Original Article

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Lay beliefs about autism spectrum disorder among the general public and childcare providers

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Abstract

We conducted a survey of beliefs about autism among the general public in the United States and Canada (n = 823) and among individuals working in childcare facilities in the state of Idaho (n = 176). Results included the following. Almost all respondents correctly believed that autism's primary causes are genetic and neurological (not parenting, drugs, or current diet), that it can be identified in early childhood, and that helpful interventions exist. Respondents generally distinguished diagnostic from non-diagnostic traits, but approximately half incorrectly labeled constant squirming as diagnostic and difficulties in making friends as non-diagnostic. College graduates and childcare workers were more likely to have learned about autism in professional/academic settings and to correctly recognize diagnostic traits. Of concern, 10% of respondents considered vaccinations to be among the two main causes of autism. Accurate public understanding of autism spectrum disorders can facilitate early identification and effective intervention; our results suggest that efficient channels for conveying accurate information include broadcast and online media (from which the general public, especially members of ethnic minority groups, were most likely to learn about autism), and professional development courses for childcare providers.

Keywords

autism, autism spectrum disorder, childcare providers, lay beliefs

Introduction

Autism spectrum disorder (ASD) is a neurodevelopmental disorder in which individuals show persistent deficits in social communion and interaction (such as difficulties with sustaining conversations and developing friendships) and restricted, repetitive patterns of behavior or interests (such as stereotyped movements, insistence on routines, and narrow preoccupations) (*Diagnostic and Statistical Manual of Mental Disorders*, 5th ed. (DSM-5); American Psychiatric Association, 2013). Beginning in the mid-1990s, epidemiological studies have reported an increasing prevalence of ASD. In the United States in 2008, the Autism and Developmental Disabilities Monitoring Network estimated that 1 in 88 children had an ASD, with prevalence rates being five times greater in boys than girls (Baio, 2012). The increase in reported ASD prevalence may reflect greater inclusion of individuals with milder ASD as well as increased awareness of ASD among professionals and the general public. Regardless, the prevalence of ASD means that many people—both within and outside of the health and helping professions—are likely to have contact with someone with ASD. Therefore, it is important that there is awareness and accurate understanding of ASD among the general public as well as among members of various professions. Among other benefits, such awareness and understanding can help individuals with ASD to be identified and receive appropriate supports as early as possible.

Despite increasing awareness of ASD, recent studies of both professionals and the general public find continuing

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misconceptions or inadequate training regarding the causes, symptoms, and treatments of ASD. Surveys of speech-language pathologists have shown improvements over time in their academic and clinical training related to ASD, but also continuing weaknesses in identifying ASD diagnostic criteria and in self-efficacy for working with children with ASD and their parents (Plumb and Plexico, 2013). A 2012 survey of Doctor of Pharmacy students in the United States likewise found that while beliefs were more often accurate than not, over 21% agreed with the statement “Autism is a rare disorder which affects less than 200,000 individuals” and over 10% agreed with the statement “Vaccines can cause autism” (Khanna et al., 2014). A survey of students, faculty, and staff on a college campus also found that while beliefs about autism were more often accurate than not, some misconceptions remained prevalent; for example, only 43% of respondents agreed with the statement “autism runs in families” and only 58% of respondents disagreed with the statement “vaccines are causing an increase in autism” (Tipton and Blacher, 2014).

As noted above, surveys of awareness and knowledge of ASD have been conducted among various categories of professionals; however, to our knowledge, no such surveys have been conducted among people working in childcare facilities. Because childcare workers typically are in a position both to observe a particular child for many hours per week and to compare that child’s behaviors with those of same-age peers, they are particularly well-placed to identify children with ASD features. Moreover, they are likely to have many opportunities to communicate their observations to parents and to guide parents towards appropriate local resources for assessment and intervention. Given that (a) childcare workers can play a critical role in facilitating early identification and intervention and (b) early identification of ASD facilitates better outcomes (Makrygianni and Reed, 2010), it is important to assess how childcare workers learn about ASD and whether there are areas in which their understanding of ASD could be enhanced. Conducting such an assessment was one aim of this study.

Most studies have focused on the understanding of ASD within specific groups, and primarily within specific categories of professionals working in medical or educational settings. Only a few studies have assessed the beliefs of members of the general public (e.g. Furnham and Buck, 2003; Holt and Christensen, 2013). Furnham and Buck (2003) had members of the general public in England indicate their agreement with statements about the etiology and treatment of autism. While respondents generally expressed beliefs consistent with the scientific consensus (e.g. genetics and brain abnormalities are causal factors and behavioral therapies can help), some also endorsed a variety of non-scientific beliefs (e.g. early traumatic experiences or food allergies can cause autism). Holt and Christensen (2013) conducted a telephone survey assessing the understanding of autism among residents of Utah. Among other findings, they found that respondents were most likely to have obtained their information about autism from radio or TV, and the majority admitted to not knowing how autism was diagnosed. Thus, surveys suggest that while the general public has a generally accurate impression of ASD, many also have misconceptions or gaps in their knowledge of its characteristics, causes, and treatments. However, there are no recent surveys of the general public in the United States and Canada. Therefore, a second aim of this study was to conduct such an assessment.

Finally, in addition to exploring whether there were differences between childcare workers and the general public, we explored whether beliefs regarding ASD among the general public varied as a function of ethnicity, education level, or having a direct family connection with ASD. We used an online survey to conduct our assessments. We asked questions similar to those asked in Holt and Christensen’s (2013) telephone survey. The main difference is that Holt and Christensen generally asked open-ended questions (e.g. “What do you think causes autism”) and subsequently categorized the responses, whereas we asked closed-ended questions and gave respondents response options mirroring those into which Holt and Christensen had categorized their participants’ responses.

Method

Participants

The general public sample consisted of 823 individuals living in the United States or Canada (336 male, 487 female; *M* age = 32.7 years, standard deviation (*SD*) = 11.7 years, *range* = 18–77 years) who accessed and completed our questionnaire through Amazon’s Mechanical Turk (MTurk) website (Mason and Suri, 2012) between 11 April and 7 June 2013, in exchange for US$0.30. The sample only included respondents who completed the questionnaire and correctly answered a validity-check question embedded in the questionnaire. Respondents’ self-reported ethnicities were White/Caucasian (77.8%), Hispanic/Latino (4.3%), Asian (6.4%), Black (7.2%), multi-racial, and other (4.5%).

The childcare sample was recruited between 3 June and 1 July 2013, through the State of Idaho Department of Health and Welfare (IDHW). The IDHW regional directors e-mailed all childcare facilities registered through Idaho’s State Training and Registry System (IdahoSTARS); the e-mail contained a brief description of the study and invited all employees of the facility to participate. The respondents were 176 volunteers currently working in childcare facilities in Idaho (174 female, 2 male; *M* age = 43.4 years, *SD* = 12.0 years, *range* = 20–67 years). The respondents described their “role at the childcare facility

Table 1. Characteristics of the general public and childcare worker samples.

	Sample	
	General	Childcare
Highest level of education attained		
Less than a high school degree	1.3%	1.2%
High school degree or some college	45.7%	52.1%
College graduate	41.1%	37.7%
Graduate degree	11.8%	9.0%
Total annual household income		
Less than US$40,000	51.4%	41.1%
US$40,000–US$80,000	33.0%	44.8%
More than US$80,000	15.6%	14.1%
Member of household with ASD?		
No	83.7%	86.1%
Don't know/not sure	4.1%	1.7%
Yes	12.2%	12.1%
Self	1.8%	0.6%
Brother or sister	2.8%	2.3%
Son or daughter	4.6%	6.2%
Other	1.8%	2.5%
Prefer not to say	1.1%	0.6%

ASD: autism spectrum disorder.

where you work" as direct service provider (35%), facility director (44%), both facility director and service provider (18%), or office administration (3%). The respondents reported working at childcare facilities (in any capacity) for an average of 14.0 years (*SD* = 10.1 years). Their self-reported ethnicities were White/Caucasian (89.2%), Hispanic/Latino (5.7%), Native American (2.3%), and all other categories (2.9%).

At the end of the questionnaire (after answering the autism questions described below), participants were asked the following: "What is the highest level of education that you have attained?"; "What is your total annual household income?"; "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 autism spectrum disorder?"; and, if they answered "yes" to the preceding question, they were also asked "Who in your family has autism, Asperger's disorder, pervasive developmental disorder, or other autism spectrum disorder? (Please check all that apply)." Table 1 reports the responses to these questions in each sample.

Procedure

Participants completed an anonymous online questionnaire. After consenting to participate and reporting their age, gender, and racial/ethnic background, participants answered the following questions (shown here verbatim): "Where have you gotten most of your information about autism?"; "Please choose which two of the following you believe are the main causes of autism"; "What is the earliest age that you think a person can be diagnosed with autism?"; "If you suspect someone you know has autism, where should they go for help first?"; "What kind of testing do you think is done to diagnose autism?"; "Please select 6 of the following traits that you believe are most diagnostic of autism"; "Do you think there are therapies or treatments for autism?"; and, if they answered "yes" to the preceding question, they were asked "Which of the following are appropriate therapies or treatments for autism? (please pick 3)." Tables 2 to 8 show the response options for each question and list the response options in order from the option that was chosen most often to the option that was chosen least often (but when the questionnaire was administered, the QuestionPro survey software presented the response options in different random orders to different participants).

Results

Because the survey software required respondents to answer each question before proceeding to the next question, there were no missing data. However, two of the questions were presented only to a subset of respondents; specifically, "Which … are appropriate therapies" was only presented to respondents who endorsed "there are therapies or treatments for autism," and "Who in your family has … autism spectrum disorder" was only presented to respondents who indicated that someone in their

Table 2. Percentage of respondents endorsing each information source as their primary source of information about autism.

	Sample		Ethnicity		Family autism		College graduate	
	General	Childcare	White	Other	No	Yes	No	Yes
Media (including print, broadcast, and internet)	**46.1%**	**12.5%**	**43.3%**	**55.7%**	**50.4%**	**17.0%**	48.3%	44.1%
Friend, neighbor, or family member	21.1%	12.5%	22.3%	16.9%	**18.9%**	**36.0%**	23.0%	19.3%
School, work, or professional organization	**15.8%**	**44.3%**	15.8%	15.8%	17.0%	10.0%	**10.1%**	**20.9%**
Personal experience	**8.0%**	**23.9%**	9.2%	3.8%	**5.5%**	**27.0%**	8.0%	8.0%
Unsure or other	6.9%	6.8%	7.2%	6.0%	6.8%	4.0%	8.0%	6.0%
Doctor, hospital, or clinic	2.1%	0.0%	2.2%	1.6%	**1.5%**	**6.0%**	2.6%	1.6%

Boldfaced numbers indicate that the frequencies of endorsement versus non-endorsement of that response option differ between groups (phi coefficients ≥ 0.1). The groups compared were sample (general or childcare), ethnicity (White or non-White), family autism (no or yes), and college graduate (no or yes).

family had an ASD diagnosis. For these two questions, the percentages reported below were calculated based on just the subset of respondents who received the question.

Below we tested whether the likelihood of endorsing each response option differed between groups. Specifically, we conducted four types of group comparisons. First, we compared childcare workers with the general public. Then, within the general public sample, we compared (a) individuals who had completed an undergraduate degree (52.1% of the sample) with those who had not, (b) members of ethnic minority groups (22% of the sample) with White individuals, and (c) individuals who had a household member (which could include the self) with an ASD diagnosis (12% of the sample) with those who did not. (We did not compare these subgroups within the childcare worker sample because of the sample's small size and lack of diversity.) We used φ (phi) coefficients to test whether group membership predicted endorsement versus non-endorsement of each response option, with the criteria of significance being $\varphi \geq 0.1$, which corresponds to group membership explaining at least 1% of the variance in endorsements. (All φ coefficients ≥ 0.1 were also significant at $p < 0.006$ using traditional null hypothesis significance tests.)

Where received information about autism?

Table 2 shows the sources from which respondents reported receiving the most information about autism. Almost no one received most of their information from doctors, clinics, or hospitals. Among the general population, the most common source of information was media (including print, broadcast, and internet); the second most common source was personal contacts, such as friends and family members. Compared to members of the general public, childcare workers were more likely to have learned about autism through their academic, professional, and (to a lesser extent) personal experiences and less likely to have received most of their information from the media. Not surprisingly, people who had completed college were also more likely to have learned about autism in a professional or academic setting. Individuals with ASD or a family member with ASD (compared to those without a family connection to ASD) were more likely to have received information from personal contacts, experience, and medical settings and less likely to have received information from the media. Compared to members of other ethnic groups, Whites were also less likely to have received most of their information from media.

What are the causes of autism?

Table 3 shows what respondents believed were the main causes of autism. Most people believed the main causes of autism were genetic and neurological, with environmental exposures a distant third. Nonetheless, approximately 10% of the general sample and 7% of the childcare worker sample believed that vaccinations were one of the two primary causes of autism. Compared to members of other ethnic groups, Whites were less likely to mention pre-natal nutrition and mental illness. Individuals with ASD or a family member with ASD were more likely to mention environmental exposure.

Earliest age autism can be diagnosed?

Table 4 shows the earliest age at which respondents believed a person can be diagnosed with autism. Approximately 65% of respondents believed that autism could be diagnosed by 24 months, and over 95% of respondents believed that autism could be diagnosed by age 5 years. There were no differences between groups.

Where should someone go for help?

Table 5 shows where respondents suggested someone should go first for help regarding autism. Most people suggested first contacting a doctor; however, psychologists

Table 3. Percentage of respondents endorsing each option as one of the two main causes of autism.

	Sample		Ethnicity		Family autism		College graduate	
	General	Childcare	White	Other	No	Yes	No	Yes
Genetic	73.0%	74.4%	73.6%	71.0%	74.3%	69.0%	71.8%	74.3%
Neurological	66.6%	72.7%	68.1%	61.2%	67.9%	57.0%	68.2%	65.3%
Environmental exposure	14.3%	19.9%	15.3%	10.9%	**13.1%**	**24.0%**	12.9%	15.6%
Mental illness	11.8%	6.8%	**10.0%**	**18.0%**	12.0%	8.0%	12.7%	11.0%
Vaccinations	10.2%	6.8%	10.8%	8.2%	9.0%	17.0%	9.8%	10.6%
Nutrition issues during pregnancy	9.1%	4.5%	**7.5%**	**14.8%**	10.0%	3.0%	9.0%	9.2%
Dietary/nutritional deficiencies	4.9%	8.0%	5.2%	3.8%	4.6%	6.0%	5.4%	4.4%
Family	4.3%	4.0%	4.1%	4.9%	3.5%	9.0%	4.1%	4.4%
Drugs	3.3%	2.8%	3.0%	4.4%	3.2%	4.0%	4.1%	2.5%
Parenting	2.2%	0.0%	2.0%	2.7%	1.9%	3.0%	1.6%	2.8%

Because participants selected two options, the percentages in each column sum to 200%. Boldfaced numbers differ between groups (phi coefficients ≥ 0.1).

Table 4. Percentage of respondents endorsing each age range as the earliest autism can be diagnosed.

	Sample		Ethnicity		Family autism		College graduate	
	General	Childcare	White	Other	No	Yes	No	Yes
Less than 18 months	22.5%	19.3%	22.5%	22.4%	22.2%	23.0%	22.0%	23.0%
18–24 months	41.2%	44.9%	42.3%	37.2%	40.6%	43.0%	40.8%	41.4%
3–5 years of age	31.8%	34.1%	31.4%	33.3%	32.9%	26.0%	32.3%	31.5%
6 years of age or older	4.5%	1.7%	3.8%	7.1%	4.2%	8.0%	4.9%	4.1%

Table 5. Percentage of respondents endorsing each option for where someone should go first for help.

	Sample		Ethnicity		Family autism		College graduate	
	General	Childcare	White	Other	No	Yes	No	Yes
Doctor	64.0%	52.8%	64.5%	62.3%	66.6%	53.0%	64.1%	63.9%
Psychologist	**14.1%**	**2.8%**	14.2%	13.7%	12.8%	20.0%	13.7%	14.5%
Early intervention specialist	**11.1%**	**33.0%**	11.4%	9.8%	10.6%	14.0%	11.4%	10.8%
Internet	3.9%	1.7%	3.9%	3.8%	3.3%	5.0%	4.1%	3.7%
Health department	2.7%	3.4%	**1.7%**	**6.0%**	2.8%	2.0%	3.9%	1.6%
Parent organization	2.1%	0.6%	1.9%	2.7%	1.7%	4.0%	1.6%	2.5%
School district	**1.5%**	**5.7%**	1.7%	0.5%	1.3%	2.0%	0.5%	2.3%
Hotline/phonebook	0.7%	0.0%	0.6%	1.1%	0.9%	0.0%	0.8%	0.7%

Boldfaced numbers differ between groups (phi coefficients ≥ 0.1).

and early intervention specialists were also mentioned. Compared to members of the general public, childcare workers were more likely to suggest contacting a school district or early intervention specialist and less likely to suggest contacting a psychologist. Compared to members of other ethnic groups, Whites were less likely to suggest contacting the health department.

What testing is done to diagnose autism?

Table 6 shows what kind of testing respondents believed was used to diagnose autism. Approximately half of the sample chose "Psychological, Educational, or Developmental testing"; the other commonly mentioned categories were behavioral testing and observation. There were no differences between groups.

What traits are diagnostic of autism?

Respondents were asked which 6 (from a list of 12) traits they believed were most diagnostic of autism. In actuality, six traits were diagnostic indicators of autism (while the others were more indicative of attention deficit/hyperactivity, oppositional-defiant, or schizophrenic disorders).

Table 6. Percentage of respondents endorsing each option for kind of testing used to diagnose autism.

	Sample		Ethnicity		Family autism		College graduate	
	General	Childcare	White	Other	No	Yes	No	Yes
Psychological, educational, or developmental testing	53.2%	49.4%	53.9%	50.8%	53.4%	57.0%	52.5%	53.8%
Behavioral testing	22.0%	18.2%	21.9%	22.4%	22.6%	19.0%	22.7%	21.4%
Observation	11.3%	19.3%	11.9%	9.3%	11.0%	12.0%	11.1%	11.5%
Medical/physical examination	3.8%	5.1%	3.3%	5.5%	3.5%	2.0%	3.9%	3.7%
Speech and language evaluation	4.6%	1.7%	4.2%	6.0%	4.2%	7.0%	4.7%	4.6%
Blood work, chemical testing, or genetic testing	4.9%	2.8%	4.5%	6.0%	5.1%	2.0%	4.9%	4.8%
Other	0.2%	3.4%	0.3%	0.0%	0.1%	1.0%	0.3%	0.2%

Table 7. Percentage of respondents endorsing each trait as diagnostic of autism.

	Sample		Ethnicity		Family autism		College graduate	
	General	Childcare	White	Other	No	Yes	No	Yes
Diagnostic traits								
Poor non-verbal communication (limited eye contact or gestures)	91.6%	97.2%	92.7%	88.0%	92.0%	92.0%	90.2%	93.1%
Poor back-and-forth communication skills	87.0%	81.3%	88.4%	82.0%	87.4%	88.0%	86.8%	87.4%
Strong resistance to changes in routines	**86.4%**	**94.9%**	**88.3%**	**79.8%**	86.5%	88.0%	83.5%	89.2%
Repeating same behavior over and over (e.g. hand flapping)	86.0%	90.9%	85.6%	87.4%	85.9%	90.0%	88.1%	84.4%
Intense, restricted interests	75.2%	75.0%	76.6%	70.5%	74.7%	78.0%	**70.0%**	**80.0%**
Inability to make or sustain friendships	54.6%	61.9%	55.3%	51.9%	54.0%	62.0%	**48.1%**	**60.5%**
Non-diagnostic traits								
Fidgets and squirms constantly	51.5%	47.2%	51.4%	51.9%	**53.7%**	**39.0%**	**57.4%**	**46.4%**
Illogical thinking	21.1%	14.8%	**18.4%**	**30.6%**	22.1%	12.0%	22.7%	19.8%
Cannot control unwanted thoughts	19.3%	17.6%	18.0%	24.0%	19.3%	17.0%	19.9%	18.9%
Consistently violent behavior	11.7%	9.1%	10.9%	14.2%	10.9%	11.0%	14.0%	9.7%
Seeing or hearing things that do not exist	6.9%	4.0%	6.4%	8.7%	5.8%	11.0%	8.3%	5.7%
Performs actions to deliberately annoy others	6.8%	6.3%	5.6%	10.9%	6.0%	9.0%	**9.6%**	**4.4%**

Because participants selected six options, the sum of each column is 600%. Boldfaced numbers differ between groups (phi coefficients ≥ 0.1).

Table 7 shows that respondents correctly endorsed the diagnostic traits more often than the non-diagnostic traits. The most commonly endorsed traits were poor non-verbal and reciprocal communication skills, strong resistance to changes in routines, and repetitive behaviors. The least commonly endorsed diagnostic trait was the inability to make or sustain friendships. The most commonly endorsed *non*-diagnostic trait was “fidgets and squirms constantly” (a feature more indicative of attention-deficit hyperactivity disorder (ADHD)), which was endorsed by almost half of respondents; the least commonly endorsed traits were “seeing or hearing things that don’t exist” and “performs actions to deliberately annoy others,” which were each endorsed by less than 7% of respondents. Compared to the general public, childcare workers were generally more likely to endorse the diagnostic traits, especially “strong resistance to changes in routines.” College graduates were also more likely to correctly endorse diagnostic traits (especially “intense, restricted interests” and “inability to make or sustain friendships”) and less likely to endorse non-diagnostic traits (especially “performs actions to deliberately annoy others” and “fidgets and squirms constantly”). Compared to members of other ethnic groups, Whites were more likely to endorse resistance to changes in routines and less likely to endorse illogical thinking. Individuals who had an ASD or a family member with ASD were less likely to mention “fidgets and squirms constantly.”

What are appropriate treatments for autism?

When asked whether “there are therapies or treatments for autism,” 90.5% of the general public and 95.5% of childcare workers answered “yes.” Those who answered “yes”

Table 8. Percentage of respondents endorsing each option as an appropriate therapy or treatment for autism.

	Sample		Ethnicity		Family autism		College graduate	
	General	Childcare	White	Other	No	Yes	No	Yes
Behavior therapies	71.0%	72.7%	71.6%	67.5%	70.8%	71.9%	**64.5%**	**76.3%**
Training or educating parents	**57.6%**	**68.4%**	59.1%	51.5%	57.8%	55.2%	54.1%	60.5%
Counseling, psychological, or group therapies	**43.1%**	**27.3%**	41.6%	47.9%	44.4%	33.3%	43.3%	42.8%
Educational therapies	32.7%	35.2%	33.2%	30.7%	32.5%	34.4%	33.1%	32.3%
Play therapy	**25.3%**	**50.9%**	26.3%	21.5%	25.8%	21.9%	25.3%	25.3%
Speech therapy	24.4%	26.7%	22.0%	32.5%	**22.0%**	**38.5%**	27.3%	21.8%
Special schools	**21.0%**	**4.3%**	21.3%	19.6%	21.3%	17.7%	25.6%	17.0%
Drugs/medication	**19.8%**	**8.5%**	18.4%	24.5%	19.7%	19.8%	20.9%	18.8%
Physical exercise	5.1%	6.1%	5.3%	4.3%	4.7%	6.3%	4.9%	5.3%

Because respondents chose three options, the sum of column is 300%. Boldfaced numbers differ between groups (phi coefficients ≥ 0.1).

then indicated three appropriate therapies or treatments for autism; Table 8 shows the results. The most commonly endorsed interventions were behavior therapies and training/educating parents. Compared to the general public, childcare workers were more likely to endorse play therapy and parent training and less likely to endorse medication, special schools, and counseling/psychological therapies. College graduates were more likely to endorse behavior therapies. Individuals with ASD or a family member with ASD were more likely to endorse speech therapy.

Discussion

General findings

The most important source of ASD information—at least for people without some personal connection to ASD—was mass media; Holt and Christensen (2013) reported similar findings. Another important source of information was personal contacts (e.g. friends and family). Few people received information from doctors, clinics, or hospitals unless they or a family member had an ASD. Thus, although direct contacts with clinics, hospitals, and medical professionals are important sources of information for individuals who are specifically seeking help with ASD, such contacts are probably not effective means through which to increase awareness and understanding of ASD among the general public. Instead, the most effective approach may be to improve the quality and clarity of information about autism conveyed through broadcast media and websites; such information may then further spread through networks of personal contacts (Green et al., 2009; Southwell and Torres, 2006).

Despite the limited—and potentially biased—sources of information to which the general public is exposed, most respondents demonstrated a reasonably accurate understanding of ASDs. Almost all respondents correctly believed that individuals can be diagnosed with autism in early childhood, and that the primary methods of testing were observation and psychological, developmental, and behavioral tests. Respondents tended to correctly distinguish diagnostic traits from non-diagnostic traits and were especially likely to identify poor non-verbal and reciprocal communication skills, strong resistance to changes in routines, and repetitive behaviors as diagnostic; however, many respondents also incorrectly considered "fidgets and squirms" diagnostic of ASD. Most respondents correctly focused on genetic and neurological causes of autism; however, approximately 5% mentioned one's current diet and 10% mentioned vaccinations as one of the two primary causes of autism. Finally, a large majority of our respondents believed that there are therapies or treatments available for autism; Holt and Christensen (2013) also found this to be true in their sample. The two most commonly endorsed interventions were "behavior therapies" and "training or educating parents."

Ethnicity

Compared to White respondents, members of other ethnic groups were more likely to have received their knowledge of autism from media sources, suggest seeking help from the health department, mention mental illness or pre-natal nutrition as causes, and endorse illogical thinking and not endorse resistance to change as diagnostic features. Holt and Christensen (2013) likewise found that individuals identifying as Hispanic or Latino were more likely to have learned about autism from media sources; thus, media sources may be a particularly effective way to educate certain minority groups about autism. The tendency for non-White respondents to associate autism with mental illness and illogical thinking suggests that one focus of such educational efforts should be differentiating autism from other psychiatric problems. A limitation of these results is that different ethnic minority groups may differ in important ways; however, our sample was too small to conduct those more fine-grained comparisons.

Education

College graduates were more likely to have learned about autism in a professional or academic setting, correctly distinguish between diagnostic and non-diagnostic traits, and endorse behavior therapies as preferred interventions. Holt and Christensen (2013) likewise found college graduates to be more likely to have learned about autism at school or work (rather than from radio or TV) and to endorse behavioral therapies. The fact that college graduates were more successful at identifying traits diagnostic of autism may suggest that information conveyed in professional or academic settings is typically more accurate than that conveyed through the channels—namely, media and personal contacts—on which less educated individuals are relatively more reliant.

Personal connections with ASD

Autism directly affects many families. Approximately 12% of our respondents indicated that either they or a household member (most commonly a son or sibling) had ASD. Compared to other respondents, respondents with this type of personal connection with ASD were more likely to have received information about autism from personal contacts, personal experience, and medical settings (rather than from the media), more likely to endorse speech therapy as an appropriate intervention, and less likely to consider constant fidgeting diagnostic of autism. These results make sense: individuals affected by ASD are more likely to have discussed autism with people they know and with professionals (including speech-language specialists) and are also more likely to know individuals with ASD who are not distinctively fidgety. Interestingly, respondents with ASD or a family member with ASD were also more likely to consider environmental exposures as possible causes.

Childcare workers

Compared to members of the general public, childcare workers were more apt to have received most of their knowledge of autism from academic, professional, and personal experiences (rather than from the media); suggest people seeking help first contact the school district or early intervention specialist (rather than a psychologist); endorse diagnostic (rather than non-diagnostic) traits, especially "strong resistance to changes in routines"; and endorse as interventions play therapy and parent training (rather than medication, special schools, or counseling/psychological therapies). Most of these differences—such as learning about autism through work, being aware of early intervention specialists, recognizing resistance to change as a symptom, and emphasizing play therapy and parent training—are understandable outcomes of working with very young children and in a childcare setting. However, follow-up research—perhaps using interviews—may help us to better understand why childcare workers were less apt to recommend psychological and medical interventions.

Limitations

We obtained our general public sample through MTurk, an online crowdsourcing site that has been shown to generally yield diverse and representative samples (Buhrmester et al., 2011). For example, an investigation by US political scientists Berinsky et al. (2012) concluded that "the demographic characteristics of domestic MTurk users are more representative and diverse than the corresponding student and convenience samples typically used in experimental political science studies" (p. 352). Although their conclusion applies to the current sample as well, we should caution that compared to 2012 US population census data, our sample contained a larger percentage of college graduates and a smaller percentage of African Americans and Latinos, which is one reason we reported the findings separately for Whites and non-Whites and for individuals who had versus had not graduated from college. On the other hand, because our analyses showed that most beliefs about autism were not influenced by ethnicity or education, there is generally no reason to believe our sample produced biased estimates of lay beliefs about autism.

We likewise cannot guarantee the representativeness of our sample of childcare providers. Although our invitation to participate was sent to all 1254 licensed childcare programs in Idaho, we have no way to verify that our 176 respondents were representative of all providers at those facilities. Also, Idaho home childcare providers who serve six or fewer children are not required to be licensed, and unlicensed providers did not receive our invitation. Finally, even a representative sample of childcare providers in Idaho—whose residents tend to be less wealthy, diverse, and urban than residents of other states—may not be representative of childcare providers in other locations. Therefore, it will be interesting to compare how the results of future research on other samples of childcare providers converge with or diverge from the results obtained from the current sample.

For pragmatic reasons, our survey employed closed-ended questions with limited response options. Consequently, sometimes we cannot be certain what respondents meant by a particular response. For example, individuals with a personal connection with ASD were apt to suggest environmental exposure as a potential cause, but it is unclear what types of exposures (e.g. pre-natal exposure to toxins, post-natal exposure to pathogens) they had in mind. Thus, while the current research provides a rough sketch of what people believe about ASD, future research that elicits more in-depth or personalized responses is needed to fill in the details.

Conclusion

This study provides a snapshot of the general public's knowledge of ASD in 2013. On the one hand, most of the findings were encouraging. Almost all respondents correctly believed that ASD can be diagnosed using observations and tests in early childhood and that there were interventions that could help; most respondents emphasized genetic and neurological (rather than parenting, drugs, and dietary) causes of ASD; and most of the time they correctly distinguished diagnostic traits from non-diagnostic traits. On the other hand, there were areas of confusion. Approximately half of respondents incorrectly considered "fidgets and squirms" diagnostic and "inability to make or sustain friendships" not diagnostic of ASD. Moreover, despite a growing literature finding no linkage between vaccines and neurodevelopmental disorders, approximately 10% of the public—regardless of their level of education—believed vaccines to be among the top two causes of autism (a belief which, by reducing vaccination rates, clearly poses a threat to public health). Given that mass media is the single most important source of ASD information for the general public, media outlets should continue to be encouraged to communicate current and accurate data on the risks and benefits of vaccination.

This study also provides a snapshot of beliefs about autism among one state's childcare providers. The results indicate that childcare providers' knowledge of autism is generally no better or worse than that of the general public. Thus, their knowledge was generally accurate, but there were areas for improvement. For example, 7% of childcare providers believed vaccinations were one of the two main causes of autism, and 25% did not consider restricted interests to be diagnostic of ASD. As noted earlier, childcare providers are often uniquely well-positioned to compare the behavior and development of a child with that of their peers, help parents to access resources for assessment and early intervention, and thereby improve the life trajectory for children with ASD. On the one hand, childcare providers—like other members of the public—are neither expected nor licensed to make diagnoses; therefore, it is more crucial that childcare providers recognize when a child's symptoms warrant assessment by a trained professional than that they accurately match the symptoms to specific diagnostic categories themselves. On the other hand, when childcare providers even informally mention that a specific developmental problem might explain a child's behavior, anxious parents—eager for guidance and direction—may prematurely cling to that label and resist alternative suggestions, potentially delaying how long it takes the child to receive the most accurate diagnosis and most effective interventions. Therefore, childcare providers should strive to have a better understanding of ASD than does the general public, and the dissemination of current and accurate information about ASD should be a core component of professional development opportunities for childcare providers.

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