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ORIGINAL PAPER

# Do Implicit and Explicit Racial Biases Influence Autism Identification and Stigma? An Implicit Association Test Study

**Rita Obeid[1,6,7] · Jennifer Bailey Bisson[2] · Alexandra Cosenza[3] · Ashley J. Harrison[4] · Faith James[3] · Sabine Saade[5,8,9] · Kristen Gillespie-Lynch[6,9]**

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## Abstract

Are implicit and explicit biases related to ASD identification and/or stigma? College students ($N=493$) completed two IATs assessing implicit stigma and racial biases. They evaluated vignettes depicting a child with ASD or conduct disorder (CD) paired with a photo of a Black or White child. CD was more implicitly and explicitly stigmatized than ASD. Accurately identifying ASD was associated with reduced explicit stigma; identifying CD led to more stigma. Participants who identified as White implicitly associated the White child with ASD and the Black child with CD. A trend in the reverse direction was observed among Black participants. Implicit and explicit biases were unrelated. Findings highlight a need for trainings to ameliorate biases favoring one's in-group.

**Keywords** IAT · Autism spectrum disorder · Conduct disorder · Stigma · Implicit · Explicit

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental condition characterized by difficulties in social interaction and communication, in addition to repetitive behaviors and restricted interests (American Psychological Association 2013). ASD can often be accurately diagnosed before 2 years of age (Guthrie et al. 2013). Early diagnosis and intervention are associated with improved outcomes for autistic individuals[1] (Bryson et al. 2003; Zwaigenbaum et al. 2015). However, ASD is often diagnosed years after symptoms become apparent and/or misdiagnosed (Mandell et al. 2007). Delays in ASD diagnosis are most consistently documented among racial and ethnic minority groups (i.e., Black and Hispanic children in the United States and other ethnic minorities outside of the US), economically disadvantaged children, and girls (Begeer et al. 2009, 2013; Mandell et al. 2002, 2007, 2009; Mandell and Palmer

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✉ Rita Obeid
rita.obeid@case.edu

✉ Jennifer Bailey Bisson
jbisson@clemson.edu

✉ Kristen Gillespie-Lynch
kgillyn@gmail.com

[1] Case Western Reserve University, 10900 Euclid Ave, Cleveland, OH 44106, USA

[2] Clemson University, 418 Brackett Hall, Clemson, SC 29634, USA

[3] College of Staten Island, City University of New York, Staten Island, NY, USA

[4] University of Georgia, Athens, GA, USA

[5] Present Address: American University of Beirut, Beirut, Lebanon

[6] Graduate Center, CUNY, New York, USA

[7] College of Staten Island, Lehman College, Bronx, USA

[8] Université du Québec à Montréal (UQAM), Montréal, Canada

[9] College of Staten Island and The Graduate Center (CUNY), 2800 Victory Blvd, Staten Island, NY 10314, USA

[1] We use identity-first language (e.g., autistic people) rather than person-first language (e.g., people with autism) because identity-first language is preferred by autistic people (Kapp et al.; 2013; Kenny et al., 2016) and may be less likely to contribute to stigma (Gernsbacher, 2017). As recommended by Dunn and Andrews (2015), the APA now recommends that researchers follow the preferences of minority groups by using the terms that they prefer to describe them (https://www.apa.org/pi/disability/resources/choosing-words).

2005; Valicenti-McDermott et al. 2012). Even after overcoming delays in diagnosis, Black and Hispanic children may receive lower quality healthcare than White children (Magaña et al. 2012). Given that the autistic people who are most likely to experience delayed diagnosis and/or misdiagnosis differ from stereotypical representations of ASD as a condition affecting affluent White males (Sarrett 2011; Matthews 2019), researchers have speculated that implicit and explicit biases may contribute to delays in diagnosis. However, to the best of our knowledge, no prior study has examined the degree to which implicit biases influence ASD identification. The aim of the current study is to examine the degree to which implicit and explicit biases relate to ASD identification and stigma.

## Racial and Ethnic Disparities in ASD Identification

Early epidemiological studies suggested that ASD prevalence does not differ as a function of race/ethnicity (reviewed by Fombonne 2003). Subsequent studies revealed reduced rates of identified ASD among ethnic and/or racial minorities in the US, Israel, and Sweden (Baio 2014; Hill et al. 2014). Black children in the US may receive an ASD diagnosis a year or more after their White peers (Mandell et al. 2002). They are also approximately twice as likely to be diagnosed with conduct disorder (CD) relative to White children (Mandell et al. 2007). Conduct disorder is defined by behaviors indicating persistent disregard for the rights of others (e.g., aggression, deception, and property destruction) and is a precursor to antisocial personality disorder (American Psychiatric Association 2013), which is highly stigmatized (Feldman and Crandall 2007). Not only does potential misdiagnosis of Black children with CD limit their access to appropriate supports, it likely engenders stigma.

Researchers have identified a number of factors that may contribute to racial and/or ethnic disparities in ASD identification including socioeconomic disparities in access to information and healthcare, communication barriers, cultural differences in stigma, views about development, trust in professionals and/or help-seeking behaviors, and biases among professionals (Begeer et al. 2009; Dempster et al. 2015; Donohue et al. 2019; Hill et al. 2014; Mandell et al. 2007; Nelson 2002; Zuckerman et al. 2013). Socioeconomic inequality reduces the likelihood that less affluent autistic children will be diagnosed in a timely manner (or at all) and contributes to racial disparities in ASD diagnoses in the US, where healthcare is not universally available (Durkin et al. 2017). In contrast, a prevalence study conducted in Sweden, where access to healthcare is universal, revealed heightened rates of ASD among poorer families (Rai et al. 2012).

Although access to universal healthcare alleviates socioeconomic disparities in access to ASD diagnosis and care, racial and ethnic disparities are *not* eliminated in countries with universal access to healthcare. In the Netherlands (where healthcare is universally accessible), autistic ethnic minorities (Turkish and Moroccan) were underrepresented in specialized ASD health institutions (Begeer et al. 2009). To evaluate if biases among professionals contributed to reduced detection of ASD among minority children, Begeer and colleagues (Burke et al. 2016; Begeer et al. 2009) provided 82 pediatricians with 6 vignettes depicting autistic children. The ethnic background of children in the vignettes (two Dutch majority, two Western minority and two non-Western minority vignettes) was varied independently of other characteristics. The researchers also varied the number of autistic features described in each vignette (one feature, two features, or three features). Participants first provided spontaneous clinical judgements by responding to the question *"what is the matter with this child?"* and then rated how likely they thought it was that the child in each vignette exhibited one of eight possible diagnostic categories including ASD, Attachment Disorder, Attention-Deficit/Hyperactivity Disorder, and Language Impairment. Pediatricians were less likely to spontaneously include ASD in their descriptions of vignettes depicting non-Western minority children relative to Dutch children. However, no differences were observed between spontaneous judgements of Western children who were not Dutch and non-Western children. When pediatricians were asked to rate the likelihood of an ASD diagnosis, no effect of child ethnic background was observed. These findings highlight biases among professionals as a potential source of ethnic and/or racial disparities in ASD identification. However, the significant difference in spontaneous judgements of Dutch and non-Western children arose from one of many one-tailed tests for which no statistical corrections were used.

In a follow-up study, Burke et al. (2016) examined whether ethnicity affected the degree to which school-based professionals in the Netherlands identified ASD. They recruited 50 school-based mentors (32% teachers). The design of the study was identical to their aforementioned study (Begeer et al. 2009). Ethnic background again affected ASD identification. School-based professionals were more likely to spontaneously refer to ASD in response to vignettes of Dutch majority children compared to vignettes of both Western and non-Western minority children. In contrast to the prior study with pediatricians, structured ratings of the likelihood of different diagnoses revealed heightened ratings of ASD likelihood for Dutch majority children relative to both Western and non-Western minority children.

Together, these findings suggest that ethnic/racial biases in ASD identification may be influenced by intergroup processes that participants may or may not be aware of. A large

body of prior research has demonstrated that people exhibit explicit and implicit biases favoring their own in-group over out-groups, including enhanced skill at recognizing characteristics of in-group members (Kawakami et al. 2017). However, the degree to which ASD identification is heightened for in-group versus out-group members remains an open question as the ethnicity of the pediatricians and school-based professionals who participated in the aforementioned studies was not documented.

In another follow-up study, Burke et al. (2016) used a similar survey design to assess diverse health-care professionals' ($N=431$) ability to spontaneously identify ASD, CD, ADHD, anxiety disorder, and depression. The ethnic background of the children in the vignettes (Dutch majority, Western minority, and non-Western minority) and number of symptoms of each disorder (5 or 10) was again manipulated. Unlike in their prior work, the socioeconomic background of the child in each vignette was also systematically varied (high or low), thus controlling for differences in the socioeconomic status of the child in each type of vignette. Also unlike in their prior work, spontaneous identification of any of the disorders was *not* influenced by the ethnic background of the child in the vignette. The authors speculated that the ethnic differences in identification of ASD they had observed in their prior work might have been influenced by differences in the apparent socioeconomic status of the children in the vignettes. However, the number of symptoms depicted in each vignette had also increased from their prior studies as had the number of vignettes participants had to rate (and the potential for participant exhaustion). Their innovative line of research supports the need to investigate the degree to which race and/or ethnicity might influence implicit and explicit biases towards ASD in a different cultural context than the Netherlands, such as the US, where pronounced racial and ethnic disparities in ASD identification have been observed.

## Biases that May Contribute to Discrepancies in ASD Identification

Past research examining attitudes toward ASD has focused primarily on explicit processes that are consciously accessible. In addition to the aforementioned evidence of racial and ethnic disparities in ASD identification, research about explicit attitudes toward ASD has revealed that people may quickly form negative first impressions of people exhibiting autistic behaviors (Sasson et al. 2017). However, explicit stigma towards autism may be lower than stigma towards many other disorders (Feldman and Crandall 2007; Gillespie-Lynch et al. 2020). Explicit stigma towards ASD also varies as a function of cultural context and individual differences (Gillespie-Lynch et al. 2015; Obeid et al. 2015; Someki et al. 2018). Heightened explicit stigma towards ASD is often associated with being male, increased acceptance of societal inequalities; and lesser ASD knowledge, quality of past contact with ASD, and openness to experience (e.g., Campbell and Barger 2014; Gillespie-Lynch et al. 2019; Mahoney 2008).

Due to limitations associated with the self-report nature of explicit attitudes, including the potential for responses to be influenced by social desirability bias and/or challenges with introspective access, researchers have long recognized that explicit measures may underestimate actual levels of stigma (Hinshaw and Stier 2008). To overcome the limitations of explicit measures, researchers have developed tools to measure implicit attitudes that are automatically activated outside of our immediate conscious control (Greenwald and Banaji 1995; Nosek and Banaji 2001; Karpinski and Steinman 2006; Karpinski and Hilton 2001). The Implicit Association Test (IAT) is one of the most well-established measures used to evaluate implicit attitudes (Karpinski and Steinman 2006). It is a binary sorting task that gauges reaction times for combinations of object-attribute pairings. Faster reaction times observed when sorting objects (e.g., flowers or insects) with attributes (e.g., positive or negative words) indicate a more robust implicit association.

Wilson and Scior (2014) conducted a review of all research published in English that used the IAT to measure implicit attitudes towards disabilities. The 18 studies they reviewed covered a broad range of disabilities, including physical and intellectual disabilities. However, none of the studies focused specifically on ASD, further highlighting the need for research like the current study. The review noted a pattern of moderate to strong negative implicit attitudes towards individuals with disabilities. Of the 11 studies that also examined explicit attitudes toward disability, 6 studies documented a small but significant relationship between implicit and explicit biases. The remaining 5 studies revealed no evidence of relationships between implicit and explicit measures.

In a follow-up study, Wilson and Scior (2015) examined implicit attitudes towards intellectual disabilities (ID). They delivered the IAT in an online format to 326 participants in the United Kingdom. Results showed negative implicit attitudes towards individuals with ID despite positive explicit attitudes. Although women reported more positive explicit attitudes toward people with ID, gender differences in implicit attitudes were not apparent. Explicit, but not implicit, stigma was lower among those with past contact with ID. Consistent with these diverging patterns, implicit and explicit attitudes were not related to one another. The authors put forth a number of potential reasons for the divergence between implicit and explicit attitudes including the possible coexistence of positive explicit attitudes and negative implicit attitudes, the potential impact of social desirability bias (not assessed in their study) on explicit attitudes,

or the possibility that participants were not biased against those with disabilities but rather biased in favor of those without disabilities (their in-group).

Differences between implicit and explicit attitudes in adulthood may arise from diverging developmental trajectories of implicit and explicit attitudes. An innovative study that used the IAT to examine the development of racial biases favoring White over Black people in the US revealed that even kindergartners were more likely to associate positive words with images of White people and negative words with images of Black people (Baron and Banaji 2006). The magnitude of the bias favoring White over Black people did not differ based on participants' age (27 kindergartners, 30 fifth graders, and 22 adults). While kindergartners openly expressed their explicit preference for White over Black children, fifth graders expressed a more muted explicit preference and adults expressed no explicit preference for their own in-group. These findings suggest that implicit racial biases may be deeply rooted among White people in the US although they may learn over time to reject such biases explicitly. Findings also suggest that the IAT may provide unique insights about the degree to which racial biases influence ASD identification.

The only peer-reviewed study that we are aware of wherein the IAT has been used to assess implicit attitudes toward ASD assessed implicit and explicit associative stigma towards the mother of an autistic child or a child with asthma (Thibodeau and Finley 2017). The 95 undergraduates who participated in the study reported no differences in explicit stigma towards either mother. However, they demonstrated heightened implicit stigma towards the mother of the autistic child relative to the mother of the child with asthma. Associations between implicit and explicit stigma were again not observed.

While no studies have employed the IAT to assess implicit attitudes towards autistic people, Barnes-Holmes et al. (2006) used an Implicit Relational Assessment Procedure (IRAP) to measure implicit attitudes towards ASD. The IRAP asks participants to rapidly classify relations between constructs according to researcher defined classification rules. Professionals working with autistic individuals more quickly indicated that positive words are similar to "typical development" and negative words are similar to ASD than vice versa. Similar findings were reported by Kelly and Barnes-Holmes (2013) using the IRAP with tutors and teachers. Although its theoretical foundation is innovative, concerns about the validity and reliability of the IRAP as a measure of implicit biases have been raised (Golijani-Moghaddam et al. 2013; O'Shea et al. 2016). Indeed, performance on the IRAP has been associated with socially desirable responding (Kelly and Barnes-Holmes 2013).

## Aims and Hypotheses of the Current Study

Guided by the preceding literature review, we designed a study to examine whether implicit and/or explicit racial biases influence ASD identification and stigma among college students in the US. We developed two IATs to examine participants' implicit stigma towards ASD vs CD and their tendency to implicitly associate pictures of Black children with characteristics of CD and White children with characteristics of ASD. We assessed explicit biases by pairing each of two vignettes depicting a child exhibiting characteristics of ASD and a child exhibiting characteristics of CD with a picture of either a Black or a White child.

*Primary Research Question 1. Does accurate identification of ASD in a vignette vary as a function of the race of a picture paired with the vignette and participant characteristics?* We hypothesized that participants who were randomly assigned to see a White child's picture paired with a vignette depicting characteristics of ASD would be more likely to identify the child as autistic than their counterparts for whom a Black child's picture was paired with the vignette. We also expected increased ASD knowledge to be associated with greater likelihood of accurately identifying ASD.

*Primary Research Question 2. Does explicit and implicit stigma towards ASD and CD vary as a function of participant characteristics?* We expected to replicate research linking less ASD knowledge, less pleasant past contact with ASD, and being male with heightened explicit stigma towards ASD (Gillespie-Lynch et al. 2019). Although predictors of implicit ASD stigma have not been examined, we also expected reduced ASD knowledge and less pleasant past experiences with the condition to be associated with heightened implicit stigma.

*Primary Research Question 3. Is CD more implicitly and explicitly stigmatized than ASD?* Guided by evidence that autism elicits less explicit stigma than more "disruptive" disorders (Feldman and Crandall 2007), we hypothesized that participants would preferentially associate "good" terms with ASD and "bad" terms with CD. Similarly, we hypothesized that participants would report heightened explicit stigma towards the child with CD compared to the child with ASD. We also expected implicit and explicit stigma to be weakly related to one another (as was evident in some of the studies reviewed by Wilson and Scior 2014).

*Primary Research Question 4. Will participants exhibit implicit racial biases when categorizing ASD and CD?* Based on research indicating that Black autistic children are more likely to be diagnosed with CD relative to their White autistic peers (e.g., Mandell et al. 2007), we hypothesized that participants would be more likely to implicitly pair White children with characteristics of ASD and Black children with characteristics of CD.

**Table 1** Demographic information and descriptive data on all predictor and outcome variables

| Measures | New York (N = 364) | Georgia (N = 129) | *p* value | Effect size |
|---|---|---|---|---|
| % Female[b] | 69.2% | 81.4% | 0.008 | $\varphi_C = 0.12$ |
| % White[b] | 37.9% | 81.4% | < 0.001 | $\varphi_C = 0.39$ |
| % African-American[b] | 15.9% | 7.8% | | |
| Age[c] | 19.35 (2.98) | 20.17 (2.58) | 0.006 | $\eta^2 = 0.02$ |
| Disability valence IAT[c] | 0.28 (0.29) | 0.24 (0.25) | 0.26 | $\eta^2 = 0.003$ |
| Racial bias IAT[c] | − 0.01 (0.27) | − 0.03 (0.24) | 0.65 | $\eta^2 < 0.001$ |
| Social distance ASD[c] | 11.58 (4.05) | 9.43 (2.97) | < 0.001 | $\eta^2 = 0.06$ |
| Social distance CD[c] | 22.40 (5.04) | 19.53 (5.40) | < 0.001 | $\eta^2 = 0.06$ |
| Pleasant experience ASD[c] | 4.98 (1.41) | 5.57 (1.37) | < 0.001 | $\eta^2 = 0.03$ |
| Pleasant experience CD[c] | 3.65 (1.56) | 3.89 (1.58) | 0.14 | $\eta^2 = 0.004$ |
| ASD knowledge (ASK-Q)[a] | 38.83 (3.99) | 41.15 (3.59) | < 0.001 | $\varphi_C = 0.33$ |
| Autistic phenotype (RAADS)[c] | 9.78 (8.17) | 6.44 (7.71) | < 0.001 | $\eta^2 = 0.03$ |
| Social desirability[c] | 7.30 (2.61) | 6.38 (2.81) | 0.001 | $\eta^c = 0.02$ |
| Symbolic racism[c] | 16.61 (3.76) | 14.40 (4.37) | < 0.001 | $\eta^2 = 0.06$ |
| Structured identification: ASD (ASD Vignette)[a] | 4.41 (0.88) | 4.52 (0.70) | 0.47 | $\varphi_C = 0.12$ |
| Structured identification: CD (CD vignette)[a] | 4.50 (0.81) | 4.51 (.80) | 0.92 | $\varphi_C = 0.16$ |
| Spontaneous identification: ASD (ASD vignette)[b] | 74.5% | 77.5% | 0.49 | $\varphi_C = 0.03$ |
| Spontaneous identification: ASD (CD vignette)[b] | 59.3% | 59.7% | 0.95 | $\varphi_C = 0.03$ |

Continuous variables such as age are reported as means (standard deviations) while categorical variables (e.g. gender and ethnicity) are reported as percentages, $p \leq .001$ for significance

[a]Kruskal Wallis test used

[b]Chi square test was used

[c]Independent *t* test was used

*Exploratory Question 5. Do implicit and explicit racial biases in ASD identification vary as a function of participant race?* We assessed whether White and Black participants exhibited in-group favoritism in their implicit and explicit racial biases in autism identification, or preferentially associated children of their own race with a less stigmatized disorder and children of an out-group race with a more stigmatized disorder.

# Method

## Participants

A total of 493 participants were recruited from two large public universities, one in New York City ($n = 364$; Female: 252; Male: 112; Mean Age: 19.35, $SD = 2.98$) and one in Georgia ($n = 129$; Female: 105; Male: 24, Mean Age: 20.17, $SD = 2.58$). The New York sample was more ethnically diverse (White: 38%, Black: 16%, Hispanic/Latinx: 18%, Asian: 13%, Mixed Race: 8%, Middle Eastern: 5%, Other: 2%) than the sample from Georgia (White: 81%, Black: 8%, Asian: 5%, Mixed Race: 4%, Hispanic/Latinx: 2%). Participants were undergraduate students who were recruited online and received course credit for participation. They were recruited from the Psychology subject pool in NYC (primarily from Introductory Psychology courses, a general education requirement) and the Education subject pool in Georgia (primarily students majoring in Education completing initial general education requirements).

## Measures and Design

### Demographics Questionnaire

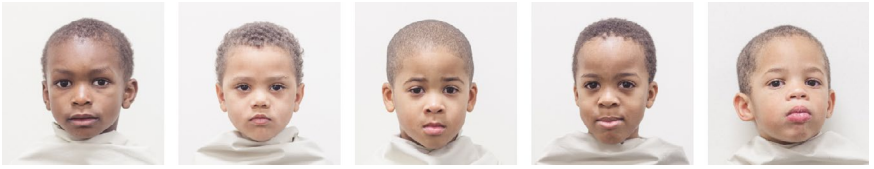
Participants were asked to complete a demographics questionnaire where they indicated their age, gender, and ethnicity. Participants reported their race/ethnicity in response to an open-ended question, which was coded by two independent coders with inter-rater agreement of over 90%. See Table 1 for demographic characteristics and descriptive data for all variables of interest.

### Implicit Association Tests

The IAT (Greenwald et al. 1998) is a computerized, closed sorting task that uses reaction times to establish the strength of a respondent's mental associations. Before the sorting begins, participants are provided with four, predetermined

For the next part of this survey, you will use the "e" and "i" computer keys to categorize items into groups as fast as you can.

These are the 4 groups and the items that belong to each:

| Category | Item |
|---|---|
| Autism Spectrum Disorder | Repeats body movements, Avoids eye contact, Displays rigid routines, Notices little details, Repeats certain words |
| Conduct Disorder | Escapes from home, Shoplifts small items, Starts fires deliberately, Disregards rules repeatedly, Hurts people/animals |
| African Americans |  |
| European Americans |  |

There are seven parts. The instructions change for each part. Pay attention!

**Fig. 1** Figure depicting the first instructions in the IAT prior to beginning the tasks. Child images were retrieved from the CAFÉ database (Lobue and Thrasher 2015)

categories (e.g., ASD, CD, African Americans,[2] and European Americans, see Fig. 1) and are given information about how target items should be sorted (i.e., to which category each target belongs). For the test trials, participants are asked to use a single keystroke (e.g., the "e" key on a keyboard) to sort targets that belong to two (of the four) categories. Targets from the remaining two categories are similarly sorted together using another keystroke (e.g., the "i" key on a keyboard). Faster response times are assumed to reflect a stronger association between the paired categories.

Two IATs were developed for this study. The first was used to quantify the association of CD and ASD with positive and/or negative attributes (i.e., Disability Valence IAT). The second measured the association of CD and ASD with African American and European American images (i.e., Racial Bias IAT). Matching procedures and preliminary testing was used to identify targets for each category (i.e., CD, ASD, good, bad, African Americans, and European Americans).

To identify targets for the CD and ASD categories, we first created 36, three-word phrases representing symptoms of CD and ASD using clinical criteria from the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (American Psychiatric Association 2013). Eighty undergraduate students, who had no clinical training, rated each phrase on "readability" and the degree to which each statement characterized ASD and CD. We identified five phrases that were rated as highly representative of ASD, but low for characterizing CD, and used these as the target items for our ASD category. We did this for the CD category as well, maintaining five phrases rated high for CD criteria, but low for ASD criteria. Internal consistency for the target items

[2] In order to be consistent with the terms used by the creators of the Child Affective Facial Expression database (CAFÉ; Lobue and Thrasher 2015), which we used to construct our racial bias IAT, we used the terms "European Americans" and "African Americans" in the Racial Bias IAT. Anonymous reviewers pointed out limitations with this choice of terms, specifically that participants had no reason to infer that a White child was necessarily of European descent or a Black child was necessarily African American. Given limitations in our choice of terms (which are discussed in more detail in the limitations section), the terms White and Black are used throughout the paper except when describing the construction of the racial bias IAT and the exact results obtained from it in the results section.

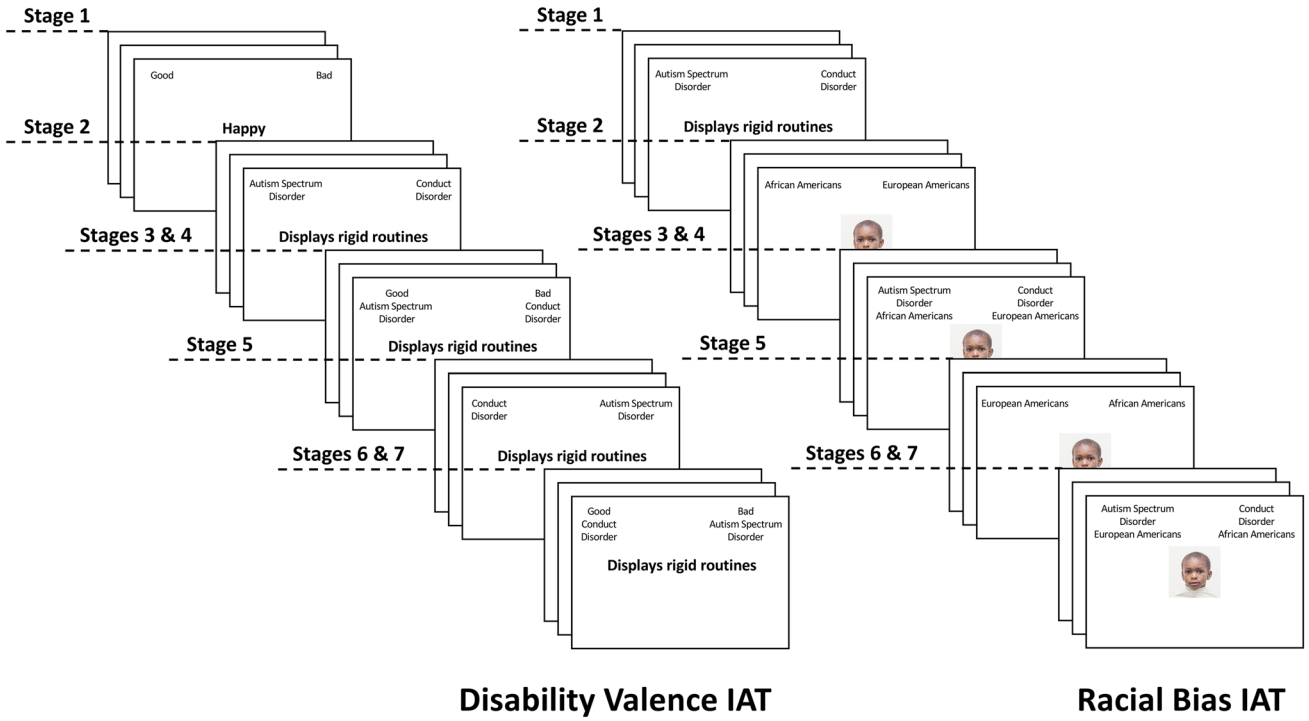



**Fig. 2** IAT diagram explaining all trials in the disability valence and racial bias IAT

included in both the ASD and CD categories was robust ($\alpha_{ASD} = 0.75$, $\alpha_{CD} = 0.77$)[3].

To identify targets for the African Americans and European Americans categories, we gathered 30 "neutral" images from the Child Affective Facial Expression database (CAFÉ; Lobue and Thrasher 2015). The pictures represented all of the available pictures of 10 African American children and 20 European American children. One-hundred and eight undergraduate participants rated all images for age, attractiveness, and racial prototypicality. Using participant ratings, we selected the most racially prototypical pictures for each race while ensuring that the average age and attractiveness of the photos from the African American image set were matched as close as possible to a corresponding photo from the European American image set. Five of these matching sets were used as target items for the African Americans and European Americans categories. Finally, target items for the "good" (i.e., love, joy, pleasure, peace, and happy) and "bad" (i.e., terrible, angry, evil, hate, and sad) categories were taken from the most frequently occurring targets used to characterize "good" and "bad" categories in Disability Valence IAT studies of the past (Wilson and Scior 2014).

### Disability Valence IAT

The Disability Valence IAT was created to examine the degree to which participants associated Clinical Diagnoses (i.e., ASD and CD) with positive or negative attributes (i.e., good and bad items). The IAT is comprised of seven stages (see Fig. 2). Each stage is comprised of 30 trials in which a single target item is presented on the screen. In Stage 1, participants practice sorting by using the "e" key to identify target items that belong to the "good" category and the "i" key to identify target items belonging to the "bad" category. In Stage 2, participants use an identical process to sort target items into the categories ASD or CD. Participants are only allowed to advance in Stages 1 and 2 when they sort the target items into the correct categories. In Stages 3 and 4, participants are asked to use a single keystroke (i.e., the "e" key) to identify target items associated with either the "good" or "ASD" category. At the same time, they are asked to use another keystroke (i.e., the "i" key) to identify targets belonging to either the "bad" or "CD" category. In Stage 3, participants receive feedback for incorrect sorting and can only advance to the next trial by sorting each target item into its appropriate category. However, in Stage 4, participants receive no feedback and are allowed to advance even if the wrong category has been identified for the target item. Stage

[3] Reaction time data from Stage 1 of the Disability Valence IAT was used to explore the construct validity (i.e., internal consistency) of the target phrases. If all terms characterize the category equally well (i.e., have high construct validity) there should be similarity in the average latency to categorize different targets from the same category. Cronbach's alpha was used to compare average latencies for target term for each participant.

5 is identical to Stage 2 with the exception that the "e" key is used for sorting target items associated with CD and the "i" key is used for sorting target items associated with ASD. Finally, in Stages 6 and 7, participants use a single keystroke to sort target items for CD and the "good" category. They use another keystroke to sort target items for ASD and the "bad" category. Participants are only provided with feedback on incorrect sorting for trials in Stage 6.

**Scoring the Disability Valence IAT** Based on the improved scoring algorithm recommended by Greenwald et al. (2003), we computed a difference standardized score (i.e., D score) for each participant to determine a strength of implicit associations. Outliers for this task were removed (see Lane et al. 2007 for IAT scoring procedures), and an error penalty of 2 standard deviations for all incorrect responses for trials in Stages 4 and 7 was applied. Positive D scores indicated that the participant showed a greater association of ASD with "good" and CD with "bad" (i.e., a more positive response to ASD than to CD). Negative D scores indicated a participants' greater association of CD with "good" and ASD with "bad" (i.e., a more positive response to CD compared to ASD).

**Psychometrics of the Disability Valence IAT** Although not commonly reported, differences in reaction time (and errors) have been documented within the IAT literature. For example, longer reaction times and more errors are reported when the IATs include words as target stimuli compared to IATs that use pictures as targets (Foroni and Bel-Bahar 2010). In our study, participants took longer to sort the ASD and CD phrases ($M = 1.57$ s; $SD = 0.53$) in Stage 2 compared to sorting the good and bad words ($M = 1.14$ s; $SD = 0.32$) in Stage 1, $t(484) = -32.69$, $p < 0.001$. Participants also made more errors when sorting the ASD and CD phrases ($M = 1.14$ errors; $SD = 1.55$) in Stage 4 compared to sorting the good and bad words ($M = 0.75$ errors; $SD = 1.15$) in Stage 4, $t(484) = -5.94$, $p < 0.001$.

The significant differences in reaction times noted above were likely due to the complexity of the three-word phrases used for ASD and CD targets (since the good and bad categories were made of only single word targets). Although IATs typically use single word targets rather than phrases, prior researchers have also used phrases in their IATs, but typically have not evaluated timing differences between the phrases and single words (e.g., Freng and Kehn 2013; Wenger and Yarbrough 2005). Regardless, observed differences in reaction times across categories are resolved by creating D scores. Specifically, participants' average reaction time to sort target terms in Stage 6 is subtracted by participants' average reaction time to sort target terms in Stage 3. Because both Stage 6 and Stage 3 include CD and ASD phrases as well as good and bad words (i.e., all the target stimuli in the study), there should be no difference in reaction time between the trials unless the participants' associations are stronger for one pairing (i.e., Stage 3) compared to the other (i.e., Stage 6).[4]

### Racial Bias IAT

The Racial Bias IAT was created to examine participants' association of clinical diagnosis (i.e., ASD and CD) with race (i.e., African American and European American). Similar to the Disability Valence IAT, participants were asked to sort target items using the traditional IAT design described above. Figure 2 illustrates the category assignments and pairings used for each stage.

**Scoring the Racial Bias IAT** The improved scoring algorithm was again used to compute a D score for each participant (Greenwald et al. 2003). Positive D scores indicated that the participant showed a greater association of CD with pictures of European American children and ASD with pictures of African American children. Negative D scores indicated that the participant showed a greater association of ASD with pictures of European American children and CD with pictures of African American children.

**Psychometrics of the Racial Bias IAT** Again, to explore differences in processing time across the stimuli categories, the reaction times for the first stage including all the ASD and CD phrases was compared with the first stage that included all pictures of African American and European American children. Participants took significantly longer to sort the ASD and CD phrases ($M = 1.28$ s; $SD = 0.44$) in Stage 1 compared to sorting the African American and European American child pictures ($M = 0.78$ s; $SD = 0.23$) in Stage 2, $t(469) = 28.51$, $p < 0.001$. Participants also made significantly more errors when sorting the ASD and CD phrases ($M = 0.93$ errors; $SD = 1.31$) in Stage 4[5] compared to sorting

[4] For the improved D score algorithm, this process is completed again by subtracting participants' average reaction time to sort target terms in Stage 7 by participants' average reaction time to sort target terms in Stage 4.

[5] There was also a difference in reaction times when participants sorted the ASD and CD phrases between the Disability Valence and Racial Bias IAT. Participants were significantly faster when sorting the ASD and CD phrases ($M = 1.28$ s; $SD = 0.44$) in Stage 1 of the Racial Bias IAT compared to Stage 2 of the Disability Valence IAT ($M = 1.58$ s; $SD = 0.52$), $t(467) = 13.35$, $p < 0.001$. Participants also made significantly fewer errors when sorting the ASD and CD phrases ($M = 0.93$ errors; $SD = 1.31$) in Stage 4 of the Racial Bias IAT compared to Stage 4 of the Disability Valence IAT ($M = 1.13$ errors; $SD = 1.53$), $t(467) = 2.55$, $p = .011$. These differences between the Disability Valence IAT and the Racial Bias IAT were likely the result of increased familiarity with the phrases since the Racial Bias IAT was always presented second.

the African American and European American child pictures ($M = 0.54$ errors; $SD = 0.95$) in Stage 4, $t(469) = 6.31$, $p < 0.001$. Similar to the Disability Valence IAT, this reaction time difference is accounted for by using the improved D score algorithm.

### Explicit Measures

After completing the two IATs, participants were presented with two vignettes. One of the two vignettes depicted behaviors of children with ASD and the other depicted behaviors of children with CD (see Online Appendix A). The ASD vignette was loosely adapted from prior vignettes developed by Harnum et al. (2007) and Segall and Campbell (2014). The CD vignette was loosely adapted from a vignette developed by Burke et al. (2016). Both vignettes were unlabeled, and participants were *not* provided with feedback about the nature of the child's diagnosis. These vignettes were randomly paired with either an image of a Black or a White child (CAFÉ; Lobue and Thrasher 2015). After reading the vignettes, participants answered a series of open-ended and closed-ended questions aimed at identifying the child's condition and also assessing stigma towards the child in the vignette.

**Social Distance Scale** Following each vignette, participants completed an adapted child-focused Social Distance Scale (Bogardus 1933; Gillespie-Lynch et al. 2015; see Online Appendix A). Social distance scales are a commonly used measure of stigma that typically exhibit good internal-consistency and evidence of validity (Link et al. 2004a). The scale was used to evaluate the participant's willingness to interact with this child in various social situations at varying degrees of closeness. Responses to the 7-items were scored on a 4-point Likert-scale from 1 (definitely willing) to 4 (definitely unwilling). Higher scores on the Social Distance Scale reflect higher explicit stigma. Internal consistency of the adapted version of the scale was robust in this sample (ASD: $\alpha = 0.89$; CD: $\alpha = 0.92$).

**Spontaneous Judgements (adapted from Begeer et al. 2009)** Participants then responded to the open-ended question: "*How would you define this child's condition?*". A coding-scheme for this open-ended question was created based on emergent patterns in the data. Responses were coded into the following non-mutually exclusive categories: "Autism", "Conduct Disorder", "Disruptive", "Normal", "Other Disorder (any other disorder, e.g., ADHD), "Negative Perception" (Any adjective that communicates negative valence), "Positive Perception" (Any adjective that shows a positive valence), "Special Needs", "Blank", and "Don't Know". Under the supervision of the first author, the third and fifth author on this manuscript established reliability of coding by double coding 20% of the responses on this question. Percent agreement for all codes was 90% or higher.

**Structured Judgements (adapted from Begeer et al. 2009)** Following the open-ended question, participants were provided with 5 closed-ended statements asking about how likely it was for the child in the vignette to have: ASD, CD, Intellectual Disability, Attention-Deficit Hyperactive Disorder, and/or typical development. Participants rated each likelihood using a Likert-type scale ranging from 1 (Very Unlikely) to 5 (Very Likely).

**Type of Past Experience (adapted from Gillespie-Lynch et al. 2019)** Participants were asked to describe their prior experiences with "people with this child's condition" by selecting relationships they had with people with the child's condition (e.g., yourself, your spouse, your friend, your child).

**Perceived Pleasantness of Past Experience** The pleasantness of participants' past experience with people with the condition depicted in each vignette was assessed with one-item adapted from a quality of contact scale used in past autism research (Gardiner and Iarocci 2014): "In the past, your experiences with individuals with this child's condition have been pleasant." Participants responded on a 7-point Likert-type scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree), with higher scores indicating higher pleasantness of past experience.

### ASD Knowledge

To examine participants' ASD knowledge, participants completed the Autism Knowledge Questionnaire (ASK-Q; Harrison et al. 2017). This questionnaire includes 49 statements that evaluate knowledge about ASD. Participants either agreed (1) or disagreed (0) with the statements that are presented. Scores can range from 0 to 49 with higher scores indicating higher ASD knowledge. The ASK-Q was developed from prior autism knowledge scales guided by input from 16 autism researchers. It has demonstrated adequate to good levels of internal consistency and test–retest reliability in past work (Harrison et al. 2019). In this sample, internal consistency was $\alpha = 0.63$.

### Autistic Traits

To assess participants' self-reported autistic traits, we used the Ritvo Autism and Asperger Diagnostic Scale (RAADS-14; Eriksson et al. 2013). The RAADS–14, designed as a screening tool for autism in adults, exhibited strong reliability and sensitivity in the initial validation study. It is a 14-item measure with responses scored on a 4-point Likert-scale ranging from 3 (true now and when I was young) to 0

(never true). Higher scores indicate more autistic traits. In this sample, internal consistency was $\alpha = 0.83$.

#### Social Desirability

To assess whether participants exhibited social desirability biases, which could impact responses on self-report items, participants completed a short form of Marlowe–Crowne's Social Desirability Questionnaire (Reynolds 1982). This commonly used measure of social desirability bias has shown acceptable internal consistency and adequate validity in past work ($\alpha = 0.65$ in the current study). It consists of 13 binary items (5 reverse scored). Higher scores indicate greater susceptibility to social desirability bias.

#### Symbolic Racism

We used the Symbolic Racism 2000 Scale (Henry and Sears 2002), which is commonly used to examine explicit racial prejudice towards African Americans. Solid evidence for its construct and predictive validity was demonstrated in an initial validation study. The 8-item scale assesses the following intertwined beliefs: racial discrimination no longer holds Black people down, they have gotten more than they deserve, the disadvantages Black people face arise from their own lack of initiative, and they should not expect special treatment. This scale had an internal consistency of $\alpha = 0.62$ in the current sample.

### Procedure

An invitation to take part in the study was posted on the Department's subject pool website at each institution. This study was one of several other options students could select from in order to satisfy an introductory course requirement. As required by the Institutional Review Board, all participants had to indicate that they were 18 years or older. Participants were informed through the consent form that their responses would not be linked to their names. When participants signed up for the study, they were directed to a Qualtrics link to an online survey. Participants consented to the study and answered questions to ensure they were in a distraction-free environment before beginning the first task. To ensure reaction times were not influenced by type of device, participants were asked to complete the study on a computer (and were prohibited from completing the survey on their cellphones and tablets).

Participants first took part in the two IATs. The Qualtrics platform has been shown to be reliable and valid for IAT presentation; it also yields similar effects in comparison to other survey software (Carpenter et al. 2019). Participants were then presented with the vignettes of children with ASD and CD, which were randomly paired with pictures of either a Black or White child. The order of the vignettes was also randomized. In response to the vignettes, participants completed the Social Distance Scale, the spontaneous and structured judgement questions, and the question eliciting their personal experience with a child similar to the one in the vignette. Participants then completed the demographic questionnaire, the autism knowledge questionnaire, the social desirability scale, the measure of autistic traits, and the symbolic racism scale. At the end of the survey, participants were presented with a message thanking them for participating that provided the first and last author's email addresses in case they were interested in learning more about the study and/or volunteering in a mentorship program for autistic college students.

## Analytic Approach

### Data Cleaning and Identification of Outliers in IAT Data

Prior to any data analysis the first and third authors inspected the qualitative sections of the data to ensure data validity. Before reviewing any of the participant responses, we decided to remove participants who: had used the same response choice on all questionnaire items (an acquiescent response set) and/or who did not respond with words to open-ended questions. A total of 113 participants were removed from the study prior to analyses. Out of these participants: 75 were removed because they either did not complete any part of the study aside from the informed consent ($n = 47$) or missed a large proportion of the study (e.g., they did not respond to any of the surveys and open-ended questions, $n = 28$), and 13 participants were removed through data inspection because they were not responding to the open-ended questionnaire items but rather pressing any string of letters (not words) in response to open-ended questions. For instance, one participant entered the letter "w" for all open-ended responses. Lastly, 25 participants were removed as part of the data cleaning step in the D algorithm computation for the Disability Valence and Racial Bias IATs (see method section for details).

Preliminary inspection of the descriptive results revealed kurtosis in IAT D scores; this data did not initially meet the assumptions required for parametric tests. Visual inspection of the data revealed that the kurtosis was attributable to outliers. In order to assess for outliers, we created z-scores for each of our variables of interest (Disability Valence IAT, Racial Bias IAT, Social Distance Scale for ASD and CD, and the ASK-Q). As per recommendations by Field (2016), any z-score that exceeded 3.3 was considered an outlier and dropped from the analyses ($n = 17$). After removing the outliers, our IAT data met the assumptions for normality,

allowing us to run parametric analyses on our primary outcome variables. It is noteworthy that removal of these outliers did not change the results, all primary analyses noted in text for the sample with outliers removed were also significant *without* the outliers removed.

### Data Analysis Plan

All data were analyzed using SPSS version 25. Due to the large number of statistical comparisons conducted and the possibility that findings might be in the opposite direction to what we predicted (Ruxton and Neuhäuser 2010), two-tailed tests with an alpha level of $\leq 0.001$ were used for all analyses. Confidence intervals are reported for all parametric analyses (as recommended by Greenland et al. 2016).

We used baseline correlations (Table 2) to begin to address our research questions. Characteristics that were at least marginally associated ($p \leq 0.05$) with each outcome variable in baseline correlations were included in models predicting that outcome variable, unless prior research suggested that a given variable was a downstream effect of the outcome variable. Therefore, we did not include either explicit stigma or perceived pleasantness of past contact in models predicting identification of ASD and CD as stigma is believed to be a downstream effect of identification (e.g., Link and Phelan 2013) and participants rated pleasantness of contact in reference to the condition they had previously reported that they believed the child had. Since pleasantness of contact was rated in reference to the condition participants identified the child as having, it does not make sense to include it as a predictor of said identification. Pleasantness of contact was also unexpectedly influenced by the race of the child randomly assigned to each vignette, so including it in identification models would constitute "conditioning on a post-treatment variable", which is not sound (Montgomery et al. 2018). For further discussion of why it is important to ensure that variables believed to be influenced by an outcome variable are not included in models predicting that variable see Pearl and Mackenzie (2018).

We used correlations to address our first research question concerning factors associated with autism identification. We used linear regressions to examine predictors of explicit stigma towards the unlabeled vignettes depicting characteristics of ASD and CD (our second research question). After a Levene's test revealed that the assumption of homogeneity of variance was not met for explicit stigma, we used a Wilcoxon signed-rank test to compare explicit stigma towards ASD and CD (the first part of our third research question). To determine if CD is more implicitly stigmatized than ASD (the second part of our third research question), we analyzed Valence IAT D scores using a one-sample t-test. To examine whether participants exhibited implicit racial biases when categorizing ASD and CD (our fourth research question), we used a one-sample t-test on Racial Bias IAT D scores. To determine if implicit and explicit racial biases in identification varied as a function of participant race (our fifth research question), we conducted a linear regression predicting D scores for the Racial Bias IAT and binary logistic regressions predicting accurate spontaneous identification of ASD and CD. For these analyses, we focused on participants whose races matched the races in the vignettes. We created a binary race variable (White: $n = 243$; Black: $n = 68$) to use as a predictor. We included the race of the child paired with each vignette and participant race in these binary logistic regressions in order to also be able to examine their interaction term.

We verified that the data met the assumptions for each analysis tested. Descriptive analyses revealed that the following variables continued to exhibit excessive skew after outliers identified in the IAT D scores were removed: explicit stigma towards ASD and CD (social distance scores) and autism knowledge (ASK-Q scores). Therefore, we used Kendall's Tau correlations for all baseline correlations. For one sample t-tests, we verified that data was approximately normally distributed without influential outliers. For binary logistic regressions, we verified absence of multicollinearity (VIFs below 1.4) and linearity of continuous independent variables and log odds (using the Box Tidwell procedure). For linear regressions, we verified that the data met the assumptions for regressions (Navarro 2013): linear relationships between IVs and DV, absence of multicollinearity, approximately normally distributed residuals (examined through P-P plots and histograms of residuals), independent residuals (Durbin-Watson tests close to 2.0), homoscedasticity (visual inspection of scatter plots of predicted scores and residuals), and no evidence of overly influential data points (Cook's Distances were below 0.06).

## Results

### Sample Characteristics

Because data was collected from two sites, independent sample t tests (for continuous variables), chi-square tests (for categorical dependent variables), and Kruskal Wallis tests (for the skewed dependent variables) were conducted to determine whether there were significant differences based on data collection site (see Table 1). Implicit biases did not differ across samples, supporting our decision to calculate D scores based on the entire sample. However, participants in NYC were more likely to be ethnically diverse and exhibited trends toward being younger and more likely to be male relative to participants in Georgia. Participants in NYC reported higher social desirability bias, more autistic traits, more racism, more explicit stigma towards ASD and

**Table 2** Correlational analyses between implicit and explicit measures

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Gender | 1.000 | 0.120$^{\dagger}$ | −0.057 | 0.043 | 0.027 | −0.019 | −0.131* | −0.016 | −0.096$^{\wedge}$ | 0.087$^{\wedge}$ | 0.004 | 0.018 | 0.021 | 0.077 | 0.137$^{\dagger}$ | 0.066 | −0.013 | −0.017 |
| 2. Site | – | 1.000 | 0.317** | −0.021 | −0.046 | −0.190** | −0.209** | −0.210** | −0.194** | 0.248** | −0.120$^{\dagger}$ | 0.168** | 0.047 | 0.031 | 0.003 | 0.057 | −0.010 | 0.022 |
| 3. Age | – | – | 1.000 | 0.034 | −0.043 | −0.082$^{\wedge}$ | −0.068 | −0.079$^{\wedge}$ | −0.016 | 0.054 | −0.007 | 0.044 | 0.059 | −0.017 | −0.011 | 0.002 | 0.008 | 0.078 |
| 4. Disability valence IAT | – | – | – | 1.000 | −0.034 | −0.036 | 0.019 | −0.001 | 0.002 | −0.015 | −0.014 | −0.014 | −0.040 | −0.006 | 0.006 | 0.006 | −0.088$^{\wedge}$ | −0.011 |
| 5. Racial bias IAT | – | – | – | – | 1.000 | 0.036 | −0.029 | −0.045 | −0.033 | −0.012 | 0.032 | 0.027 | 0.049 | 0.037 | <0.001 | −0.002 | 0.013 | −0.057 |
| 6. Autism phenotype | – | – | – | – | – | 1.000 | 0.117** | 0.046 | 0.069$^{\wedge}$ | −0.132** | −0.177** | −0.146** | −0.030 | −0.091$^{\wedge}$ | −0.027 | −0.078$^{\wedge}$ | 0.036 | −0.004 |
| 7. Social distance ASD | – | – | – | – | – | – | 1.000 | 0.176** | 0.113* | −0.234** | −0.051 | −0.384** | −0.005 | −0.149** | −0.098$^{\wedge}$ | −0.113$^{\dagger}$ | −0.055 | 0.024 |
| 8. Social distance CD | – | – | – | – | – | – | – | 1.000 | 0.087$^{\dagger}$ | −0.038 | −0.007 | −0.115* | −0.190** | 0.086$^{\wedge}$ | 0.112$^{\dagger}$ | 0.023 | −0.040 | −0.028 |
| 9. Racism | – | – | – | – | – | – | – | – | 1.000 | −0.142** | 0.011 | −0.022 | −0.048 | −0.079$^{\wedge}$ | −0.045 | −0.009 | −0.024 | 0.025 |
| 10. ASD knowledge | – | – | – | – | – | – | – | – | – | 1.000 | 0.024 | 0.166** | 0.008 | 0.216** | 0.138** | 0.045 | 0.027 | 0.030 |
| 11. Social desirability | – | – | – | – | – | – | – | – | – | – | 1.000 | 0.082$^{\wedge}$ | −0.039 | 0.052 | 0.028 | 0.015 | 0.066 | −0.010 |
| 12. Pleasant experience ASD | – | – | – | – | – | – | – | – | – | – | – | 1.000 | 0.062 | 0.142** | 0.129* | 0.101$^{\wedge}$ | −0.083$^{\wedge}$ | −0.040 |
| 13. Pleasant experience CD | – | – | – | – | – | – | – | – | – | – | – | – | 1.000 | −0.097$^{\wedge}$ | −0.055 | −0.030 | −0.005 | −0.216** |
| 14. ASD ID (spontaneous) | – | – | – | – | – | – | – | – | – | – | – | – | – | 1.000 | 0.503** | −0.051 | 0.034 | 0.001 |
| 15. CD ID (spontaneous) | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1.000 | 0.156* | 0.011 | −0.114$^{\dagger}$ |
| 16. Vignette order | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1.000 | −0.098$^{\wedge}$ | −0.023 |
| 17. Race of child (ASD vignette) | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1.000 | 0.044 |

**Table 2** (continued)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18. Race of child (CD vignette) | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | – | 1.000 |

Kendall's Tau is reported for all correlation analyses, $^{**}p<0.001$; $^{*}p=0.001$; $^{\dagger}p<0.01$; $^{\wedge}p<0.05$

ASD ID (spontaneous) = accurate spontaneous identification of ASD in the ASD vignette, CD ID (spontaneous) = accurate spontaneous identification of CD in the CD vignette

The following variables were dummy coded: gender (1 = female), site (1 = Georgia), vignette order (1 = ASD vignette presented first), Race of child (ASD vignette) (1 = African American), and race of child (CD vignette) (1 = African American)

CD, less knowledge of ASD, and less pleasant prior experiences with people like the child in the ASD vignette than participants in Georgia.

## What Contributes to Accurate Autism Identification?

In response to our first research question concerning predictors of accurately identifying autism in an unlabeled vignette, baseline correlations revealed mixed evidence for our hypotheses (Table 2). Spontaneously identifying ASD in the ASD vignette was *not* related to the race of the picture paired with the vignette, $p=0.43$. However, ASD knowledge ($r_\tau=0.22$, $p<0.001$) and pleasant past experience with ASD ($r_\tau=0.14$, $p<0.001$) were associated with accurate spontaneous identification.

Given that identification is believed to impact stigma (Link and Phelan 2013), we will discuss associations between identification, explicit stigma, and pleasantness of past contact with each condition in the section addressing predictors of explicit stigma. The only other variable that was associated with spontaneous identification of ASD in the autism vignette was spontaneous identification of CD in the CD vignette ($r_\tau=0.50$, $p<0.001$)[6]. We did not examine predictors of spontaneously misidentifying the ASD vignette with CD as only 1.4% of participants made this mistake. Indeed, a majority of the participants (75.3%) accurately identified the ASD vignette.

Participants were less accurate in spontaneously identifying CD (59.4% accurate) relative to ASD. Only 2.2% of participants misidentified the CD vignette as depicting ASD. ASD knowledge ($r_\tau=0.14$, $p<0.001$) accuracy spontaneously identifying ASD in the ASD vignette ($r_\tau=0.50$, $p<0.001$) and order of vignette presentation (with higher accuracy for CD vignettes presented after ASD vignettes; $r_\tau=0.16$, $p=0.001$) were associated with spontaneously identifying CD in the CD vignette.

## What Contributes to Explicit and Implicit Stigma towards ASD and CD?

Baseline correlations also provided insights about our second research question concerning predictors of explicit and implicit stigma towards ASD and CD. As hypothesized, more explicit stigma (greater desired social distance) towards the child in the ASD vignette was associated with lesser ASD knowledge ($r_\tau=-0.23$, $p<0.001$) less pleasant self-reported contact with people with the condition in the

[6] We focus on spontaneous judgements in analyses as they were more sensitive than structured ratings of the likelihood of a given condition in prior research (Beeger et al. 2009). However, a similar pattern of findings was observed with spontaneous and structured ratings.

vignette ($r_\tau = -0.38$, $p < 0.001$) and being male ($r_\tau = -0.13$, $p = 0.001$). Explicit stigma was also higher among participants who reported heightened autistic traits ($r_\tau = 0.12$, $p < 0.001$), racism ($r_\tau = 0.11$, $p = 0.001$), and explicit stigma towards CD ($r_\tau = 0.18$, $p < 0.001$). Identifying the child in the ASD vignette as autistic was associated with reduced explicit stigma ($r_\tau = -0.15$, $p < 0.001$).

In contrast, more pleasant prior contact with people with the condition in the CD vignette was associated with reduced explicit stigma towards CD ($r_\tau = -0.19$, $p < 0.001$). Explicit stigma towards CD was also associated with less pleasant experience with people like the child in the ASD vignette ($r_\tau = -0.12$, $p = 0.001$) and more explicit stigma towards ASD ($r_\tau = 0.18$, $p < 0.001$).

Contrary to our hypotheses, implicit stigma (Disability Valence IAT) and explicit stigma (social distance scores) were unrelated. In fact, implicit stigma and implicit racial biases in identification (Racial Bias IAT) did not correlate with one another or with any other measures. Social desirability was also unrelated to any of our primary outcome variables. However, social desirability was negatively associated with self-reported autistic traits ($r_\tau = 0.18$, $p < 0.001$).

#### Regressions Examining Predictors of Explicit Stigma

To determine predictors of explicit stigma towards ASD, all variables that were significantly (i.e., ASD knowledge, spontaneous accuracy identifying ASD, pleasantness of past contact with people with the condition in the ASD vignette, participant gender, site, self-reported autistic traits, explicit stigma towards CD, and racism) or marginally (order of vignette presentation) associated with explicit stigma towards the child in the ASD vignette in baseline correlations were entered into a regression to predict explicit stigma (social distance). To avoid including the construct of identification twice, CD identification was not included. Reduced ASD knowledge, pleasantness of past contact with people with the condition depicted in the ASD vignette, and heightened explicit stigma towards CD were associated with heightened explicit ASD stigma. This model, $F(9, 471) = 23.45$, $p < 0.001$, explained 29.6% (adjusted $R^2$) of the variance in explicit ASD stigma.

We conducted a similar regression analysis to examine predictors of explicit stigma (social distance) towards CD. All variables that were significantly (i.e., site, explicit stigma towards ASD, and pleasantness of past contact with people with the condition in the CD vignette) or marginally (i.e., participant age, racism, and spontaneous accuracy identifying CD) associated with explicit stigma towards CD were included in the model. Again, to avoid including related constructs in the model twice, pleasant experience with individuals with the condition in the ASD vignette and spontaneous identification of ASD were not included in the model. Heightened explicit stigma towards CD was associated with being in New York, less pleasant self-reported past experiences with people with the condition in the CD vignette, more spontaneous success identifying CD in the CD vignette, and explicit stigma towards ASD. This model accounted for 17.2% of the variance in explicit stigma towards CD, $F(6, 483) = 17.95$, $p < 0.001$ (Table 3).

## Is Explicit and Implicit Stigma Higher for CD than ASD?

#### Explicit Stigma

Consistent with our hypothesis, a Wilcoxon Signed Ranks test revealed that explicit stigma towards the CD vignette (Median = 23.00) was higher than explicit stigma towards the ASD vignette (Median = 10.00), $Z = -18.60$, $p < 0.001$; $r_\tau = 0.84$.[7]

#### Implicit Stigma

For the Disability Valence IAT, positive D scores indicated that participants associated "good" terms with ASD and "bad" terms with CD while negative D scores indicated that the participants associate "good" terms with CD and "bad" terms with ASD. A one-sample t test was used to determine whether or not the average D score for our sample differed significantly from 0 (i.e., indicating no difference in reaction time based on the category pairing). Consistent with our hypothesis, the average D score was significantly greater than 0; participants were more likely to associate CD with negative terms and ASD with positive terms, $t(484) = 21.02$, $p < 0.001$; $M = 0.27$, $SD = 0.28$; 95% CI [0.24, 0.29].

## Do Participants Exhibit Implicit Racial Biases in Autism Identification?

To examine whether participants demonstrated implicit associations between race (i.e., African American or European American) and diagnosis (i.e., ASD or CD), we conducted a one-sample t-test on the D scores for the Racial Bias IAT. In this task, negative D scores indicated that participants were more likely to associate pictures of African American children with CD and pictures of European American children with ASD; positive D scores indicated that participants associated pictures of African American children with ASD and European American children with CD. Inconsistent with our hypothesis, the mean D score on this task did

[7] This relationship remained significant when the analysis was run with only participants who accurately identified both ASD and CD, $Z = -16.79$, $p < 0.001$.

**Table 3** Results of regression analyses for explicit stigma towards ASD and CD

| | Social distance/explicit stigma towards ASD ($n=481$) | | | Social Distance/Explicit Stigma towards CD ($n=490$) | | |
|---|---|---|---|---|---|---|
| Predictor | B (SE) | β | 95% CI | B (SE) | β | 95% CI |
| Participant gender | −0.760 (0.343)* | −0.087 | −1.433 to −0.087 | – | – | – |
| Participant age | – | – | – | −0.024 (0.076) | −0.013 | −0.172 to 0.125 |
| Site | −0.574 (0.382) | −0.063 | −1.325 to 0.177 | −1.842 (0.528)** | −0.153 | −2.880 to −0.804 |
| ASD knowledge | −0.179 (0.043)*** | −0.183 | −0.263 to −0.095 | – | – | – |
| Autism phenotype | −0.008 (0.019) | −0.018 | −0.047 to 0.030 | – | – | – |
| ASD ID (spontaneous) | −0.918 (0.371)* | −0.102 | −1.647 to −0.189 | – | – | – |
| CD ID (spontaneous) | – | – | – | 1.758 (0.447)** | 0.163 | 0.879–2.637 |
| Racism | 0.026 (0.040) | 0.026 | −0.052 to 0.104 | 0.076 (0.056) | 0.058 | −0.034 to 0.186 |
| Pleasant Experience ASD | −0.954 (0.112)** | −0.348 | −1.174 to −0.735 | – | – | – |
| Pleasant experience CD | – | – | – | −0.827 (0.140)** | −0.244 | −1.103 to −0.552 |
| Social distance ASD | – | – | – | 0.278 (0.058)** | 0.206 | 0.164–0.393 |
| Social distance CD | 0.137 (0.030)** | 0.183 | 0.078–0.196 | – | – | – |
| Vignette order | −0.579 (0.306) | −0.074 | −1.180 to 0.022 | – | – | – |

ASD ID (spontaneous) = accurate spontaneous identification of ASD in the ASD vignette, CD ID (Spontaneous) = accurate spontaneous identification of CD in the CD vignette. The following variables were dummy coded: Participant gender (1 = female), site (1 = Georgia), and vignette order (1 = ASD vignette presented first). One is the reference category for dummy coded variables

**$p<0.001$; *$p=.001$; †$p<0.01$; ^$p<0.05$, – = not entered in the model

not significantly differ from 0, $t$ (469) = − 1.42, $p=0.16$; $M=-0.02$, $SD=0.26$; 95% CI [− 0.04, 0.01].

## Do Racial Biases Vary as a Function of Participants' Race?

As an exploratory analysis, we assessed whether participant race influenced their spontaneous identification of ASD and their responses on the Racial Bias IAT task. In order to determine whether spontaneous identification of ASD in the ASD vignette was related to the participants' race we performed a logistic regression. This analysis focused on participants who self-identified as White vs. Black (to mirror the pictures randomly assigned to each vignette). All participants who spontaneously labeled the ASD vignette as autism received a "1" and all other participants were coded as "0". Variables that had been significantly (i.e., ASD knowledge) or marginally (i.e., autistic traits and racism) associated with spontaneous ASD identification in baseline correlations were included in this analysis. Additionally, participant race, child in the vignette race, and an interaction term between participant race and race of the child in the ASD vignette was included in the model. The overall model, $\chi^2(6)=37.17$, $p<0.001$, explained 17.0% (Nagelkerke $R^2$) of the variance in identification of ASD and correctly classified 80.1% of cases. Identification of ASD was only related to ASD knowledge (see Table 4).

Another logistic regression model was created to determine whether spontaneous identification of CD for the CD vignette was related to the participants' race. For this model, participants who spontaneously labeled the CD vignette as Conduct Disorder received a "1" and all other participants were coded as "0". Variables that had been significantly (i.e., ASD knowledge and vignette order) or marginally (gender and race of child in the CD vignette) associated with spontaneous CD identification in baseline correlations were entered as predictors. Additionally, participant race and an interaction term between participant race and race of the child presented in the ASD vignette was included in the model. The overall model, $\chi^2(6)=33.59$, $p<0.001$, explained 15.8% (Nagelkerke $R^2$) of the variance in spontaneous identification of the CD vignette and correctly classified 79.3% of cases. Again, ASD knowledge was the only significant predictor (see Table 4).

Given that no participant characteristics had been associated with Racial Bias D scores in baseline correlations, we conducted a focused regression analysis with participant race (White vs. Black) as the predictor variable and D scores for the Racial Bias IAT task as the outcome variable. White participants were coded as 0 and Black participants were coded as 1. The model was significant, $F$ (1, 291) = 21.92, $p<0.001$. Participant race (β = 0.27; 95% CI [0.10, 0.23]) accounted for 6.7% of the variance (adjusted R squared) in D scores. Findings revealed that Black participants were faster than White participants to associate CD with pictures of European American children and ASD with pictures of the African American children.

Since participants' race predicted performance on the Racial Bias IAT, we split the data file by race and conducted two, one-sample t-tests on the D scores for the Racial

Bias IAT to identify simple effects. In the White/European American sub-sample, we found a significant negative difference from 0; participants were more likely to associate CD with African American children and ASD with European American children, $t$ (226) = − 3.92, $p < 0.001$; $M = -0.07$ ($SD = 0.25$); 95% CI [− 0.10, − 0.03]. When this analysis was conducted with Black participants, we found a trend toward a positive difference from 0 indicating that Black participants were more likely to associate CD with the European American child and ASD with the African American child, $t$ (65) = 3.25, $p = 0.002$; $M = 0.10$, $SD = 0.25$; 95% CI [0.04, 0.16].

## Discussion

The current study is the first to our knowledge to evaluate the possibility of implicit racial biases in ASD identification and attitudes toward ASD. We hypothesized that participants would be more likely to implicitly and explicitly associate pictures of an African American child with CD and pictures of a European American child with ASD. These hypotheses were not supported. Participants were *not* more likely to explicitly identify ASD in European American or CD in African American children. In the full sample, participants were also not more likely to implicitly associate pictures of an African American child with CD and pictures of a European American child with ASD.

However, an exploratory analysis revealed evidence that implicit racial biases in ASD vs. CD identification varied as a function of participants' self-reported race. Participants who identified as White were more likely to implicitly associate Black children with characteristics of CD and White children with characteristics of ASD. Conversely, Black participants showed the opposite trend, they implicitly associated White children with CD and the Black children with ASD. As hypothesized, characteristics of CD were also more explicitly and implicitly stigmatized than characteristics of ASD. Together, these findings expand upon prior work demonstrating that both White and Black adults exhibit implicit biases favoring their own race (e.g., Gibson et al. 2017; Rae et al. 2015) by showing that young adults preferentially associated characteristics of ASD with their own racial in-group and characteristics of CD with a racial out-group.

These findings are broadly in line with Wilson and Scior's (2015) speculation that implicit biases toward people with disabilities may arise from people favoring their in-group over an out-group. Drawing from Social Identity Theory, when individuals strongly identify with and derive self-esteem from their own in-group, they are more likely to favor their own in-group (Dasgupta 2004; Kawakami et al. 2017; Turner and Tajfel 1986). In conjunction with correlational evidence from the current study that racism and stigma towards disabilities are interrelated constructs, these findings highlight the importance of examining intersections between different forms of oppression when exploring how stigma and other forms of societal inequality are shaped by complex identities within and between people.

### Do Implicit Biases Provide Distinct Information Relative to Explicit Biases?

Although implicit racial biases in ASD vs CD identification favoring one's in-group were observed in the aforementioned exploratory analyses, no explicit racial biases in ASD or CD identification were observed. Nor did participants' race influence accuracy of identification. This lack of an effect of race on explicit categorizations was inconsistent with our hypothesis and with some prior research in this area (e.g., Begeer et al. 2009; Burke et al. 2016). However, Burke et al. (2016) did not observe explicit ethnic biases in autism identification after controlling for the socioeconomic status of the children being evaluated and increasing the number of symptoms presented in their vignettes relative to their past work. Our vignettes were more similar to Burke and colleagues' (2016) vignettes in the study where they did not observe an effect of ethnicity on identification (in fact, our CD vignette was modeled after that study); our vignettes included more symptoms than the vignettes used in their earlier studies and we did not include any confounding references to socioeconomic status in our vignettes. Together these findings suggest that racial/ethnic biases in explicit ASD identification are more likely to occur in ambiguous cases where the person under consideration has fewer symptoms and that variations in both ethnicity/race and socioeconomic status could influence judgements. Indeed, complex relationships have been observed between symptom severity, race/ethnicity, socioeconomic status, and age of ASD diagnosis (e.g., Emerson et al. 2016).

Mirroring some, but definitely not all, of the prior research examining implicit stigma towards disabilities (e.g., Thibodeau and Finley 2017; Wilson and Scior 2015), implicit and explicit measures were not related to one another in the current study and may thus have been measuring distinct constructs. While the IAT relies on reaction time data and measures associations between a stimulus and an attribute, explicit measures of stigma require participants to consciously report on their thoughts and feelings. Dovidio and colleagues (2002) explained that when a participant has time to think and make decisions, then these decisions are guided by explicit attitudes, however, when motivation is low and time constraints exist, implicit attitudes may play a larger role in affecting behavior.

It is possible that participants in the current study may have implicit biases that they do not consciously endorse or are not willing to express. Given that our measure of social

**Table 4** Results of logistic regression for spontaneous identification of ASD and CD in their respective vignettes

| Predictor | ASD vignette ($n=311$) | | | CD vignette ($n=311$) | | |
|---|---|---|---|---|---|---|
| | B (SE) | OR | 95% CI | B (SE) | OR | 95% CI |
| Race of child (vignette) | −0.90 (0.60) | 0.41 | 0.13–1.32 | 0.57 (0.58) | 1.77 | 0.57–5.47 |
| Participant race | −0.12 (0.55) | 0.89 | 0.30–2.63 | 0.51 (0.46) | 1.66 | 0.67–4.08 |
| Race of child × participant race | 0.71 (0.69) | 2.03 | 0.53–7.81 | −0.70 (0.67) | 0.50 | 0.13–1.83 |
| Participant gender | – | – | – | 0.23 (0.32) | 1.26 | 0.68–2.34 |
| ASD knowledge | 0.17 (0.04)** | 1.19 | 1.10–1.28 | 0.18 (0.04)** | 1.20 | 1.12–1.29 |
| Autism phenotype | −0.003 (0.02) | 1.00 | 0.96–1.03 | – | – | – |
| Racism | −0.06 (0.04) | 0.94 | 0.88–1.01 | – | – | – |
| Vignette order | – | – | – | −0.39 (0.29) | 0.68 | 0.38–1.21 |

– = not entered in the model because was not significant in baseline correlations

The following variables were dummy coded: race of child (vignette) (1 = African American), participant gender (1 = female), and vignette order (1 = ASD vignette presented first)

African-American entered as 1, Caucasian entered as 0. One is the reference category for dummy coded variables

Pleasantness of past contact with people with each condition was not entered into models as the contact question asked participants to reflect on the condition they had just identified. Entering contact into each model does not change the pattern of significance

**$p<0.001$; *$p=0.001$, $^{\dagger}p<0.01$; $^{\wedge}p<0.05$

desirability bias was not associated with key measures, there is no reason to believe that participants were responding in socially desirable ways. Indeed, people may be more inclined to be honest about potentially unacceptable attitudes in online surveys where their name is not paired with their responses (see Gillespie-Lynch et al. 2019 for a similar pattern of results). Therefore, it is likely that participants who had a bias toward identifying a child from their own in-group with a less stigmatizing disorder were not aware of this bias. So a primary recommendation of the current study is that trainings to reduce racial biases in disability identification and stigma are needed, not only for college students, like those in the current study, who may go on to become clinicians and educators, but also for people currently working with vulnerable populations, like the pediatricians and educators who exhibited explicit biases in autism identification in the studies conducted by Begeer and colleagues. Interventions that promote positive contact with racially diverse people with disabilities, that provide exemplars of positive role models who are diverse in multiple ways, and/or that teach people to recognize and practice overriding their stereotypes may be particularly helpful in reducing implicit and explicit biases (see Columb and Plant 2016; Dasgupta and Rivera 2008; Kawakami et al. 2017; Kubota et al. 2017; Lai, Hoffman, and Nosek 2013 for related work).

Indeed, participants who reported pleasant experiences with people like the children in the vignettes reported lower explicit (but not implicit) stigma toward ASD and CD. Furthermore, higher ASD knowledge, greater success identifying ASD in the vignette, and lower explicit (but not implicit) stigma towards the child exhibiting characteristics of ASD were interrelated. These findings extend upon past work linking heightened ASD knowledge and positive past experiences with ASD with reduced explicit stigma towards the diagnostic label ASD (e.g., Gillespie-Lynch et al. 2019) by showing that accurate identification of ASD in unlabeled vignettes is related to another measure of ASD knowledge, and that both forms of knowledge are associated with reduced ASD stigma. Therefore, interventions to decrease stigma towards disabilities should have an educational component which helps people distinguish between different diagnoses. Relatedly, questionnaires to assess ASD knowledge may be strengthened by including assessments of participants' ability to accurately distinguish between different conditions.

However, accuracy in identifying CD was associated with *heightened* stigma towards CD. This suggests that knowledge about and the ability to identify disabilities that are particularly stigmatized may *not* reduce stigma. In addition, explicit stigma may rear its head in unexpected ways. Although there were no differences in explicit stigma towards CD as a function of the race of the child paired with each vignette, participants, particularly White participants, reported that their past experiences with people with the condition depicted in the CD vignette were more negative when the picture paired with the vignette was Black. This raises the possibility that the reason past pleasantness of experience with ASD is such a consistent predictor of stigma is that it is in fact another measure of stigma projected into one's memories rather than one's expectations for the future. Social distance scales, one of the most commonly used methods for assessing explicit stigma (Link et al.

2004a), ask participants to report how willing they would be to engage with people with a specific condition in the future. Measures assessing the quality of past contact with a given condition ask people how they feel about their past contacts with the condition. In the current study, the race of a picture associated with the CD vignette was associated with reports of more negative *past* (pleasantness of contact) but not *future* (social distance) contact with people exhibiting characteristics of the condition. Findings suggest that people may be more willing to express negative attitudes toward past than future contacts and point to memories of past contact as a key area to explore in future stigma research. Future research should assess the degree to which pleasantness of past contact is associated with measures of stigma that are less similar to it than the social distance scale is, such as Corrigan and colleagues' (2015) semantic differential scale.

## Limitations

A key limitation of this study is its length. After participants completed both IATs, they may have experienced fatigue which may have affected their responses to explicit measures. Another possible source of bias is that we did not counterbalance congruent and incongruent blocks within each IAT. We also did not counterbalance the order of presentation of IATs relative to vignettes due to concerns that exposure to explicit measures might influence implicit associations, given that implicit attitudes may be influenced by explicit tasks (Dasgupta and Rivera 2008). Wilson and Scior (2014) indicated that the order of presentation of implicit versus explicit measures has had little impact in prior research but recommended counterbalancing to allow for examination of possible order effects unless there is a strong reason not to do so. Indeed, we found that the randomized order of vignettes influenced the accuracy of identification of CD while the order of IATs influenced overall reaction times, indicating that order effects did influence participant's responses.

Due to experimenter error, pictures of the Black and White children were randomized separately for each vignette, leading to some duplicates in which a single picture was paired with each vignette. However, excluding people who viewed the same race child for both vignettes ($n = 258$) did not change the pattern of findings. Additionally, pictures of two of the children that appeared in the IAT Racial Bias task (one of each race), were the same pictures that were randomized to the vignettes. This limitation was due to pronounced difficulty finding an adequate and sufficiently diverse number of depictions of minority children in available stimulus sets. Although the stimulus set we used was the most comprehensive stimulus set we encountered in terms of the availability of ethnically/racially diverse children, only 10 Black boys compared to 30 White boys were available in it. Preliminary pilot data revealed that many of the Black children were not rated as prototypical of their race (many looked quite Nordic), further constraining the available number of pictures. There is a strong need for more comprehensive stimulus sets depicting diverse people of different races/ethnicities to improve the generalizability of psychological research. Our focus solely on pictures of males is a limitation of the current study that may have inadvertently reinforced gender biases in autism identification (e.g., Halladay et al. 2015).

An anonymous reviewer pointed out that the finding that participants view CD as more negative (in valence) than ASD should be interpreted with caution given that the phrases we used to portray characteristics of CD in the Disability Valence IAT (and the CD vignette) were more negative than the phrases used to portray characteristics of ASD. In creating the phrases to represent ASD and CD in the current study, we were consistent with the characterization of each disorder in the DSM-5 (American Psychiatric Association 2013). All potential phrases were rated by a pilot sample as "characteristic of ASD" and "characteristic of CD"; only the qualities that were rated highly representative of one disorder and unrepresentative of the other disorder were included in the main study (i.e., phrases that characterized both disorders were eliminated). Therefore, when compared to the phrases for ASD, the remaining phrases used for CD may have provoked more extreme negative valence ratings from participants in the Disability Valence IAT through their unique (i.e., unshared) linkages with morality, vice, and criminality. The diagnostic criteria for CD, which emphasizes harm to people, animals, and property and/or serious rule violations, have been critiqued for confounding negative moral evaluations and medical categories (Sadler 2014). In contrast to the aggressions and transgressions that characterize the diagnostic criteria for CD, the diagnostic criteria for ASD highlight interpersonal difficulties and idiosyncratic behaviors/interests that are *not* framed as harmful to others. Given that dangerousness to others is a central contributor to stigma (Link et al. 1999), the diagnostic criteria for CD may be inherently more stigmatizing than the diagnostic criteria for ASD. While past research suggests that the salience of IAT categories, or the degree to which they draw attention, may contribute more to IAT effects than the valence of the categories (e.g., Rothermund and Wentura 2004), future research should critically examine the mechanisms underlying category differences observed with IATs.

Given that the majority of clinicians in the US are White (Lin et al. 2018), the current findings align with prior work suggesting that the diagnostic criteria for CD should be reconsidered (Sadler 2014) as they may contribute to institutionalized racism (e.g., Atkins-Loria et al. 2015). Indeed, we chose to focus on CD as the comparison category to ASD because Black youth are more likely to be diagnosed

with CD than White youth; a CD diagnosis also tends to have more negative long-term effects for Black than White youth (Mizock and Harkins 2011). Specifically, a diagnosis of CD has been shown to impact clinician concerns about future criminality, access to mental health care, and likelihood/duration of incarceration. Given that CD is the most common diagnosis in the US criminal justice system, the way CD is defined and identified may contribute to the pronounced racial disparities in incarceration in the US (Atkins-Loria et al. 2015). Future research should examine if implicit biases linking Blackness with criminality may account for the bias White participants in the current study demonstrated linking Black children with CD rather than ASD. Future research should also examine implicit and explicit racial biases in relation to other, less stigmatizing disorders that Black children are more likely to be diagnosed with than White children, such as ADHD (Mandell et al. 2007).

Our decision to use the terms African Americans and European Americans in our Racial Bias IAT diverges from the vast majority of past IATs assessing racial biases, which have traditionally used the terms Black and White (e.g., Schnabel et al. 2008). Our choice of terms is not unprecedented; a few other IAT studies have also used African American rather than Black (Blair et al. 2013; Foroni and Bel-Bahar 2010). Our choice of terms, derived from the terms used in the CAFÉ database from which we drew pictures for our study, aligns with the preferences of urban African American youth, who may prefer the term African American over Black (Sigelman et al. 2005). Nevertheless, participants in our study had no way to ascertain the ancestral background of the photos they were classifying. Therefore, the more commonly used terms Black versus White would have been more consistent with the information available to participants, and thus more accessible. Given that the term Black may be more stigmatizing than the term African American (Hall et al. 2015), our choice of terms likely weakened our ability to detect effects. Future researchers may wish to use the race terms more traditionally used in the racial IAT literature (i.e., White/Black).

It is also noteworthy that we only had 68 participants who identified as Black compared to 243 participants who identified as White, so generalizations of implicit in-group favoritism need to be interpreted with caution. In addition, our samples from Georgia and NYC were not well-matched. The many distinctions between the samples could be attributable to a number of factors including the academic background of students at each site (students in Georgia were majoring in education and may thus have had predispositions toward and/or training promoting acceptance of diversity), the selectivity of the institutions from which participants were recruited (substantially higher in Georgia than NYC), and/or the political climate in each context (students in NYC were recruited from a unique part of NYC that is more conservative in its political orientation relative to most of the city).

However, our inclusion of students from diverse locations could also be seen as a strength of this study as it enhances the generalizability of findings. Future research investigating these types of biases should include a range of institutions and majors to identify broader cultural factors, institutional factors and individual differences that are associated with reduced bias. Such research should examine structural stigma, or institutional practices and cultural norms that prevent members of stigmatized groups from receiving the opportunities that rightfully belong to everyone (Hatzenbuehler 2016).

Our ability to investigate associations between variables was also limited by the psychometric properties of assessments, many of which exhibited relatively low internal consistency (e.g., ASK-Q, social desirability bias and symbolic racism) and/or were not normally distributed (e.g., ASK-Q and measures of explicit stigma). In contrast, the reliability of our measures of implicit and explicit stigma was a strength of this study. Finally, pleasantness of prior contact with each condition was assessed with a single item; future studies should assess Quality of Contact using scales with established psychometric properties.

## Conclusions and Future Directions

This study is the first that we are aware of to examine implicit biases towards ASD in relation to race. Participants were more likely to implicitly and explicitly stigmatize characteristics of CD relative to ASD. They were also more likely to implicitly associate pictures that depicted members of their in-group with characteristics of ASD while pairing members of an out-group with (the more stigmatizing) characteristics of CD. Evidence that college students hold biases towards children with disabilities and these biases are implicitly affected by race highlights the need to examine implicit biases among healthcare and school-based professionals. While the current study examined autism *identification* among students, we did not assess ASD diagnosis. Future research should examine if implicit biases are influential in shaping *diagnostic* decisions made by clinicians in order to inform research on diagnostic disparities in the field. Given limited patient contact and substantial time pressures often experienced by clinicians (Tanner et al. 2009), we hypothesize that in group favoritism may cause the accuracy of ASD diagnosis to vary as a function of clinician race and/or ethnicity.

Future work in this area should not only examine predictors of implicit biases but should also evaluate trainings to reduce such biases. Future work should also examine implicit biases toward autistic females, who have received

little attention compared to males on the spectrum, and autistic immigrants and refugees, particularly given the current political climate where immigrants and refugees face particularly pronounced discrimination in the US and elsewhere.

Despite it being over half a century since the Civil Rights Movement, African Americans and other minority groups still face substantial discrimination, including pronounced disparities in access to healthcare (e.g., Mandell et al. 2002; Westcott 2015). Delays in diagnosis may prevent minority children on the spectrum from receiving much needed services that their majority peers have earlier access to and could therefore limit their development at a critical point in time. Given that racial and ethnic disparities in ASD identification and care are likely deeply rooted, a comprehensive set of approaches should be used to alleviate them (e.g., Rutland and Killen 2015). Such approaches should include trainings to help people at different stages in their life better understand and appreciate ASD and other conditions, as implicit biases may take root very early in development (e.g., Baron and Banaji 2006). Trainings should highlight intersectionality and racial disparities in diagnosis and care and could use IAT-based feedback to help people become aware of their own biases. By shining light on the issue, hopefully we can help ensure that diagnoses and supports are more accessible for autistic people from all walks of life.

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