The degree of impairment associated with an ASD was made independently of the cognitive level of functioning, when possible. Definitions of mild, moderate, and severe impairment are from the 'XV. General impressions' rating on the Childhood Autism Rating Scale (Schopler E et al., 1980).

[b]The results of pairwise comparisons using likelihood ratio based contrasts are as follows: (1) for the mild impairment level outcome, those living in census tracts with median incomes of <$30,000 are significantly different than those in the US$60,001–90,000 and >$90,000 categories, and those in the $30,001–60,000 category are significantly different from those in the $60,001–90,000 and >$90,000 categories ($p < 05$); (2) for the moderate impairment level outcome, those living in census tracts with median incomes of <$30,000 were significantly different than those living in all other median incomes level census tract categories; and those living in census tracks with median income of $30,001–60,000 were significantly different than those in the $60,001–90,000 category ($p < 05$); (3) for the severe impairment level outcome, those living in census tracts with median income >$90,000 were significantly different than those living in the other three median income census tract categories ($p < 05$). Other than those noted above, no additional categories differed significantly from each other for any of the severity outcomes.

(<$30,000); and 2.2 (1.5–3.1) comparing the highest (>$90,000 median income) with the lowest. The same multivariable analysis was repeated for each impairment level. Adjusted models show that at each impairment level, differences in prevalence are not significant by race/ethnicity but remain significant by census tract median income category (data not shown).

Discussion

These data show a strong ecological association of ASD prevalence with SES, with an adjusted prevalence ratio of 2.2 comparing census tracts with highest (>$90,000) versus

Table 3 Univariate and multivariable analysis[a] of factors associated with prevalence of autism in eight-year-old children four counties in New Jersey, 2000 and 2002

Factor or characteristic	Adjusted prevalence ratio (CI)	*p* values from univariate regression model	*p* values from multiple regression model
Gender		<.001[a]	<.001[b]
Male	4.0 (3.3, 5.0)	<.001	<.001
Female	1.0 (reference)		
Race/ethnicity		<.001[a]	.3[b]
White non-Hispanic	1.0 (reference)		
Black non-Hispanic	0.9 (0.7–1.2)	.001	.5
Asian non-Hispanic	1.2 (0.9–1.7)	.5	.3
Hispanic	0.9 (0.7–1.1)	<.001	.2
Median income of census tract		<.001[a]	<.001[b]
≤$30,000	1.0 (reference)		
$30,001–60,000	1.2 (0.9–1.6)	.06	.1
$60,001–90,000	1.7 (1.2–2.3)	<.001	.001
>$90,000	2.2 (1.5–3.1)	<.001	<.001

All dollars are US$.

[a]The multiple Poisson regression model included the following factors for which prevalence could be calculated, using census 2000 denominator data: sex, race/ethnicity, and median household income of census tract of child's residence at age eight (in 2000 or 2002).

[b]*p* value for the overall effect of the variable.

lowest (≤$30,000) median incomes. An association of race/ethnicity with prevalence of ASD seen in univariate analysis was no longer present when adjusting for median income of census tract. Our findings support the recent findings by Durkin et al. (2010), showing a gradient in ASD prevalence across SES strata. Like Durkin, we also found a slightly stronger gradient by SES in children with an ASD diagnosis documented in the record (Table 1).

Our study is not able to explore reasons for the association of ASD diagnosis and SES, but speculation about the role of access to and quality of health care may arise based on our data that earlier age at diagnosis and greater number of evaluations available for abstraction was seen in census tracts with higher median household income. In higher SES areas, children with developmental delays or perceived behavioral problems may come under scrutiny earlier than children in lower SES areas (Croen et al., 2002; Johnson et al., 2007) due to greater resources available in wealthier school districts and/or greater awareness by parents and teachers. Medical providers who care for children from lower SES may not be as well trained to identify autism, or may not have as much time per patient to make an accurate diagnosis. Parents from lower SES areas may not recognize, or may not point out differences in development and behavior as readily as parents from higher SES. Alternatively, other measures of SES such as parental education may also be associated with ASD diagnosis; more highly educated parents might also be more likely to demand evaluation of a child not meeting expected standards. In an analysis of a national telephone survey, Kogan et al. (2009) reported an association of ASD prevalence with parental education. We did not study parental education; instead our income data is ecologic, from census tract of residence, and measures community resources rather than a direct measure of family resources.

We find no association of ASD prevalence and race/ethnicity. Several other studies also find no association (Kogan et al., 2009; Yeargin-Allsopp et al., 2003). In contrast, in at least two studies Latino children were found to have a lower prevalence of ASD than other children (Croen et al., 2002; Liptak et al., 2008). Minority race/ethnicity has been associated with later age at diagnosis (Mandell et al., 2009). Minority children are more likely to live in poorer areas, and later age at diagnosis could result in lower prevalence ascertained at age eight.

Other authors who have reported differences in ASD by SES, have also speculated that access to care and services may explain the differences (Bhasin and Schendel, 2007; Mandell et al., 2009; Thomas et al., 2007). Bhasin and Schendel (2007) suggest the potential for social class bias in US studies of autism, because of disparities in service availability and use. In a recent study from Denmark, where there is universal publically available health care, and electronic records allow matching of demographic and autism diagnosis data, no association was found between autism and maternal education or parental wealth (Larsson et al., 2005). The absence of an association of ASD with SES in this setting suggests that disparity in access to care may be an important contributor to differences in prevalence. However, the Danish population may be more homogeneous compared with the United States in many ways, including income.

A potential for an SES provider bias is further suggested by Cuccaro et al. (1996). They administered a survey to 185 providers, including speech pathologists, psychologists, and psychiatrists. Each provider was given two vignettes, one describing a child with vague autism symptoms, and the other a child with vague symptoms of attention deficit hyperactivity disorder (ADHD). Each vignette had four variations: white or black child, low or high SES. Providers were more likely to consider autism in the high SES scenarios, while the likelihood of considering a diagnosis of ADHD was not affected by SES.

The association we report does not necessarily imply an etiological relationship between SES and autism, but does suggest a residual inequality and that SES is associated with factors etiologically associated with an autism diagnosis. In order to optimize detection of ASD and other developmental disabilities, and ensure early intervention, children must have access to regular pediatric care during preschool years, and easy, affordable access to a variety of specialists. Even in wealthy areas of New Jersey this access is limited, and currently our developmental centers are booking appointments months into the future. For families who cannot plan that far ahead, do not have transportation, etc., this is a barrier.

Limitations

While we are confident we had a complete list of children with possible ASD, as the New Jersey Special Education registry is thorough and reliable, some professional evaluations were not available for abstraction. We have no measure of completeness of records across school districts, which could influence comparisons by SES. A greater likelihood of missing evaluation documents in the school records in lower SES districts could account for the lower prevalence of ASD diagnosis. On the other hand, the CDC protocol allows for assignment of ASD diagnosis based on key words and facts in the record, even if the professionals who saw the child did not assign the diagnosis of ASD. Incorrect assignment of the diagnosis based on chart abstraction could result in overdiagnosis in records with greater numbers of evaluations available. It is possible that in higher SES

areas, with more evaluations available for abstraction, the key words needed to meet the CDC criteria might be more likely to be found. However, bias in the CDC ascertainment method does not fully explain the association with SES, as the same association was present when the analysis was repeated using only the 69% of children who had ASD documented in the record.

Despite some suggestions of ascertainment differences, our study could not directly evaluate whether differential access to care can fully explain the higher prevalence of autism in New Jersey and in higher SES children. Such a study would require a different methodological design.

Ecologic studies by their nature lack specific data on individuals. This can lead to a false association. For example, since the ADDM data do not include family income or parental education data, the SES categories could have an ecological bias (e.g. a poor family could live in a wealthy census tract, and vice versa). Finally, in this dataset we do not have information on other factors which might be associated with both autism and SES, for example, parental age and details on the services available in the towns where the children live (Durkin et al., 2008; Reichenberg et al., 2006). Other such phenomena might include, for example, different genetic composition, or different environmental exposure (for instance wealthier mothers have more exposure to plastics such as while drinking bottled water, during pregnancy). Such data would help us understand reasons for the SES disparity, but would not be likely to undo the association observed.

Conclusion

We examined differential prevalence levels of autism in New Jersey, and found a strong association with median household income of the census tract of residence. Among the children with autism, younger age at diagnosis and a greater number of evaluations were also associated with higher SES. In a multistate study, the CDC ADDM network had previously reported an association of higher prevalence of autism with higher SES. (Durkin, Maenner et al. 2010). We suspect that having greater resources provides greater sensitivity in the diagnosis of autism, but there may be the possibility that an etiologic factor is also associated with both autism and SES.

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