

Racial Disparities in Autism Identification in the United States During 2014

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Abstract

The underidentification of students with autism is a well-documented phenomenon that implies minority children are less likely to receive autism-specific interventions and services vital for better outcomes. Previous research has found that minority children are less likely to be identified as having autism, but recent changes in federal reporting from five to seven racial categories warrant further investigation of minority underidentification in the autism category. This logistic regression analysis of autism count data was conducted to examine differences in identification according to seven racial reporting categories. We calculated the probability of autism identification for each racial group and tested odds ratios for significant differences within each state and Washington, DC. We also compared odds of autism identification for each racial group in each state to the odds of identification for White students in California. Within-state analyses indicated minority students in most states continue to be identified at rates significantly lower than their White counterparts. Between-state analyses revealed White students and minority students in most states were underidentified compared to White students with autism in California. The change to seven racial reporting categories appears to have clarified the extent to which minority students are underidentified in the autism category, which may mean minority students experience restricted access to evidence-based interventions and services for students with autism.

Autism spectrum disorder (autism) is a neurodevelopmental disorder that affects language, social, and behavioral development (American Psychiatric Association [APA], 2013). The manifestation of autistic characteristics can vary by degree, with some individuals experiencing somewhat minor impairments (e.g., social awkwardness) and others very severe impairments (i.e., intellectual disability with extremely limited or absent speech). Children and young adults are eligible for special education services when their autism negatively affects educational performance (Individuals with Disabilities Education Improvement Act [IDEA], 2004). Irrespective of severity, individuals with autism have better long-term outcomes when provided with highly specialized and intensive interventions. Researchers have for decades reported that early intervention improves social, communication, behavioral,

and academic performance of children with autism (e.g., Eldevik et al., 2010; Lovaas, 1987; National Research Council, 2001; Reed, Osborne, & Corness, 2007; Smith, Groen, & Wynn, 2000; Virués-Ortega, 2010). The amount of intervention also appears critical for obtaining positive effects, suggesting that more intensive intervention generally confers greater benefit than less intervention (Eldevik et al., 2010; Klintwall, Eldevik, & Eikseth, 2015; Reichow, 2012; Warren et al., 2011). Achieving better social, behavioral, communicative, and academic outcomes therefore hinges

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on timely identification and provision of services. If children are not accurately identified as having autism, then they may be less likely to access evidence-based interventions at sufficient levels of intensity that are necessary for achieving desired outcomes.

Autism is believed to be resultant of a complex interaction between genetic and environmental factors that affect fetal and early childhood development. These include stress, nutrition, exposure to toxins, socioeconomic status, and infections (Becerra et al., 2014; Fakhoury, 2015). Although there is no evidence of a racially or ethnicity-specific genetic link to autism (Elsabbagh et al., 2012; Fombonne, 2003, 2005, 2007), a growing body of epidemiological research indicates autism is less likely to be diagnosed among minority populations (Becerra et al., 2014; Centers for Disease Control and Prevention [CDC], 2016; Gaugler et al., 2014; Mandell et al., 2009; Palmer, Walker, Mandell, Bayles, & Miller, 2010). The epidemiological findings align with results from studies of special education eligibility determinations due to autism. For example, Travers, Tincani, and Krezmien (2013) examined special education count (i.e., population) data to calculate national identification rates of autism from 1998 to 2006 to ascertain whether racial groups were proportionately represented. They found autism identification increased for all racial groups over time, but there were statistically significant differences in odds of identification by race. Specifically, Black (or African American) students were overrepresented compared to White students in the first two years of their analysis but underrepresented in all subsequent years, with a growing trend of underidentification over time. Travers et al. also found persistent and statistically significant underidentification of Hispanic (i.e., Latino) and American Indian or Alaska Native students in all years.

Concerned the national level results were potentially skewed by concentrated disproportionality in large states (e.g., California, Florida, Texas), Travers, Krezmien, Mulcahy, and Tincani (2014) investigated autism identification for White, Black (or African American), and

Hispanic (i.e., Latino) students for all states in 2000 and 2007. Every state they analyzed had underidentified Hispanic students with autism compared to White students with autism in 2007, and all but three states underidentified Black (or African American) students with autism in 2007. Travers et al. concluded that no single state appeared to influence national-level autism identification and suggested within-state analyses might further shed light on what factors other than race alone predicted eligibility for special education due to autism.

These findings are consistent with several other reports of autism identification rates. Sullivan (2013) used linear regression to analyze relative risk ratios for autism and found identification rates varied by race and state. Sullivan's results were consistent with Palmer et al. (2010), who used regression to test risk ratios and found White children in Texas schools during 2004 were twice and sometimes three times more likely than Hispanic (i.e., Latino) children to be eligible due to autism. Similarly, descriptive data reported by Becker, Seay, and Morrison (2009) indicated Hispanic children in Texas during 2006 were less likely than White students to be identified with autism, but statistical significance tests were not used. Boswell, Zablotsky, and Smith (2014) used a series of ANOVA tests to analyze whether enrollment, teacher-student ratio, student mobility (i.e., whether students came moved from a previous district), attendance, median income, or district funding amount correlated with autism eligibility in Maryland during 2010. They found only Asian students were more likely than White students to be identified with autism, but districts with high median income and few Title 1 students had the highest rates of autism identification. Boswell et al. further found districts with high funding also had high rates of autism when compared to districts with low funding.

The available national-, state-, and district-level analyses of special education eligibility data indicate minority students with autism are underidentified when compared to their White counterparts. The extant findings are supported by earlier studies of autism identifi-

cation as well as various epidemiological studies that found minority children were less likely to be diagnosed with autism (Dyches, Wilder, Sudweeks, Obiakor, & Algozzine, 2004; Mandell et al. 2010; Mandell, Ittenbach, Levy, & Pinto-Martin, 2007; Mandell, Listerud, Levy, & Pinto-Martin, 2002; Morrier & Hess, 2010; Tincani, Travers, & Boutot, 2009). The disparate identification implies that children from traditionally marginalized racial groups likely experience diminished access to the highly specialized, evidence-based interventions that predict better long-term outcomes (e.g., Wong et al., 2015) and that White students with autism are more likely to receive autism-specific interventions and supports. However, it is unclear whether and to what extent disparate autism identification rates have occurred subsequent to recent changes in federal reporting requirements.

Changed Racial Reporting Categories

In 1997, the federal Office of Management and Budget announced a shift from reporting aggregate data based on five racial categories to seven racial categories for count data. Count data represent the number of individuals within each category and are how states report special education eligibility. One significant change was the establishment of a reporting category for individuals who identify as more than one race (i.e., “Two or More Races”) for reporting count data. All education-related agencies ranging from elementary schools to state education agencies and institutions of higher education were required to begin reporting data using the seven racial categories. During the transition period, states reported count data using either the previous five categories, the seven new categories, or both. The gradual change from five to seven reporting categories resulted in incomplete or disparate special education count data reporting from 2008 to 2011. Incomplete data sets limited studies of autism identification and disproportionate representation of students with disabilities more broadly.

Given changes in racial reporting requirements, it is unclear how differences in autism identification by race with seven categories may vary from differences in autism using five categories. It seems plausible the additional reporting categories may yield racial disparities in autism eligibility that differ from previous reports. Multiple reasons support this possibility and justify investigation. First, the creation of the Two or More Races (2+R) category likely will influence disproportionate representation broadly and the autism category specifically. For example, 80.1% of individuals who identified as 2+R in the 2000 U.S. census identified as White and at least one other race (Jones & Smith, 2001). Consequently, a corresponding reduction in the number of students in the White (only) category might be observed, which effectively reduces the denominator for risk and odds calculations when using White students as a reference category for statistical comparisons. Also, 25.8% of individuals identified themselves as Black or African American and at least one other race in the same census (Jones & Smith, 2001). Consequently, we might expect to observe a corresponding decrease in the number of Black or African American students in schools, which could result in reduced odds of identification for this group. Similarly, Asian (24.1%), Hispanic (i.e., Latino) (32.6%), and American Indian and Alaska Native (24.3%) people identified as Two or More Races (Jones & Smith, 2001). These racial groups tend to have fewer individuals identified with autism, and seemingly small fluctuations in these numbers (as a function of categorizing some as 2+R) may affect the odds of identification. Third, count data for Hawaiian or Pacific Islander students historically have been aggregated as Asian or Pacific Islander students, but this group is now separated into respective Asian and Hawaiian or Pacific Islander categories. This separation may affect autism identification among Asian students whose count data have traditionally approximated White students, and statistical analysis would reveal previously unreported rates of autism identification among Hawaiian or Pacific Islander students. Finally, the Hispanic national population count

has approximated that of Black or African Americans (35.3 million and 34.6 million, respectively). However, these groups have had distinctly different autism identification rates (e.g., Travers et al., 2013). Students who may previously have been identified as Black or African American or Hispanic may now be identified as 2+R, which would affect the odds of identification for these groups.

Purpose of the Study

Children with autism fare better when provided with intensive, evidence-based interventions that are demonstrably effective for learners with autism (Wong et al., 2015). Access to such services often hinges on accurate identification of students with autism. The extant literature suggests minority students were significantly less likely to be identified with autism, but changes to federal reporting requirements from five to seven racial categories may reveal different rates of autism identification than previously reported. Travers et al. (2014) found disparate identification among the five racial groups, but they did not examine prevalence rates for every state due to limited data. Accordingly, the purpose of this study was to investigate administrative autism prevalence for each state and Washington, D.C., and determine whether states identified students differently in each of the seven racial categories. The following questions guided our research:

Research Question 1: What was the percent of autism identification in each of the seven racial categories (as mandated in 2012) for each state and Washington, D.C.?

Research Question 2: Were there within-state differences in autism identification among the seven racial categories and Washington, D.C.?

Research Question 3: Did states differ in autism identification by the seven racial categories?

Given the potential for a large percentage of children to be reported as being Two or More

Races, we suspected Hispanic (i.e., Latino), Black or African American, Hawaiian or Pacific Islander, and American Indian or Alaska Native students with autism would be significantly underrepresented. We also suspected most states reported Asian students eligible for special education due to autism at rates that approximated rates for White students, and the administrative prevalence rates for Two or More Races would vary between states.

Method

We relied on official count data for students with autism by seven racial categories from the IDEA Data Center, an Office of Special Education–funded center that collects, reports, and analyzes mandated reporting data (ideadata.org). The IDEA Data Center provided count data in 2014 for all 50 states and Washington, D.C., except for Wyoming (which reported no data for any group), which left us with 49 states for analysis. The autism eligibility figures for students who were reported in 2014 as White, Black or African American, Asian, Native Hawaiian or Pacific Islander, Hispanic (i.e., Latino), American Indian or Alaska Native, and Two or More Races were retrieved and entered into a database. We relied on 2014 for three reasons. First, these data were the most recent and complete data set available. Second, potential impacts related to revisions to clinical diagnostic criteria (APA, 2013) would be minimized due to the temporal proximity of the revision. Third, local and state education agencies had reported races using the seven reporting categories for at least two years prior, allowing time to address potential fluctuations in data reporting associated with this major bureaucratic adjustment.

We also obtained enrollment data from the Digest of Education Statistics at the NCES (<http://nces.ed.gov/programs/digest>) for all seven racial categories for 2014. Count data were exported from the NCES website to database files and added to our database for autism counts. We then used the count data to ascertain the number of students with and

without autism in each racial category (i.e., group) for all states and Washington, D.C. We were interested in understanding the autism identification rate for each racial group for all states and Washington, D.C. Accordingly, we calculated the percentage of a student being found eligible for special education due to autism within each racial group.

Analyses

We analyzed the data in three ways. We therefore have described the three separate analyses as Part 1, Part 2, and Part 3 of the study. All data were analyzed using IBM SPSS Statistics 23.

Part 1. We calculated the percentage of students identified as having autism by each racial group for each state and Washington, D.C. We divided the number of students with autism within the racial group for a specific state by the total number of students in that same racial group for the same state to determine the percent identified.

Part 2. We used the logistic regression (logit link) model to examine odds of identification within each racial group within each state, consistent with Travers et al. (2014). The odds represented the number of students in each group identified as having autism divided by the number in each group not identified. The odds and odds ratios were calculated in SPSS 23 in the logistic regression analysis. This analysis allowed us to examine differences in odds of identification of autism by race within each state. Individual-level data were not available. Consequently, we used aggregated data from the state reports, and we weighted the data by the number of students in each group. For logistic regression analyses, this created a count within each group that represented individuals in our calculated odds and odds ratios. Autism was the criterion variable (i.e., 0 = no autism, 1 = autism). Race was a categorical variable entered as a predictor in the model. Each racial group had a unique code. For example, American Indian or Alaska Native was a distinct group with a

unique code (AI/AN). There were seven racial categories: American Indian or Alaska Native (AI/AN), Asian (AS), Black or African American (AA), Latino (LAT), Hawaiian or Pacific Islander (H/PI), Two or More Races (2+R), and White (WH). The WH group was the reference group because it (a) was the largest group in our data set and therefore supported a conservative calculation and (b) has been traditionally used for analyses of disproportionality (Donovan & Cross, 2002; Tabachnick & Fidell, 2001).

Part 3. We used the logistic regression (logit link) model to examine odds of identification within each racial group across states, consistent with Travers et al. (2014). This analysis allowed us to compare the odds of identification by race across the states. Autism was the criterion variable (i.e., 0 = no autism, 1 = autism). Race was a categorical variable entered as a predictor in the model (AI/AN, AS, AA, LAT, H/PI, 2+R, WH). Additionally, state was a categorical variable entered as a predictor. California was the largest state, the reference group, and coded as 0. Additionally, WH was the largest group in California and had a percentage of autism identification (1.6%) that was relatively consistent with the CDC (2016) prevalence rate (i.e., 1.5%). We used WH in California as the reference group because it was the largest group, a decision consistent with standard practices (Hosp & Reschly, 2003). Each of the other states and Washington, D.C., was entered alphabetically with codes from 1 to 50 (Wyoming did not report any data and therefore was omitted from the analyses).

Results

Part 1: Percentage of Students With Autism by Race

Table 1 displays the number and percentage of students identified with autism by race within each racial group identified with autism. Because White students in California was the reference group for the logistic regression analysis, California is listed first in this table.

Table 1. Number and Percentage of Students With Autism for Each State and Washington, D.C., by the Seven Racial Groups in 2014.

	American Indian or Alaska Native		Asian		Black or African American		Hispanic (Latino)		Hawaiian or Pacific Islander		Two or More Races		White	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Alabama	34	0.6	55	0.5	1,720	0.7	172	0.4	290	0.9	113	1.0	3,741	0.9
Alaska	132	0.4	68	0.8	30	0.7	75	0.9	5	0.4	109	1.0	663	1.0
Arizona	339	0.6	301	1.0	589	1.0	3,157	0.6	12	0.8	313	1.3	5,327	1.2
Arkansas	28	0.9	68	0.9	543	0.5	302	0.5	27	0.5	94	1.0	2,730	0.9
California	402	1.0	10,158	1.5	5,566	1.4	30,434	0.9	290	0.9	2,752	1.3	24,525	1.6
Colorado	42	0.6	139	0.5	217	0.5	1,137	0.4	13	0.8	231	0.8	3,520	0.7
Connecticut	26	1.7	333	1.3	917	1.3	1,267	1.1	15	1.0	171	1.3	4,677	1.5
Delaware	7	1.2	57	1.2	332	0.8	115	0.6	5	0.8	25	0.8	706	1.1
Washington, D.C.	0	0	9	0.8	516	0.9	58	0.5	1	8.2	10	0.8	85	1.2
Florida	72	0.8	730	1.0	4,606	0.7	8,532	1.0	7	0.9	952	1.1	12,739	1.1
Georgia	29	0.8	569	0.9	5,216	0.8	1,412	0.6	33	0.4	507	0.9	7,189	1.0
Hawaii	7	0.9	400	0.7	28	0.7	145	0.8	9	0.4	152	0.8	329	1.3
Idaho	41	1.1	35	0.9	25	0.8	91	0.2	260	0.8	229	3.9	1,982	0.9
Illinois	100	1.6	1,017	1.1	3,237	0.9	3,322	0.7	8	2.1	619	1.0	11,527	1.1
Indiana	28	1.1	197	1.0	1,274	1.0	968	0.9	45	0.6	635	1.4	10,604	1.4
Iowa	4	0.2	7	0.1	59	0.2	71	0.1	4	0.1	26	0.2	480	0.1
Kansas	26	0.5	96	0.7	305	0.9	403	0.4	1	0.4	183	0.8	2,406	0.7
Kentucky	8	0.9	61	0.6	512	0.7	194	0.5	3	0.3	141	0.7	4,224	0.8
Louisiana	23	0.4	78	0.7	1,665	0.5	153	0.4	2	0.3	61	0.5	2,215	0.7
Maine	29	1.9	27	1.0	60	1.0	48	1.4	2	1.6	57	1.9	2,405	1.4
Maryland	31	1.2	589	1.1	3,486	1.2	942	0.8	3	0.6	354	1.0	4,177	1.2
Massachusetts	19	0.9	711	1.2	1,123	1.4	1,807	1.1	7	1.5	430	1.5	10,443	1.7
Michigan	133	1.2	420	0.9	2,547	0.9	662	0.6	15	1.3	387	0.9	11,662	1.1
Minnesota	251	1.7	710	1.3	1,266	1.5	918	1.3	18	3.0	591	2.1	11,800	2
Mississippi	7	0.7	41	0.8	1,349	0.6	90	0.6	16	1.7	42	0.7	2,152	1.0
Missouri	43	1.1	207	1.2	1,441	1.0	378	0.8	3	0.5	251	1.1	7,076	1.1
Montana	48	0.3	4	0.3	3	0.2	23	0.4	9	0.9	17	0.5	499	0.4
Nebraska	40	0.9	61	0.9	181	0.9	322	0.6	3	0.5	101	1.0	2,098	1.0
Nevada	40	0.8	312	1.2	439	1.0	1,487	0.8	2	0.9	311	1.2	2,220	1.4
New Hampshire	5	0.9	41	0.7	44	1.2	70	0.9	55	3.6	5	0.1	2,086	1.3
New Jersey	21	1.0	1,528	1.2	2,353	1.1	3,196	1.0	5	1.2	192	1.2	9,203	1.4
New Mexico	141	0.4	35	0.9	60	0.9	1,007	0.5	35	1.0	60	1.2	905	1.1
New York	181	1.1	1,554	0.6	5,381	1.1	6,108	0.9	4	n/a	494	1.2	15,251	1.2
North Carolina	96	0.5	392	0.9	3,910	1.0	1,421	0.7	0	0.7	572	1.0	8,500	1.1
North Dakota	52	0.6	10	0.7	36	1.1	22	0.6	13	1.2	11	0.7	723	0.9
Ohio	26	1.2	325	1.0	2,488	0.9	700	0.9	3	0.7	770	1.0	14,857	1.2
Oklahoma	623	0.6	94	0.7	368	0.6	420	0.4	7	0.3	199	0.4	2,912	0.8
Oregon	118	1.2	317	1.4	161	1.1	1,211	0.9	6	1.0	491	1.6	6,026	1.6
Pennsylvania	36	1.4	702	1.2	3,140	1.2	2,032	1.2	40	1.4	1,348	2.9	18,478	1.5
Rhode Island	14	1.5	29	0.7	112	1.0	274	0.8	18	0.4	68	1.5	1,567	1.8
South Carolina	17	0.7	98	0.9	1,964	0.8	325	0.6	1	0.4	208	0.9	3,151	0.8
South Dakota	107	0.7	10	0.4	23	0.7	35	0.6	4	0	19	0.6	664	0.7
Tennessee	17	0.9	117	0.7	1,396	0.6	419	0.5	0	0.6	108	0.7	5,622	0.9
Texas	176	0.9	2,178	1.1	5,700	0.9	17,825	0.7	6	0.8	1,161	1.2	16,771	1.1
Utah	37	0.5	56	0.5	45	0.6	503	0.5	55	0.3	121	1.0	4,109	0.9
Vermont	2	0.8	18	1.1	23	1.4	17	1.2	31	3.6	13	0.6	888	1.1
Virginia	46	1.1	1,028	1.3	3,425	1.2	1,659	1.0	2	1.6	806	1.3	8,552	1.3
Washington	112	0.8	843	1.1	470	1.0	1,352	0.6	29	0.5	743	1.0	6,985	1.1
West Virginia	3	0.9	16	0.8	84	0.6	28	0.7	55	0	41	0.7	1,594	0.6
Wisconsin	158	1.4	290	0.9	671	0.8	811	0.9	0	1.5	257	1.2	7,682	1.2

Forty-six of the 49 states (including Washington, D.C.) had a percentage for White students that were lower than California. The only states with higher percentage of White students identified with autism were Massachusetts (1.7%), Minnesota (2.0%), and Rhode Island (1.8%). Oregon had the same percentage (1.65%). The lowest probabilities for White students were in Colorado (0.7%), Iowa (0.1%), Louisiana (0.7%), Montana (0.4%), South Dakota (0.7%), and West Virginia (0.6%).

None of the states or Washington, D.C., identified 1.6% of Black or African American students with autism, the percentage for White students in California (i.e., the comparison group). The states with the highest percentage of African American students identified were California (1.4%), Connecticut (1.3%), Massachusetts (1.4%), Minnesota (1.5%), and Vermont (1.4%). The states with the lowest percentage were Arkansas (0.5%), Colorado (0.5%), Iowa (0.2%), Louisiana (0.5%), Mississippi (0.6%), Montana (0.2%), and Utah (0.6%). No states or Washington, D.C., had higher a percentage of Latino students identified with autism than the percentage for the comparison (WH) group. The states with the highest probabilities of Latino students were Connecticut (1.1%), Maine (1.4%), Massachusetts (1.1%), Minnesota (1.3%), Pennsylvania (1.2%), and Vermont (1.2%). The states with the lowest probabilities were Alabama (0.4%), Colorado (0.4%), Iowa (0.1%), Louisiana (0.4%), Montana (0.4%), New Mexico (0.5%), and Utah (0.5%).

No state or Washington, D.C., had a higher percentage of Asian students identified with autism than the percentage for the (WH) comparison group. The states with the highest percentage were California (1.5%), Connecticut (1.3%), Minnesota (1.3%), and Oregon (1.4%). The states with the lowest percentage were Colorado (0.5%), Iowa (0.1%), Montana (0.3%), and South Dakota (0.4%). Three states (Connecticut, Illinois, Maine) had a higher percentage of American Indian students identified with autism than the percentage for the (WH) comparison group. The states with the highest percentage were Con-

necticut (1.7%), Illinois (1.6%), Maine (1.9%), and Rhode Island (1.5%). The states with the lowest percentage were Alaska (0.4%), Iowa (0.2%), Montana (0.3%), New Mexico (0.4%), and North Carolina (0.5%).

Forty of 48 states (including Washington, D.C.) had a percentage of Hawaiian or Pacific Islander students identified with autism that were lower than the percentage for the comparison group. New York did not report any data for analysis in this group. States with the highest percentage were Washington, D.C. (8.2%), Illinois (2.1%), Maine (1.6%), Mississippi (1.7%), New Hampshire (3.6%), and Vermont (3.6%). The states with the lowest percentage were Alaska (0.4%), Iowa (0.1%), Louisiana (0.3%), Oklahoma (0.3%), and Utah (0.3%). Forty-three states (including Washington, D.C.) had a percentage of students reported as Two or More Races identified that were lower than the percentage for the comparison group. The states with the highest percentage were Idaho (3.9%), Maine (1.9%), Minnesota (2.1%), and Pennsylvania (2.9%). The states with the lowest percentage were Iowa (0.2%), Montana (0.5%), New Hampshire (0.1%), and Oklahoma (0.4%).

Part 2: Within-State Comparisons Using Logistic Regression

For Part 2, we first used the logistic regression model to test differences in odds of identification by racial group within each state (see Figure 1). For each state, we compared the odds of identification for six racial categories (AI/AN, AS, AA, LAT, H/PI, 2+R) to the odds for the reference group (WH) within that state. The shading in Figure 1 displays the proportionate or significantly different ($p < .05$) odds of identification for the six racial groups for each of the 49 states and Washington, D.C. The shading indicates that the relationship between the odds identification of autism for the race associated with the map (e.g., Latino) to the odds of identification of the WH group within the state. For example, Figure 1 shows that Illinois is shaded dark grey for the AI/AN group. This means the odds in Illinois of being identified as having autism for AI/AN is sig-

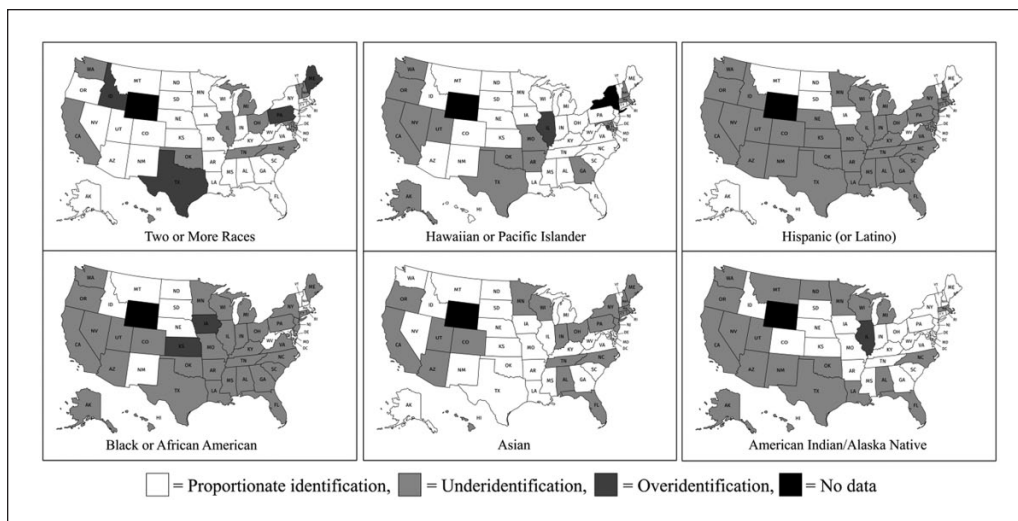


Figure 1. Within-state comparisons of odds ratios using logistic regression with shading to indicate proportionate identification, significant underidentification, or significant overidentification of each group compared to White students within the same state.

nificantly higher ($p < .05$) than the odds for the WH group in Illinois.

Figure 1 also shows that Latino students were significantly underidentified with autism in the greatest number of states (42), including Washington, D.C. African American students were significantly underidentified in the second highest number of states (37 including Washington, D.C.), followed by Asian students (22 states), American Indian or Alaskan Native (21 states), and Hawaiian or Pacific Islanders (14 states). The students from the Two or More Races group were significantly underidentified in the fewest states (13). California significantly underidentified every racial group. Six states significantly underidentified five of six racial groups within the respective state (HI, NC, OK, OR, UT, and WA). Twelve states significantly underidentified four of six racial groups (AL, AZ, FL, MA, MI, MN, NV, NH, OH, TN, TX, and WI). Figure 1 also shows that four states overidentified students in the Two or More Races group. Two states overidentified students from the African American group. One state and Washington, D.C., overidentified students from the Hawaiian or Pacific Islander group. One state (IL) overidentified students from

the American Indian or Alaska Native group and Hawaiian or Pacific Islander.

Part 3: Between-State Comparisons Using Logistic Regression

For Part 3, we used the logistic regression model to test differences in odds of identification between each state. First, we compared the odds of identification of each state to the odds of identification in the comparison group, California. The model was significant (chi-square = 34,134, $p < .001$). Figure 2 displays the odds ratios and 95% confidence intervals for each state except California (the comparison group). Thirty-nine states had odds ratios less than 1.0, indicating they were significantly less likely to identify students with autism than California. Iowa had the lowest odds of autism identification (0.11). Eight states (CT, IN, ME, MA, MN, OR, PA, and RI) had odds ratios greater than 1.0, indicating they were significantly more likely to identify students with autism than California. Minnesota had the highest odds ratio of identification (1.55). Three states (NH, NJ, WA) had odds ratios for students with autism consistent with California.

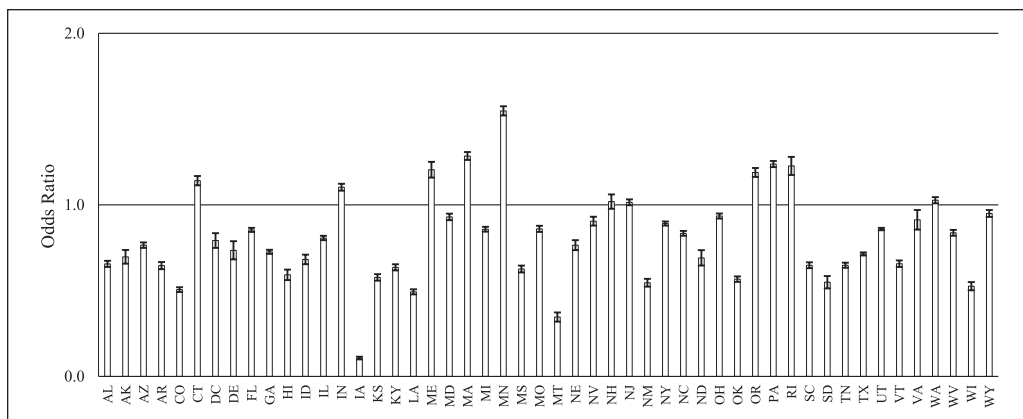


Figure 2. Odds ratios of autism identification in each state and Washington, D.C., compared to California with 95% confidence intervals.

Note. Proportionate representation is indicated when any portion of the confidence interval overlaps with 1.0 (e.g., NH, NJ). Overrepresentation is indicated when the lower end of the confidence interval is higher than 1.0 (e.g., MN, WA), and underrepresentation is indicated when the upper end of the confidence interval is less than 1.0 (e.g., OH, VA).

Second, we used the logistic regression model to test differences in odds of identification by racial group between each state. For each state, we compared the odds of identification for seven racial groups (AI/AN, AS, AA, LAT, H/PI, 2+R, WH) to the odds for the reference group (WH in California). In California, we compared the six racial categories to the WH group. Table 2 shows the odds ratios (ORs) and the associated significance tests for the seven disability categories across states. For instance, a significant OR of 0.5 for the AA group in a state indicates that African American students in the state were 0.5 times as likely (i.e., half as likely) to be identified as White students in California. There is no OR for the WH group in California because it was the reference group.

All but two states (ME, RI) significantly underidentified four or more racial categories. Seventeen states underidentified five of seven racial categories, and 18 states underidentified students from every racial group when compared to California (AK, AZ, AR, CO, FL, GA, IA, KS, MI, MO, NC, NV, NY, OK, SC, TX, UT, WA). The LAT and AS groups were significantly underidentified in the greatest number of states (49 including Washington, D.C.), while the AA group was underidentified in 48 states (including Washington D.C.).

The 2+R group and the WH group were underidentified in nearly all states (45 and 46, respectively). The AI/AN group was significantly underidentified in 33 states while the HI/PI group was significantly underidentified in the fewest number of states (27). The range of OR for groups significantly underidentified varied. The range for the underidentified AI/AN group ranged from 0.13 (IA) to 0.78 (OR). The range for the underidentified AS group ranged from 0.04 (IA) to 0.93 (CA). The range for the underidentified AA group ranged from 0.14 (IA, MT) to 0.92 (CA). The range for the underidentified LAT group ranged from 0.09 (ID) to 0.84 (MN). The range for the underidentified H/PI group ranged from 0.07 (IA) to 0.8 (MI). The range for the underidentified 2+R group ranged from 0.07 (NH) to 0.86 (IN). The range for the underidentified WH group ranged from 0.08 (IA) to 0.97 (PA).

There were 32 states where the LAT group had significant ORs below 0.50. There were 20 states where AI/AN group and the AA groups had significant ORs below 0.50. There were 19 states where the H/PI group had significant OR below 0.50 and 18 states where the AS group had significant ORs below 0.50. There were 15 states where the 2+R group had significant ORs below 0.50, while there were just 9 states where the WH group had ORs

Table 2. Odds Ratios by Race for All States Compared to White Students With Autism in California.

	American Indian or Alaska Native	Asian	Black or African American	Hispanic (Latino)	Hawaiian or Pacific Islander	Two or More	White
California	0.66***	0.93***	0.92***	0.58***	0.56***	0.85***	—
Alabama	0.35***	0.34***	0.43***	0.26***	0.57	0.61***	0.56***
Alaska	0.27***	0.53***	0.42***	0.55***	0.24***	0.64***	0.65***
Arizona	0.41***	0.62***	0.65***	0.41***	0.53***	0.81***	0.75***
Arkansas	0.57***	0.59***	0.33***	0.35***	0.28***	0.62***	0.56***
Colorado	0.40***	0.33***	0.33***	0.25***	0.48**	0.48***	0.46***
Connecticut	1.07	0.83***	0.82***	0.69***	0.62	0.84*	0.93***
Delaware	0.77	0.77	0.51***	0.38***	0.49	0.48***	0.71***
Washington, D.C.	0	0.5*	0.57***	0.33***	5.62***	0.51*	0.78
Florida	0.50***	0.66***	0.47***	0.66***	0.59**	0.7***	0.72***
Georgia	0.49***	0.59***	0.52***	0.39***	0.28***	0.6***	0.62***
Hawaii	0.59	0.42***	0.46***	0.49***	0.27***	0.52***	0.82***
Idaho	0.67	0.57***	0.5***	0.11***	0.5*	2.55***	0.55***
Illinois	1.03	0.7***	0.56***	0.41***	1.32	0.62***	0.71***
Indiana	0.69*	0.63***	0.63***	0.58***	0.38	0.86***	0.91***
Iowa	0.13***	0.04***	0.14***	0.09***	0.07**	0.10***	0.08***
Kansas	0.33***	0.46***	0.54***	0.28***	0.22***	0.5***	0.46***
Kentucky	0.58	0.39***	0.44***	0.34***	0.2*	0.44*	0.5***
Louisiana	0.28***	0.47***	0.33***	0.28***	0.2*	0.33***	0.42***
Maine	1.22	0.61*	0.65***	0.92	1.05	1.2	0.91***
Maryland	0.76	0.71***	0.73***	0.50***	0.35**	0.64***	0.75***
Massachusetts	0.54**	0.77***	0.86***	0.70***	0.95	0.98	1.07***
Michigan	0.75***	0.58***	0.57***	0.4***	0.8***	0.56***	0.7***
Minnesota	1.09	0.83***	0.98	0.84***	1.94**	1.34***	1.25***
Mississippi	0.43*	0.53***	0.35***	0.4***	1.09	0.47***	0.61***
Missouri	0.68*	0.74***	0.6***	0.49***	0.32***	0.71***	0.67***
Montana	0.19***	0.21**	0.14***	0.24***	0.59	0.29***	0.27***
Nevada	0.58***	0.54***	0.56***	0.38***	0.33	0.63***	0.63***
Nevada	0.53***	0.78***	0.62***	0.51***	0.58***	0.78***	0.87***
New Hampshire	0.55	0.46***	0.79	0.54***	2.32	0.07***	0.81***
New Jersey	0.66	0.76***	0.68***	0.61***	0.73	0.76***	0.87***
New Mexico	0.26***	0.56***	0.59***	0.31***	0.63	0.78	0.69***
New York	0.72***	0.41***	0.69***	0.58***	-	0.77***	0.76***
North Carolina	0.29***	0.6***	0.63***	0.41***	0.47**	0.64***	0.7***
North Dakota	0.36***	0.45*	0.7*	0.36***	0.79	0.45**	0.54***
Ohio	0.74	0.62***	0.56***	0.57***	0.41*	0.63***	0.75***
Oklahoma	0.38***	0.47***	0.37***	0.26***	0.2***	0.26***	0.52***
Oregon	0.78**	0.88*	0.69***	0.58***	0.63**	1.03	1.01
Pennsylvania	0.87	0.74***	0.75***	0.77***	0.86	1.86***	0.97**
Rhode Island	0.95	0.44***	0.62***	0.52***	0.26	0.95	1.14
South Carolina	0.44**	0.59***	0.47***	0.37***	0.28**	0.58***	0.51***
South Dakota	0.45***	0.28***	0.41***	0.37***	0	0.35***	0.42***
Tennessee	0.45***	0.28***	0.41***	0.37***	0	0.35***	0.42***
Texas	0.6*	0.42***	0.39***	0.34***	0.41*	0.42***	0.54***
Utah	0.55***	0.73***	0.55***	0.42***	0.51***	0.76***	0.7***
Vermont	0.32***	0.33***	0.35***	0.32***	0.21***	0.62***	0.54***
Virginia	0.72*	0.81***	0.73***	0.63***	1.01	0.85***	0.82***
Washington	0.48***	0.7***	0.62***	0.38***	0.34***	0.66***	0.72***
West Virginia	0.58	0.51**	0.40***	0.45***	0	0.47***	0.39***
Wisconsin	0.92	0.58***	0.50***	0.56***	0.97	0.77***	0.77***
Total states with significant underrepresentation	33	49	48	49	27	45	46

Note. New York did not report data for Hawaiian or Pacific Islander students with autism in 2014. Wyoming did not report any count data for the autism category in 2014. Asterisks denote statistically significant odds ratios for the comparisons with White students in California.

* $p < .05$. ** $p < .01$. *** $p < .001$.

below 0.50. There were few instances of racial groups being overidentified compared to the reference group. The Two or More Races group was significantly overidentified in three states (ID, MN, PA). The Hawaiian or Pacific Islander group was significantly overidentified in two states (Washington, D.C, MN), and the White group was significantly overidentified in two states (MA, MN).

Discussion

The purpose of this study was to examine racial differences in administrative autism identification rate within and between states in 2014. Accordingly, we analyzed the probability a student would be eligible for special education according to the IDEA (2004) autism category as well as differences in odds of identification by race within and between states. Regarding our first research question, we found within-state variations in the probability of autism in all seven racial categories and that some states had remarkably low rates of autism in some racial categories. For example, Hawaiian or Pacific Islander students had the highest overall probability of being identified with autism at 9.1% in Washington, D.C., which is contrasted with Asian students in Iowa, who had an 0.1% probability of being identified with autism. In Iowa, only 0.22% of African American students were eligible for special education due to autism. Although a student's eligibility determination does not dictate the services to be provided, categorization provides professionals with important starting points for intervention selection (Kauffman, Anastasiou, Badar, Travers, & Wiley, 2016). Failure to acknowledge a child's autism may complicate, delay, or result in denied access to interventions that are demonstrably effective (Wong et al., 2015) and therefore most likely to confer social, communicative, behavioral, and academic benefit. For example, the remarkably low rates of autism in Iowa, which may be related to its reliance on noncategorical eligibility requirements, suggests some students with autism in that state may have limited access to autism-specific interventions (cf. Ryan, 2017).

Racially diverse groups had low rates of autism in many states, but the disparity was less pronounced and not apparent in every racial group (e.g., ID, KS, LA, MO, NM, OK, SD). Conversely, some states had relatively higher probabilities for all (MN) or most racial categories (e.g., CT, MA, VT, VA). In general, the percentage of students identified with autism within states varied considerably by race even with the addition of the Two or More Races group.

Regarding our second research question, we found consistent patterns of differences in odds of identification within states. Only seven states (IA, ID, IL, KS, ME, PA, TX, and Washington, D.C.) overidentified any non-White racial groups within the respective state. Of those, only one state (IL) overidentified students in more than one racial category (Hawaiian or Pacific Islander and American Indian or Alaska Native). Latino students were underidentified in the highest number of states, followed by African American students, Asian students, and American Indian or Alaskan Native students. Students in the Two or More Races and Hawaiian or Pacific Islander groups were underidentified in the fewest number of states. This is potentially an important finding considering both were new mandated racial reporting categories unexamined in previous autism identification research. Only three states (IA, SD, WV) did not underidentify any racial groups, but these states also had extremely low probabilities of identifying White students (i.e., the reference group) and underidentified every racial group, including the White group when compared to California. The data do not permit any adequate explanation for the varied pattern of underidentification within states.

With respect to our third research question, we found differences in overall odds of identification across states, with consistent patterns of significant underidentification of all racial groups, including the White group, when compared to California. Latino, African American, and Asian students were significantly underrepresented in 49, 48, and 49 states, respectively. The underidentification of Asian students with autism is a notable and represents a novel

finding inconsistent with prior research (Dyches et al., 2004; Sullivan, 2013; Travers et al., 2013). It is possible the change in identification patterns is a function of the separation of Hawaiian or Pacific Islander and Asian students into discrete groups. Students in the Two or More Races group were underidentified in 45 states. This suggests the new racial category had little or no effect on disproportionality among African American and Latino groups, the racial groups from which the majority of students in the Two or More Races group were likely drawn.

We also found White students were significantly underidentified in 46 states when compared to White students in California. There are several plausible explanations for the disproportionate identification of White students between states. One explanation is White students in California were overidentified, which would complicate comparisons of other groups to this reference group. However, this notion conflicts with the prevailing rate of autism from an epidemiological perspective. The CDC (2016) reported the autism prevalence for White children in the United States as approximately 1.6%, consistent with the rate in California. Although the CDC uses a different system for identification, the comparable rates do not support the explanation that White students in California are overidentified. We suspect White students who have autism in other states are not consistently identified under the IDEA (2004) eligibility criteria. This explanation is consistent with prior findings on autism identification (Morrison & Hess, 2012; Sullivan, 2013; Tincani et al., 2009; Travers et al., 2013, 2014). Importantly, it seems very unlikely that state lines have any bearing on whether a child has autism. We instead suspect state policies and practices influence whether a child who has autism is accurately identified and provided with autism-specific interventions that are evidence-based (Wong et al., 2015).

The underidentification of White students in states other than California is critical for understanding disproportionate identification of autism in those states because we used White students with autism in a state as the reference group for within-state analyses. Pro-

portionate identification of groups within a state may mask underidentification of White students in that state. For example, Kansas proportionately identified autism for four racial groups (American Indian or Alaska Native, Asian, Hawaiian or Pacific Islander, and Two or More Races). However, only 0.7% White students in Kansas were eligible due to autism, which was less than half the probability of autism in California. Each of the four proportionately identified racial groups in Kansas were significantly underidentified when compared to White students in California. We observed numerous similar findings for different racial groups within different states. Consequently, it seems critical to examine within-state prevalence rates within the broader national context.

General Interpretations

Our findings extend prior research but also reveal previously unknown disproportionate identification of students with autism across and within states. Specifically, we found evidence consistent with prior research that Latino, African American, and American Indian or Alaska Native students are significantly underidentified in most states. We also found new evidence that White students in most states are identified at significantly lower rates than White students in California. The two new racial reporting categories revealed widespread underidentification of autism. Whereas previous studies found Asian students had identification rates that approximated White students (e.g., Tincani et al., 2009; Travers et al., 2013, 2014), our findings indicate Asian students with autism were underidentified in most states when compared to White students in California, but often were proportionately identified with White students within their respective states.

Racially diverse students with autism were not identified at rates consistent with their White counterparts and, consequently, may not access autism-specific interventions and services with a sufficient degree of intensity to achieve necessary outcomes. Federal IDEA compliance indicators 9 and 10 were adopted to address

disproportionate representation in special education due to inappropriate identification, but the government has found almost no states out of compliance with these indicators despite widespread and persistent disproportionality (Government Accountability Office, 2013). This study extends previous evidence of disproportionate identification of autism and highlights the continued failure of government to address underrepresentation in the autism category.

One might expect some variation between states with very different racial demographics. However, inspection of regionally similar states revealed no consistent patterns. For example, Nebraska had nearly one-third fewer Asian students with autism than Iowa but identified nearly 9 times as many Asian students. Conversely, New England states reported prevalence rates for African American students that were similar to each other and similar to rates reported in Minnesota. Similar albeit less striking discrepancies existed between several other neighboring states (e.g., Latino students in FL and GA; American Indian or Alaska Native students in WA and OR; Asian, African American, Latino, Hawaiian or Pacific Islander, and Two or More Races students in KY and VA). The discrepancies suggest that within-state factors moderate identification. Although data from this study could not be used to determine factors that may have accounted for discrepant identification, we speculate that such factors might include (a) varied administrative definitions of autism; (b) different state evaluation policies; (c) varied assessment practices at the district, school, and individual (evaluator) levels; (d) varied financial resources between and within districts and schools; (e) autism-related infrastructure (e.g., health insurance mandates for autism treatment; Medicaid); and (f) various social factors (e.g., limited access to pediatric care).

Implications

There are at least three main implications of our findings. First, students with autism likely do not access autism-specific interventions because they are not accurately identified as eligible for services (i.e., false negatives). Although IDEA makes clear that eligibility

category should not determine services, local education agencies (LEAs) as well as parents continue to rely on eligibility categories to inform practical decisions about services and delivery. Furthermore, researchers continue to clarify what interventions are evidence-based for learners with specific disability types (e.g., Wong et al., 2015). If minority students are underidentified compared to White students, then it is reasonable to conclude they are not eligible for services due to their autism and consequently may be denied access to specialized interventions and supports that are evidently effective for learners with autism.

Second, White students more often receive autism-specific services that in turn function to restrict access to the same services by minority students. This would occur if White students are more often found eligible under the autism category despite having a different primary disability (i.e., false positives; White overrepresentation). If relatively expensive autism services are largely directed toward White students with and without autism, then fewer services would be available to serve minority students. A resource-limited environment may effectively discourage multidisciplinary teams from finding minority students eligible under the autism category, especially when parents are less likely to advocate for an autism eligibility or their child does not have a clinical diagnosis.

Third, minority students may be unidentified because the eligibility process may have a racial or cultural component that results in underidentification of specific subgroups. That is, the behaviors and characteristics associated with autism are inaccurately attributed to racial, cultural, or linguistic differences. The bias theory of disproportionality partly motivated IDEA compliance indicators 9 and 10 and has for decades been a prominent explanation for disproportionality of students in the learning disability, intellectual disability, and emotional/behavioral disorder categories. Concerns about racial bias and overrepresentation of minority students in other categories may have constrained minority autism identification. For example, Latino families who primarily speak Spanish may encounter barriers to the autism

eligibility that emanate from professional concerns about dual language learning. Similarly, professionals may conclude the behavior of an African American child is more accurately a reflection of parental discipline style than autism. Without malice and out of concerns related to overrepresentation of minority students in special education, team members may wrongly conclude a minority student has a different or no disability when a White student with a similar profile is found eligible under the autism category. Minority students could be denied an autism eligibility and consequently, access to autism specific services due to professional concerns about cultural, racial, or linguistic biases during the eligibility determination process.

Limitations and Directions for Future Research

Previous epidemiological studies have found that age and race function as barriers to timely diagnosis, but we did not disaggregate count data according to student age. Thus, our analyses did not account for variability in autism identification according to student age, and there may have been an age effect. For example, the IDEA allows states to use “developmental delay” as an eligibility category for a child until age nine years. States (and LEAs) that more frequently use this category may have impacted the administrative codes in those states by using developmental delay rather than autism as the eligibility category for younger children. The differences we found could have been more likely in older students than young students, which would be an important discovery. To address this limitation, future studies should examine whether odds of autism are different among age groups by race.

We relied on California as the comparison state because it was the state with the largest population. Comparing states to California was useful for revealing differences between states for all seven racial categories and indicated how proportionate identification within states may occur irrespective of between-state differences. Other comparison states (e.g., Texas, Florida, New York) would produce dif-

ferent between-states results, although conclusions would be consistent relative to the reference state. That is, if the odds of identification in the reference state were half that in California, we would have found fewer states with underidentification and more states with overidentification. However, the differences across the states would have been consistent with respect to magnitude of differences, and conclusions from such analyses would parallel ours. Nonetheless, between-state analyses that use reference states within regions for analyses between states within the respective regions could reveal important regional differences in identification.

The lack of clarity with respect to the Two or More Races group also limited the interpretation of some of our findings. We do not know about any racial variability within this group or whether this group is composed largely of students of a particular combination of races (e.g., Black or African American and White; Black or African American and Latino; White and Latino). Although the addition of Two or More Races may have functioned to clarify identification rates in the other racial groups, the ambiguous composition complicates interpretation of identification rates for students within this category.

Another limitation commonly associated with studies of autism identification relates to varied eligibility criteria and procedures across states. Autism eligibility under the IDEA requires a determination that a child’s autism negatively affects educational performance (IDEA, 2004). This subjective criterion may affect autism eligibility. For example, some LEAs may consider social development an essential aspect of educational performance and consequently find a student with Asperger syndrome and excellent academic skills eligible for special education based on impaired social skills. Conversely, other LEAs may perceive educational performance as strictly pertaining to measures of academic performance and would determine the same student not eligible for special education. Other policies may affect racial differences within a state, especially if differences in LEA eligibility determinations are influenced by

the racial composition of the students served by that LEA. Consequently, our findings of differences between states cannot be entirely explained. Future research that examines whether law, policy, and practices at state, LEA, and school levels are related to accurate eligibility determinations could address this limitation.

Future research also should aim to discover the accuracy of autism identification and pursue development of a consistent identification process that accounts for and limits the effect of subjective eligibility determinations resultant of cultural, racial, socioeconomic, or linguistic bias. Additionally, researchers should examine the eligibility determination processes across LEAs within states to determine the standards applied and procedures used in determining eligibility. Such studies may reveal patterns of practice that influence identification and autism-specific services. Research also is needed that examines the negative effects associated with inaccurate identification. Specifically, researchers should examine whether unidentified or misidentified students fail to receive evidence-based interventions and supports for students with autism. Researchers also should examine ways to investigate autism identification within and across states by age and other factors. It is possible, if not probable, that state and district factors such as per pupil expenditure, percentage of novice education professionals, median home value, and others might reveal whether and to what extent student race combined with other factors more accurately predict underidentification of children with autism.

Conclusion

Autism identification continues to vary by race both within and between states, and the presence of new racial categories has clarified the underidentification of minority students in this eligibility category. Minority students in most states are identified at rates lower than their White counterparts within their respective states, and minority students in most states are underidentified when compared to students of the same race in California. White students

in most states are underidentified compared to their White counterparts in California. These findings may be explained by limited resources that restrict student access to autism-specific services, the presence of bias in the eligibility determination process, or a combination of these and other factors. Regardless of whether these presumptions account for underidentification of minority students, these and previous findings suggest that states are not held accountable to primary tenets of the IDEA and that LEAs may persistently and with impunity misidentify or deny eligibility to minority students with autism (e.g., Carroll & Rosenthal, 2016; Rosenthal, 2016).

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