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MEDICAL STUDENTS' KNOWLEDGE OF AUTISM COMPARED TO THE GENERAL POPULATION: A PILOT STUDY

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ABSTRACT

Background: Historically, there has been some concern regarding the level of training in autism spectrum disorder (ASD) for medical students. Throughout medical programs in the US, there is no standardised curriculum, and therefore, to make improvements in this area of medical training, a first step is to determine the current areas of competency of medical students. This pilot study investigated whether differences exist in knowledge among third-year medical students and a general population sample.
*Methods: W*e investigated beliefs about autism among a group of third-year medical students (n = 202) and among a crowdsourced sample of the general public (n = 858). A survey assessed autism knowledge regarding sources of information, causes, age of earliest diagnosis, front-line treatment providers, and diagnostic versus non-diagnostic symptoms. The third-year medical student sample was obtained from a Health Sciences Center in the Southwest. Third-year medical students were surveyed during their paediatrics rotation. The general public sample accessed and completed the survey through Amazon's Mechanical Turk (MTurk) platform.
Results: Results suggested that although third-year medical students had lower confidence regarding their autism-knowledge base, they possessed more knowledge of autism related to sources of information, causes, and diagnostic testing options than the comparison sample. Additionally, they were significantly better at differentiating diagnostic symptoms from non-diagnostic symptoms.
Conclusions: Overall, the results suggest that by their third year, medical students know more about autism than the general public. Results from the current study indicate an improvement in medical students' knowledge with

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respect to autism. Treatment options and the continued need for more training to enhance medical student confidence are discussed.

Keywords: autism spectrum disorder, autism education, medical student training, autism knowledge

INTRODUCTION

Autism spectrum disorder (ASD) is a neurodevelopmental disorder characterised by deficits in behaviour (e.g., repetitive mannerisms, restricted interests, sensory dysfunction) and social communication (e.g., using communication skills, both verbal and nonverbal, to engage someone in social interaction). Although recent research indicates the importance of early recognition and intervention for children with autism, historically, educational research suggests that the overall knowledge and competency in autism among medical students is fairly limited (Shah, 2001; Major et al., 2013). Furthermore, medical students also report general discomfort with the disorder (Austriaco et al., 2019). This line of research has been extended beyond medical school into paediatric residency. For example, Meyers et al. (2017) surveyed final-year paediatric residents regarding their comfort level and knowledge of autism based on specifications provided by the American Academy of Pediatrics (AAP). Interestingly, they found that a large proportion (approximately 33%) of the sample (N = 1700 paediatric residents) did not feel prepared for managing the healthcare of those with autism. This is quite alarming as autism prevalence rates continue to climb and primary care providers (e.g., paediatricians, family medicine) are often frontline clinicians who typically make first contact and provide initial screening for those children showing early signs of autism (Hyman et al., 2020).

There is emerging evidence to suggest that education for medical and residency students may be changing in positive directions. For example, Hansen and Barry (2020) surveyed 142 medical students using the "Survey of Knowledge of Autism Spectrum Disorder (Hansen, 2015)" and found that the students' actual knowledge was relatively high. Intuitively, they also found that higher knowledge led to higher confidence ratings. Furthermore, additional efforts are being made to improve medical personnel's knowledge base for developmental disorders and autism. Havercamp et al. (2016) investigated whether a didactic lecture that included a panel presentation with individuals with autism could improve knowledge. Their findings suggest that information presentation as well as exposure to individuals with autism increased the level of knowledge of the students. Simin et al. (2020) used a pre-test/post-test design to improve the attitudes, comfort level, and knowledge towards children with developmental disabilities. Though not specific to autism, their results suggested that medical students could improve these

areas of competence with just 6 hours of didactic training specific to child development.

This seemingly contradictory history may be the product of the ever-changing nature of the disorder itself. The prevalence rates for autism have dramatically increased in the last 20 years. In 2002, the prevalence rate was estimated to be 1 in 150. By 2012, it soared to 1 in 68, with the most recent estimate now at 1 in 36 (Maenner et al., 2023). Another factor contributing to the difficulty in assessing medical knowledge of autism is the conceptualisation, or the diagnostic picture of the disorder has changed recently. In 2013, the various pervasive developmental disorders, which included autistic disorder, Asperger's disorder, child disintegrative disorder, and others, were collapsed into one disorder called ASD. Furthermore, diagnostic language and minimum criteria were changed from the Diagnostic and Statistical Manual for Mental Disorder, Fourth Edition – Text Revision (DSM-IV-TR) to DSM-5 (Kim et al., 2014). These moving targets make it quite difficult to study autism knowledge in medical students.

There is insufficient information in the literature regarding individuals with autism experience with the medical system, especially adults. What is known does not paint a confident picture. Bruder et al. (2012) surveyed over 1,500 primary doctors to find 346 respondents who provided regular care to adults with autism. These physicians admitted to inadequate regarding their autism and most of the training occurred after medical school, such as during residency or continuing medical education. Greater than 50% of the physicians surveyed stated that would welcome additional training in caring for individuals with autism. Given that individuals with autism have a greater likelihood of suffering from certain medical conditions, such as epilepsy, sleep disorder, gastrointestinal problems, dental issues, and immune conditions (Olivie, 2012), it is important to have physicians skilled in working with the population. Increasing attention has been paid to the unique challenges of parents and children with autism experience when seeking medical care. Everything from difficulty waiting to overwhelming environments to problems communicating with the staff could be improved upon with a greater understanding of autism on the physicians' part (Wilson and Peterson, 2018).

Given the inconsistency in previous research and difficulty with the autism diagnosis, the purpose of the present study was to obtain an estimate of autism knowledge in medical students. However, at present, no studies have been conducted comparing medical students' knowledge of autism to that of the lay public. Mitchell and Locke (2015) compared lay people's (college graduates) beliefs about autism with the general public knowledge, and results suggested that lay people correctly believe accurate information regarding primary cause and treatment options for autism. In addition, they were generally able to distinguish between diagnostic and non-diagnostic symptoms. The results of Mitchell and Locke's study provided the basis for

the current study. By comparing third-year medical students' responses to an autism survey to a general public sample, we hoped to answer the following questions:

(1) Do third-year medical students have more autism knowledge compared to general public?
(2) Are the medical students more confident regarding their autism knowledge?
(3) Are there knowledge differences in respect to the cause, symptoms, and treatments of autism among the two groups?
(4) Can medical students distinguish between diagnostic and non-diagnostic symptoms better than the general public?

METHODS

PARTICIPANTS

Two hundred and two (N = 202) third-year medical students were surveyed using a pencil and paper adaptation of Mitchell and Locke's questionnaire (2015). Third-year medical students were chosen for this study due to their unique position of transition from classroom learning to the clinical environment. They had completed the necessary foundational coursework and were expected to have acquired a fundamental understanding of medical science and clinical skills (including autism) but had yet to refine this knowledge and put it into practice. Although the depth and breadth of knowledge about autism can vary among individual medical students, their understanding may be further expanded during clinical rotations and interactions with patients. Because first- and second-year students typically have not completed required classwork and fourth-year students have already had the benefit of training within clinical rotations, third-year medical students were ideal for inclusion in the present pilot study. Eight hundred and fifty-eight adults completed the same autism survey via MTurk online. According to Hitlin (2016), MTurk samples tend to be adequate representations of the general US population in regard to many characteristics. However, MTurk users tend to be younger (ages 18–34), more educated (have a college degree), and more tech-savvy. Based on these data, the MTurk sample was judged to be an adequate representation of the general US population.

SURVEY

A modified version of a survey designed by Mitchell and Locke (2015) was used to assess autism knowledge regarding sources of information, causes,

age of earliest diagnosis, front-line treatment providers, and diagnostic versus non-diagnostic symptoms. In addition to demographic questions, two additional questions were utilised to obtain information regarding confidence in current autism knowledge and whether the participant or family member has experience with autism. The survey is presented in the Appendix. While information on age, gender, and race was obtained, specific data on socioeconomic status were not recorded. The results of the survey are presented in Tables 2–9.

PROCEDURE

All appropriate University Institutional Review Board (IRB) procedures were followed, and the IRB approved the study protocol. The third-year medical student sample was obtained from a Health Sciences Center in the Southwest. Third-year medical students were surveyed during their paediatrics rotation. Third-year medical students were asked to complete the survey on a voluntary basis; data were collected over a 3-year period. Medical student participants did not receive any compensation or renumeration for participating in the study. The general public sample accessed and completed our questionnaire through Amazon's Mechanical Turk (MTurk) website (Mason and Suri, 2012) between June and August 2021. Subjects were paid US$ 0.30 if they completed the questionnaire and correctly answered a validity-check question embedded in the questionnaire. The respondents were limited to only those in North America (US and Canada). The survey was available online for 52 days, from 16 July 2021 to 6 September 2021. MTurk has been shown to validly allow researchers to access large numbers of subjects in a quick, efficient manner, and the profile of these subjects is similar to those participating in other forms of survey research (Huff and Tingley, 2015).

DATA ANALYSIS

The MTurk Toolkit Pro Features platform was used to manage and enhance the study data collection process. This add-on platform assisted with blocking responses from the same IP address, increasing anonymity, verification of a worker's location, and blocking "low quality" participants. Once the data were collected, data were entered into the statistical software package SPSS 27.0 for analysis purposes. Using the same statistical analysis procedures as in the original study (Mitchell and Locke, 2015), phi coefficients were used to measure the strength of association between various responses to the survey of the third-year medical students and the general public sample. Percentages and the results of the phi coefficient analyses are presented in Tables 2–9.

RESULTS

RESPONDENT DEMOGRAPHICS

Sample demographic information is presented in Table 1. A total of 202 medical students completed the questionnaire (48.67% males and 51.33% females; age range 22–39). Medical student respondents reported the following ethnicities: 81.5% White/Caucasian, 13.5% Other (Hispanic, Black, and Asian), and 5% preferred not to say. The general public sample consisted of 858 adults in the United States (170 male, 684 female; age range = 15–78 years). Reported ethnicities included: 73.7% White/Caucasian, 25.1% Other (Hispanic, Black, Asian, etc.,) and 1.2% preferred not to say.

Table 1. Demographic characteristics of the general population and third-year medical students

	Sample	
	General	**Third-year medical students**
Age		
18–24	15.2	33.2
25–29	18.6	62.2
30–34	18.1	2.6
35–39	12.5	2
40–44	11.2	0
>45	24.4	0
Range	15–78	18–39
Ethnicity		
White	73.7	81.5
Black	9.9	–
Hispanic	6.3	–
Other	8.9	13.5
Prefer Not to Say	1.2	5
Member of household with ASD?		
No	62.4	91.1
Don't know/Not sure	4.7	
Yes	33	7.4
Self	8	0.5
Brother/sister	7.6	3.5
Son/daughter	14.6	0.5
Other	8.4	1
Prefer not to say	5.7	0.5

Table 2 presents the confidence level of the respondents in the two groups. Participants were asked "How would you rate your confidence level regarding you knowledge of ASD?" Participants were asked to rate their level of confidence on a 5-point Likert scale: *Very Confident, Somewhat Confident, Neutral, Somewhat unconfident, and Very Unconfident.* The general public were significantly more confident in their ASD knowledge than third-year medical students, $\varphi = 0.270$, $p < 0.001$. According to the results, 60.1% of general public were very confident to somewhat confident, whereas only 33.3% of third-year medical students had similar levels of confidence.

INFORMATION ABOUT ASD

Table 3 displays the percentages of responses of participants to each source of information about autism. The respondents were asked to respond to the question "Where have you gotten most of your information about autism?" The general public reported sources of information including media, friends, neighbours, family, experience, and doctors at a higher rate than the

Table 2. Confidence level regarding knowledge of ASD

	Sample	
	General	**Third-year medical students**
Very Confident	15.4	1
Somewhat Confident	44.7	32.3
Neutral	20.8	45.7
Somewhat Unconfident	14.6	18.9
Very Unconfident	4.6	1.9

Table 3. Source of information

	Sample	
	General	**Third-year medical students**
Media (including print, broadcast, and Internet)	49.3	21.8**
Friend, neighbours, or family	35.5	20.8**
School, work, or professional organisation	43.1	67.8**
Personal experience	31.8	15.8**
Unsure or other	2.8	3
Doctor, hospital, or clinic	23.0	5.4**

Note: Presented as percentage of respondents. *$p < 0.05$. **$p < 0.001$.

third-year medical students. The medical students obtained the highest percentage of their information from school, work, or professional organisations.

MAIN CAUSES OF ASD

To determine the knowledge regarding the causes of autism, participants were asked "Please choose which two of the following you believe as the main causes of autism?" Table 4 presents the percentages for each group. Although both groups rated genetic and neurological causes at the highest level, third-year medical students chose genetics at a significantly higher rate than the general public. Furthermore, the general public (4.8%) endorsed vaccines at a much higher rate than did the medical students (0%).

AGE OF DIAGNOSIS

Age of diagnosis knowledge was assessed with the following question: "What is the earliest age that you think a person can be diagnosed with autism?" Both the general public (96%) and third-year medical students (98%) accurately believed that autism could be diagnosed prior to 5 years of age. Table 5 displays the percentages of respondents for each group who endorsed the various age ranges.

Table 4. Two main causes of autism

	Sample	
	General	**Third-year medical students**
Genetic	76.8	85.1*
Neurological	67.5	69.3
Environment exposure	17.6	26.2*
Mental illness	9.7	5.4*
Vaccinations	4.8	0*
Nutrition issues during pregnancy	10.4	3**
Dietary/nutritional deficiencies	5.8	0.5**
Family	7.9	5
Drugs	4.2	0.5*

Note: Presented as percentage of respondents. *$p < 0.05$. **$p < 0.001$.

Table 5. Age of onset of diagnosis

	Sample	
	General	**Third-year medical students**
Less than 18 months	23.9	12.4*
18–24 months	45.4	65.8*
3–5 years of age	27.3	19.8*
6 years of age or older	3.4	2

Note: Presented as percentage of respondents. *$p < 0.001$.

Table 6. Where to go for help?

	Sample	
	General	**Third-year medical students**
Doctor	67.8	43.1**
Psychologist	11.3	29.8**
Early Intervention specialist	18.5	25.5*
Parent Organization	.6	.5
School District	.4	1.1

Note: Presented as percentage of respondents. *$p < 0.05$. **$p < 0.001$.

WHERE TO GO FOR HELP?

Table 6 shows where the participants believed one should go when needing help for autism. The question posed to each participant was "If you suspect someone you know has autism, where should they go for help first?" Each group reported that a "doctor" was the best option for help regarding autism, followed by a psychologist and early interventionist, respectively.

DIAGNOSTIC TRAITS OF ASD

Table 7 shows the response percentages for endorsement of diagnostic and non-diagnostic traits of autism. These responses were elicited with the following item: Please select 6 of the following traits that you believe are the more diagnostic of autism. The general public group correctly identified the most common diagnostic traits at a rate over 70% for all traits but "Inability to make or sustain friendships." The third-year medical students correctly endorsed the diagnostic traits over at a rate of 70% for each diagnostic trait.

Table 7. Diagnostic traits of autism

	Sample	
	General	**Third-year medical students**
Diagnostic traits		
Poor non-verbal communication (limited eye contact or gestures)	92.8	99**
Poor back-and-forth communication skills	81.2	93.1**
Strong resistance to changes in routines	86.5	97.5**
Repeating the same behaviour over and over (e.g., hand flapping)	87.8	93*
Intense, restricted interests	69.2	95**
Inability to make or sustain friendships	50.8	72.3**
Non-diagnostic traits		
Fidgets and squirms constantly	54.4	20.8**
Illogical thinking	12.2	5*
Cannot control unwanted thoughts	19.5	10.9*
Consistently violent behaviour	7.3	1**
Seeing or hearing things that do not exist	4.0	0**
Performs actions to deliberately annoy others	7.1	1**

Note: Presented as percentage of respondents. *$p < 0.05$. **$p < 0.001$.

Furthermore, there were statistically significant differences among the general public and the third-year medical students. In general, medical students correctly endorsed diagnostic traits at a significantly higher rate than the general public, whereas the general public were significantly more likely to endorse non-diagnostic traits.

TREATMENTS FOR AUTISM

To determine the participants' knowledge of treatment options, they were instructed to answer the following question: "Do you think there are therapies for autism? If yes, which of the following are appropriate therapies or treatments for autism (please pick 3)." Table 8 displays the percentages of responses for each treatment option for both groups. Approximately, 94% of the general public acknowledged there were treatments for autism. For the third-year medical students, 99.5% of the participants endorsed the presence of specific treatments for autism. The general public chose behaviour therapies (78%), training or educating parents (51.6%), and counselling, psychological, or group therapies (42.1%) as their top treatment options. The third-year medical students endorsed training or educating parents (81.3%), behaviour therapies (70.3%), and play therapy (54%) as their top three treatment options.

Table 8. Most appropriate therapy or treatment

	Sample	
	General	**Third-year medical students**
Behaviour Therapies	78	70.3
Training or education parents	51.6	81.3
Counselling, psychological, or group therapies	42.1	31.7
Educational Therapies	39.6	11.4
Play Therapy	41.6	54
Speech Therapy	35.0	36
Special Schools	19.8	14.4
Drugs/Medication	11.0	.5
Physical Exercise	16.1	3

Note: Presented as percentage of respondents. *$p < 0.05$. **$p < 0.001$.

DISCUSSION

The survey utilised in this study accessed six areas of autism knowledge among third-year medical students. Results were then compared to a general public sample. The areas included (1) sources of information, (2) causes, (3) age of diagnosis, (4) first-line treatment providers, (5) diagnostic symptoms, and (6) treatment. Third-year medical students (67.8%) reported their major source of autism information was school, work, or professional organisations, whereas the general public was more scattered (media, personal experience, friends, etc.). Despite having access to vetted sources of information, medical students were less confident in the knowledge regarding autism when compared to the general public. It should be noted that the aim of this pilot study was to investigate medical student knowledge of ASD to the general public and not to investigate medical student knowledge compared to participants in other subgroups based on age or occupation.

Regarding causes of autism, medical students and the general public were more likely to correctly endorse genetic and neurological causes; however, medical students reported environmental exposure as the third highest cause, which was significantly higher than the general population. Within both groups, vaccines were reported at very low rates. In fact, comparing the current general public sample (4.8%) to the original 2015 sample by Mitchell and Locke (6.8–10.8%), these rates have dramatically decreased, suggesting an improvement in basic knowledge from a variety of sources.

Although third-year medical students were more likely to endorse an earlier age of onset of autism (78.2% prior to 24 months) than the general public (69.3%), the majority of both groups correctly reported age of diagnosis prior

to age 5 years. Both groups also correctly endorsed doctor, psychologist, and early interventionist as the first place to go for help. The AAP recommends developmental screenings at 18 and 24 months to monitor the emergence of developmental delays as well as autism-related symptoms (Hyman et al., 2020). These screenings are important because autism can be validly and reliably diagnosed by 18 months of age. This is relevant because in the present case, medical students demonstrate appropriate knowledge in age of diagnosis that is consistent with recommendations from national organisations.

In an attempt to be consistent with the original study published by Mitchell and Locke (2015), the examiners did insert a question regarding "what kind of testing do you think is done to diagnose autism?". Due to technical reasons, this question could not be included in the analysis or discussion. The general sample was given a forced choice format, which allowed them to pick only one type of testing, while the medical students were allowed to select multiple forms of testing. The change in response style made it fundamentally a different question posed to each group, and therefore, comparison was not possible.

According to the results, third-year medical students more accurately differentiated between diagnostic traits and non-diagnostic traits of autism compared to the general public sample. This is an important finding because it provides evidence that medical students do understand the basic diagnostic symptoms of autism. Similar to Mitchell and Locke (2015), the most commonly endorsed treatments for autism were training and education for parents and behaviour therapy. The most widely used evidence-based therapy for children with autism is Applied Behaviour Analysis (ABA), and our data support a working knowledge of this fact (Odom et al., 2010; Roane et al., 2016; Anderson and Carr, 2021). However, ABA is not the only effective evidence-based autism treatment, and in our data, there was a good deal of inconsistency after parent education and behaviour therapy. This may suggest that although medical students' knowledge of autism has improved (when compared to previous research), applying this knowledge in respect to treatment still may be lacking.

Despite the fact that third-year medical students generally had more knowledge of autism in the majority of the areas surveyed, they had significantly lower confidence in their autism knowledge compared to the general public. This trend is seen in advanced stages of training such as residency (Meyers et al., 2017) and in specialties within medical education including critical care (Al Ansari et al., 2021), palliative care (Leung and Wong, 2021), emergency radiology (Leschied et al., 2013), surgery (Tocco et al., 2013), and others. The easiest way to ameliorate low-confidence ratings is to provide enhanced educational experiences that improve knowledge, which in turn increased confidence. For example, Truntzer et al. (2014) found that when medical students received a targeted didactic and skill development intervention related to muscular skeleton development, significant improvement in confidence was noted and the test score improved, both immediately and long term. These efforts can be seen at the medical school level as well as post-medical school.

Specific to autism, one training program in particular that has received extensive peer review and development by the American Academy of Pediatrics is called "Autism Case Training (ACT): A Developmental-Behavioural Pediatrics Curriculum." This program is designed to be used with paediatric residents to enhance their abilities in the diagnosis and management of children with ASD (Major, 2015). Preliminary data suggest a program such as this can improve knowledge in students in medical residency.

Although medical students tend to have a lower self-confidence regarding their competence in many areas of medicine, in the present study, another factor that should not be overlooked is the overconfidence bias. Kruger and Dunning (1999) found that individuals who have better insight into their own competencies tend to have more realistic confidence than those individuals with less knowledge. Karpen (2018) explained that this tendency is heightened when individuals are asked to provide self-assessment of knowledge. In this study, the general public's knowledge of autism was significantly less in most of the areas surveyed than that of the third-year medical students. However, they were significantly more confident. In other words, the general public was overconfident even though they had less knowledge, which appears consistent with the overconfidence bias theory.

CONCLUSIONS

The overall results suggest that third-year medical students have significantly more knowledge of autism than the general public, which is contrary to previous findings (e.g., Shah, 2001; Major et al., 2013; Austriaco et al., 2019). This finding is encouraging and may indicate improvements have been made in medical education, although other explanations are possible. Autism has become more visible in all forms of media, and disability awareness is openly discussed on college campuses. Due to the fact that they are a college-educated group, medical students' knowledge of autism may be advanced, regardless of actual changes to medical school instruction.

LIMITATIONS

This study relied on crowdsourcing survey data via Amazon's MTurk as well as pencil and paper surveys. The general public sample data were collected electronically, and the third-year medical student data were collected by traditional means. Some argue that electronic data collection is superior because it provides increased anonymity and may reduce socially desirable responding. Furthermore, the response profile may be different depending on the method, thereby making comparisons between two different groups less valid and reliable (Ward et al., 2014). To combat some of these issues, we utilised the Pro Features platform to improve our electronic data quality. It is acknowledged there may be subtle differences in response profiles between

the groups given the different presentation formats; however, these methodological problems are the highest when survey questions are of a sensitive or personal nature. Within each sample, a low percentage of respondents had personal experience with autism and the survey questions were targeted toward current knowledge rather than questions of a sensitive nature. Therefore, it is believed that respondents were less likely to be influenced by social-desirable responding. Therefore, the method presentation should not have significantly influenced responding and introduced significant bias in the data.

Although the MTurk data collection method has received support for its effectiveness in medical research (Mortensen and Hughes, 2018), it does not come without criticism. According to some critiques, the platform may not provide a representative "general public" sample because respondents tend to be younger (and therefore more technology savvy), less religious, more educated, and less likely to have traditional employment (Goodman et al., 2013). Our goal was to compare an estimate of the general population to that of third-year medical students. The MTurk sample may have been composed of "more educated" and unemployed participants as compared to that of the general population; however, it would not present a problem when comparing them to students with at least 6 years of post-high school education, many of whom are full-time students. It is argued that our MTurk sample provides an adequate comparison group for medical student group.

Finally, the scope of the pilot study is relatively limited in terms of the sampling of participants. The medical students were sampled from only a single Health Center, making it difficult to know to what extent the findings are representative of medical students receiving training in other parts of the US as well as in different curriculums. Replication of this pilot study is necessary to investigate students in different schools around the country as well as those studying unrelated fields in order to better control for the influence of general socio-demographic factors.

AUTHORS' CONTRIBUTIONS

AB and MY wrote the main manuscript. AB collected the majority of third-year medical student data and provided statistical analysis and prepared all manuscript tables. MY converted the survey into digital format and prepared the MTurk tool. Both authors read and approved the final manuscript.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

AVAILABILITY OF DATA AND MATERIALS

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

DECLARATIONS, ETHICS APPROVAL, AND CONSENT TO PARTICIPATE

The methods described in our study were carried out in full accordance with the ethical guidelines and standards set by the Louisiana State University Health Shreveport (LSUH-S) Institutional Review Board (IRB). The LSUH-S IRB reviewed and approved the experimental protocol for this study. All subjects involved in the study read an IRB-approved informed consent letter, and completion of the survey documented their willingness to participate in the study.

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APPENDIX

ASD SURVEY

1. **How would you rate your confidence level regarding your knowledge of ASD?**
   Very Confident Somewhat Confident Neutral
   Somewhat Unconfident Very Unconfident

2. **Has a doctor, nurse, school psychologist, or any other professional ever said you or a member of your household has autism, Asperger's disorder, pervasive developmental disorder, or other ASD? Yes No Don't know/not sure**
   If yes, who in your family has autism, Asperger's disorder, pervasive developmental disorder, or other ASD? (Check all that apply)
   Self Son/Daughter Brother/Sister
   Parent Other:_____ Rather not say

3. **Where have you gotten most of your information about autism?**
   School, work, or professional organisation
   Doctor, hospital, or clinic
   Personal Experience
   Media (including print, broadcast, and Internet)
   Friend, neighbour, or family member
   Unsure or other:_____

4. **Please choose which two of the following you believe are the main causes of autism?**
   Genetic Neurological Environmental Exposure Mental Illness
   Vaccinations Family Drugs
   Nutrition issues during pregnancy Dietary/Nutritional deficiencies

5. **What is the earliest age that you think a person can be diagnosed with autism?**
   Less than 18 months 18–24 months 3–5 years of age 6 years or older

6. **If you suspect someone you know has autism, where should they go for help first?**
   Doctor Early Intervention specialist Internet
   Parent Organisation School District Health Department
   Psychologist Social Media (Facebook, Twitter) Hotline/Phonebook

7. What kind of testing do you think is done to diagnose autism?

Psychological, educational, or developmental
Medical/physical examination
Blood work, chemical testing, or genetic testing
Behavioural Testing
Observation
Speech and language evaluation
Other: _____

8. Please select 6 of the following traits that you believe are most diagnostic of autism

Fidgets and squirms constantly
Poor back-and-forth communication
Cannot control unwanted thoughts
Inability to make or sustain friendships
Preforms actions to deliberately annoy others
Poor non-verbal communication (limited eye contact or gestures)
Repeating the same behaviour over and over (e.g., hand flapping)
Intense, restricted interests
Strong resistance to change in routines
Seeing or hearing things that do not exist
Consistently violent behaviour
Illogical thinking

9. Do you think there are therapies or treatments for autism? Yes No

If yes, which of the following are appropriate therapies or treatments for autism?

(please pick 3). Physical exercise Training or educating parents
Behaviour Therapies
Play Therapies
Educational therapies
Counselling, psychological, or group therapies
Speech Therapy
Special Schools
Drugs/Medication