

Knowledge and beliefs about autism spectrum disorders among physicians: a cross-sectional survey from China

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ABSTRACT

Background The incidence of autism spectrum disorders (ASDs) is increasing greatly, with high demands for earlier diagnosis and intervention. However, little is known about ASD knowledge and beliefs among physicians in China.

Methods A questionnaire survey was used to assess the knowledge and beliefs about the diagnosis and management of ASD and 24 beliefs regarding the treatment and prognostic aspects of ASD among physicians of any medical specialty in China.

Results A total of 1160 physicians were recruited and surveyed, with an average score of 8.48 ± 2.66 (total of 18 points) for the questionnaire on the main symptoms of ASD and 14.35 ± 3.69 (total of 24 points) for beliefs about ASD. Physicians' age, sex, specialty and practice years were related to their knowledge of identifying patients with ASD. Physicians specialising in paediatrics/psychology/psychiatry scored higher than those specialising in other specialties both in response to diagnostic questions (8.98 ± 2.63 vs 8.30 ± 2.65 , $p < 0.001$) and beliefs about ASD (15.57 ± 3.44 vs 13.97 ± 3.97 , $p < 0.001$).

Conclusions Knowledge and beliefs about ASD symptoms, diagnosis and treatment are insufficient among physicians in China. Education and training programmes on this topic should be enhanced in physicians of all specialties, especially for male physicians who have short years in practice.

INTRODUCTION

With a high worldwide prevalence, autism spectrum disorder (ASD) has now been considered an emerging public health issue.^{1 2} Studies have shown a rising trend of ASD prevalence in the past two decades, estimated to be 1%–2% worldwide.^{3–7} The prevalence of ASD is 2.5 per 100 in the USA⁸ and 0.94 per 100 in Korea.⁹ The prevalence of ASD in China was estimated to be 0.70% (95% CI: 0.64% to 0.74%) resulting from a multicentre population-based survey,¹⁰ with more than 10 000 000 patients with ASD. Among them, more than 2 000 000 were aged less than 12 years.

Early diagnosis and intervention are beneficial for better outcomes in children with ASD. Studies have revealed that early

WHAT IS ALREADY KNOWN ON THIS TOPIC

- ⇒ Autism spectrum disorder (ASD) has now been considered to be a public health issue worldwide.
- ⇒ There are high demands for earlier diagnosis and intervention in China.

WHAT THIS STUDY ADDS

- ⇒ The knowledge and beliefs about ASD symptoms, diagnosis and treatment were insufficient among physicians in China.
- ⇒ Paediatricians/psychologists/psychiatrists knew more information on ASD than those specialising in other specialties.
- ⇒ Male physicians with a short practice period had fewer medical knowledge of ASD.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

- ⇒ Training programmes of continuing medical education on ASD knowledge should be carried out in all specialties of physicians in China.

intervention using the Early Start Denver Model Programme among children as young as 18 months can improve learning and language abilities and adaptive behaviour and reduce symptoms of autism.^{4 11–16} Early diagnosis enables early intervention, which will have positive effects on functional outcome, life expectancy and quality of life for individuals with ASD.¹⁷ However, the knowledge of healthcare workers would affect the diagnosis and management of children with ASD.¹⁸

In many countries, paediatricians as well as child and adolescent psychiatrists and psychologists are the first contact professionals of children presenting with ASD symptoms. China still has a shortage of paediatricians, psychiatrists and psychologists, particularly child psychiatrists and psychologists.¹⁹ Only tertiary paediatric hospitals or tertiary general hospitals in metropolitan cities have paediatric psychiatrists and psychologists. Therefore, identifying children with ASD may be performed by physicians in multiple disciplines, including



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general physicians, paediatricians, neurologists, rehabilitation professionals, psychologists and psychiatrists. Studies showed that the age of the first visit for ASD diagnosis in China is commonly between 3 and 6 years, which is much later than the 1.5–2 years suggested by the American Psychological Association.^{20 21} In China, few primary healthcare institutions are implementing early ASD screening programmes in children aged 18–24 months.²⁰

Early diagnosis is attributed to physicians' correct understanding of the symptoms' profile and the developmental trajectory of ASD. Healthcare professionals who assess child development should have a sound understanding of autism.²² It is also important for all clinicians involved in patient care to recognise red flags of ASD so that early referral and intervention can be made.²³

To date, few studies have been carried out to assess knowledge and beliefs about ASD among physicians in China. A large knowledge gap in China should be addressed. Herein, we carried out this survey to investigate the knowledge and beliefs of physicians about ASD in China.

METHODS

Between January 2016 and June 2019, we conducted a survey using a self-administered questionnaire to assess knowledge and beliefs about ASD among physicians from China.

We recruited participants from the Academic Annual Conferences in all special medical fields from 2016 to 2019 in China. Survey recruitment invitations were sent to the physicians at that time of meeting with a description of survey purpose; voluntary and anonymous participation and a hyperlink to the online survey were also included. Participants were regarded to consent to the study once the questionnaire was completed. The contents of the questionnaire were quoted and adapted from the research questionnaires developed by Daley and Sigman,²⁴ Imran *et al.*²⁵ and Bakare *et al.*²⁶ which were shown to have good internal consistency and repeated measures consistency (For details see Appendix 1). The independent translators translated it to Chinese, and blindly translated it to English backward to assure the meaning of the items in the questionnaire is consistent with the original instrument. Any content equivalence of the questionnaire would be discussed and resolved by the team consisting of the authors and translators. We added several items with respect to Chinese culture. For the treatment domain, we added items of 'traditional Chinese medicine can treat ASD', 'acupuncture can treat ASD', 'there is no training centre for ASD' and 'physicians' knowledge of ASD is insufficient in China'. Pilot studies were carried out in 20 physicians, and possible confusing survey questions were revised in order to suit Chinese custom and avoid ambiguous

interpretation. The Chinese-language questionnaire is available from the authors upon request.

The survey comprised two sections: (1) demographics of the respondents (age, gender, working years, academic degree, specialty, hospital level); (2) respondents' knowledge of diagnosis and management of ASD including main symptoms; clinical characteristics; treatment options for improving core symptoms of ASD; 24 beliefs regarding social, emotional, cognitive, treatment and prognostic aspects of ASD; ASD training requirement; and knowledge about referral of patients with ASD and local ASD training institutions. Respondents were asked to assess the characteristics as 'necessary', 'helpful but not necessary', 'not helpful' and 'uncertain' for the diagnosis of ASD. We scored the answers as follows: for example, if the description of item was necessary to diagnose ASD, a score of 2 points would be given for the answer 'necessary', 1 point for the answer 'useful', 0 for the other answers. Respondents were instructed to rate each statement of 24 beliefs about ASD either as 'agree', 'disagree' or 'not sure'. For each question, the correct answer was scored as '1' and incorrect response counted as 'null'.

Statistical analysis

SPSS V.16.0 software was used for analysis. One-way analysis of variance and independent samples t-tests were used to compare the difference in knowledge and beliefs about the diagnosis and management of ASD among different groups based on demographics. Univariate regression was performed to evaluate the strengths of the association between outcome variables with several explanatory variables (age, sex, academic degree, specialty, institution level, practice years). A multivariate linear regression analysis was conducted to investigate the independent effects of the relevant factors on the knowledge of ASD diagnosis. A p value less than 0.05 was considered statistically significant.

Community involvement

There was no explicit community involvement in this study.

RESULTS

A total of 2100 questionnaires were distributed to the physicians by a web link using mobile phones. A total of 1497 physicians completed the questionnaires, accounting for a response rate of 71.3%. A total of 337 questionnaires were excluded from the analysis due to omissions of items or percentage of choosing the same option for questions >80%. Finally, 1160 questionnaires were included in the analysis. Among the 1160 respondents, 547 were women and 613 were men. A total of 84.7% of the participants were aged less than 40 years (median age: 33.1 (IQR 28.8–38.1)), and 53.3% had a master's degree or higher. There were 292 paediatricians/psychiatrists/psychologists, and 868 were from other specialties, which meant subclinical specialties except 'paediatrics/'

Table 1 Demographics of the respondents and the scores of knowledge and beliefs about ASD among respondents

Variables	n	%	Scoring of correct answers in response to diagnostic questions (mean±SD)	Statistical value	Scoring of correct answers in response to beliefs (mean±SD)	Statistical value
Age (years)						
20–25	97	8.4	7.90±3.16	F=3.420* P=0.005†	14.25±3.88	F=1.245* P=0.286
26–30	342	29.5	8.30±2.59		14.41±3.63	
31–35	341	29.4	8.4±2.68		14.26±4.00	
36–40	213	18.4	8.63±2.59		14.71±3.38	
41–45	138	11.9	9.18±2.37		14.23±3.51	
>46	29	2.5	8.69±2.59		13.03±2.84	
Gender						
Female	547	47.2	8.75±2.67	t=-3.361‡ P=0.001	14.82±3.39	t=-4.109‡ P<0.001
Male	613	52.8	8.23±2.61		13.94±3.90	
Academic degree						
Junior college	58	5.0	8.67±2.03	F=0.810* P=0.488	14.34±3.60	F=0.910* P=0.435
Undergraduate	484	41.7	8.56±2.69		14.26±3.38	
Master	506	43.6	8.44±2.62		14.31±3.84	
Doctor	112	9.7	8.16±2.95		14.89±4.29	
Specialty						
Paediatrics/psychology/psychiatry	292	25.2	8.98±2.63	t=3.797‡ P<0.001	15.57±3.44	t=6.078‡ P<0.001
Other specialties	868	74.8	8.30±2.65		13.97±3.97	
Institution level						
Tertiary hospital	740	63.8	8.45±2.79	F=1.078* P=0.361	14.53±3.70	F=3.171* P=0.024§
Secondary hospital	315	27.2	8.54±2.49		14.22±3.67	
Primary hospital	42	3.6	8.93±2.11		12.93±3.94	
No level	63	5.4	8.19±2.18		13.86±3.22	
Practice years						
0–1	107	9.2	7.99±2.98	F=3.353* P=0.005¶	14.82±3.71	F=1.014* P=0.408
1–3	179	15.4	8.16±2.64		14.31±3.67	
3–5	178	15.3	8.48±2.94		14.14±3.92	
5–10	256	22.1	8.42±2.68		14.25±3.97	
10–15	213	18.4	8.44±2.59		14.68±3.54	
>15	227	19.6	9.04±2.44		14.13±3.30	
Total	1160	100	8.48±2.66	—	14.35±3.69	—

The term ‘other specialties’ means subclinical specialties except ‘paediatrics/psychology/psychiatry’, such as surgery, internal medicine, gynaecology and obstetrics, etc.

*One-way analysis of variance.

†Bonferroni multiple comparison among groups: age group 1 (20–25 years) versus age group 5 (41–45 years), $p=0.004$; age group 2 (26–30 years) versus age group 5 (41–45 years), $p=0.015$.

‡Independent samples t-test.

§Bonferroni multiple comparison among groups: age group 2 (1–3 years) versus group 4 (5–10 years), $p=0.024$.

¶Bonferroni multiple comparison among groups: group 1 (0–1 year) versus group 6 (>15 years), $p=0.011$; group 2 (1–3 years) versus group 5 (>15 years), $p=0.013$.

ASD, autism spectrum disorder.

psychology/psychiatry’, such as surgery, internal medicine, gynaecology and obstetrics, etc (table 1). A total of 740 physicians were from tertiary hospitals. Approximately 40% of the respondents had been practising for less than 5 years.

The average score of all the participants was 8.48±2.66 (total of 18 points) for the questionnaire on the main symptoms of ASD and 14.35±3.69 (total of 24 points) for some beliefs about ASD. Only 20.1% of the participants knew the main symptoms of ASD. Participants with

longer practice duration and who specialised in paediatrics/psychology were more likely to know the diagnostic symptoms of ASD and have correct beliefs about ASD (table 1).

For the ASD belief part, 67.3% of the participants considered that ASD was not a lifelong disorder. A total of 49.2% considered that measles, mumps, rubella vaccination increased the risk of ASD, and 57.4% considered that heavy metal poisoning was a major cause of autism. With respect to ASD treatment, 24.9% did not know children with ASD required intervention; 10.6% considered that ASD could be treated with antipsychotics, 12.9% considered that ASD could be treated with antidepressive drugs and 11.03% considered that ASD could be treated with traditional Chinese medicine or acupuncture. It should be noted that 6.2% of the participants considered monotherapy with vitamins and micronutrients to cure core symptoms of ASD, and 66.5% considered vitamins and micronutrients to improve core symptoms of ASD.

Regarding knowledge about the referral of patients with ASD, 85.3% of the participants knew which institution or department should be referred to for diagnosis. A total of 75.5% did not know the local intervention institutions for ASD training. A significant difference was found between the paediatricians/psychologists/psychiatrists and those with other specialties in most of the beliefs (table 2). A total of 95.3% of the participants thought knowledge and training regarding ASD were lacking among professionals in China.

Physicians' age, sex, specialty and practice years were related to their knowledge of identifying patients with ASD. Physicians with an age ranging from 20 to 30 years, who were male, who had other specialties or short practice years had less knowledge of the core symptoms of ASD (table 1). Female physicians scored higher than their male counterpart both in response to diagnostic questions (8.75 ± 2.67 vs 8.23 ± 2.61 , $p<0.001$) and beliefs about ASD (14.82 ± 3.39 vs 13.94 ± 3.90 , $p<0.001$). Physicians specialising in paediatrics/psychology/psychiatry scored higher than those specialising in other specialties both in response to diagnostic questions (8.98 ± 2.63 vs 8.30 ± 2.65 , $p<0.001$) and beliefs about ASD (15.57 ± 3.44 vs 13.97 ± 3.97 , $p<0.001$) (table 1). Moreover, as for the association between the correct responses to diagnostic questions and related variables evaluated in the present study, multivariate linear regression analysis showed independent correlations of variables of female gender and paediatrics, psychiatry and psychology specialties with more abilities to identify patients with ASD ($\beta=0.486$, $p=0.002$; $\beta=0.537$, $p=0.003$, respectively; table 3).

DISCUSSION

This study revealed that knowledge and beliefs about ASD symptoms, diagnosis and treatment are insufficient among physicians in China. A considerable number of physicians in China had incorrect beliefs about ASD diagnosis and management. Most physicians knew little about

local ASD intervention centres and could not provide optimal recommendations about referrals and interventions for patients with ASD. The results are similar to the findings from other developing countries.^{25 27} Çitil *et al* suggested that insufficient knowledge and beliefs about ASD among paediatricians could result in diagnostic and interventional delays in Turkey.²⁸ Mukhamedshina *et al* found that primary care paediatricians had difficulties in early identification of ASD and had limited ability to provide ASD knowledge in general in Russia.¹⁷

Our study revealed that a very low percentage of participants correctly knew the main symptoms of ASD. Another study in China in child healthcare also revealed that few participants knew that the main symptoms of ASD include language disorder (38.4%) and social dysfunction (29.6%).²⁹ In a survey from Iran, Effatpanah *et al* revealed that healthcare workers and paediatricians had misconceptions about ASD regarding developmental, cognitive and emotional features.³⁰

Our survey revealed that most participating physicians had incorrect beliefs about ASD management. Nearly 80% of the participants did not know that ASD needs early intervention. Approximately 70% of the participants incorrectly believed that vitamins or micronutrients could cure or improve ASD core symptoms. The results were similar to Ma *et al's* finding that many child healthcare providers in China had incorrect beliefs about ASD. Ma *et al* found that 80% of the participants considered that there are effective drugs to treat ASD, and 94% considered that ASD is curable.²⁹ The results revealed that medical professionals in China not only lacked sufficient knowledge about ASD but also lacked general training regarding ASD diagnosis and treatment. Fortunately, almost all participants thought that professionals in China lacked special knowledge and training regarding ASD. China has a high variability in healthcare access among different areas. General practitioners in local community hospitals are the main population who may first contact a large portion of children with ASD. Training and education among general practitioners in local hospitals will increase the overall identification rate and improve treatment for patients with ASD. Ahlers *et al* found that the involvement of available clinicians with additional training in autism screening resulted in improvements in time to diagnosis and reduced charges for families.³¹

Our study revealed that physicians' sex, specialty and hospital level might be associated with their beliefs about ASD management. Female physicians and physicians specialising in paediatrics and psychology were more likely to have correct beliefs about the management of ASD. Age and institution level were not related to the knowledge about ASD. The years in practice influence the capability of identifying ASD symptoms. Female physicians had more knowledge of ASD diagnosis and were more likely to have correct beliefs about ASD management. The reason may be that women have taken more responsibilities in parenting,³² so female physicians may

Table 2 Detailed percentage of correct answers in response to questions on beliefs about ASD

Statements	Paediatricians/psychologists/ psychiatrists (n=292)	Other specialties (n=868)	X ² value	P value
Social difficulty is one of the core symptoms of ASD. (correct statement)	257 (88.0%)	698 (80.4%)	8.672	0.003
ASD is a lifelong disorder. (correct statement)	132 (45.2%)	248 (28.6%)	27.446	<0.001
ASD cannot be identified before 3 years old. (false statement)	238 (81.5%)	642 (74.0%)	6.790	0.009
The incidence of ASD in China is greatly lower than that in developed countries. (false statement)	160 (54.8%)	471 (54.3%)	0.025	0.875
It is difficult to differ ASD from developmental delay. (false statement)	186 (63.7%)	432 (49.8%)	17.030	<0.001
With the proper treatment, most children with autism eventually 'outgrow' autism. (false statement)	189 (64.7%)	454 (52.3%)	13.647	<0.001
Measles, mumps, rubella vaccination increases the risk of ASD. (false statement)	141 (48.3%)	448 (51.6%)	0.967	0.326
Heavy metal poisoning is a major cause of autism. (false statement)	150 (51.4%)	344 (39.6%)	12.314	<0.001
Withdrawal of children with autism is mostly due to cold, rejecting parents. (false statement)	225 (77.1%)	725 (83.5%)	6.170	0.013
ASD occurs more commonly among those with higher socioeconomic and educational levels. (false statement)	200 (68.5%)	594 (68.4%)	0.000	0.985
Dietary intervention is one of the most effective treatment options. (false statement)	120 (41.1%)	438 (50.5%)	7.676	0.006
ASD is commonly misdiagnosed in primary hospitals. (correct statement)	260 (89.0%)	780 (89.9%)	0.159	0.690
Supplementation of vitamins and micronutrients can cure ASD. (false statement)	170 (58.2%)	601 (69.2%)	11.906	0.001
Medicine is the main treatment option for ASD. (false statement)	254 (87.0%)	690 (79.5%)	8.096	0.004
For diagnosed ASD, social skill training is effective. (correct statement)	251 (86.0%)	666 (76.7%)	11.243	0.001
For diagnosed ASD, vitamins and micronutrients are effective. (false statement)	270 (92.5%)	818 (94.2%)	1.181	0.277
For diagnosed ASD, traditional Chinese medicine is effective. (false statement)	280 (95.5%)	816 (94.0%)	0.978	0.323
For diagnosed ASD, acupuncture is effective. (false statement)	276 (94.5%)	821 (94.6%)	0.002	0.966
Individuals with ASD cannot pass the entrance examination to a university. (false statement)	220 (75.3%)	694 (80.0%)	2.781	0.095
When a child is with ASD in childhood, he/she will suffer from schizophrenia when he/she grows up. (false statement)	128 (43.8%)	322 (37.1%)	4.179	0.041
Training programmes for the parents having children with ASD are crucial for better prognosis of ASD. (correct statement)	288 (98.6%)	830 (95.6%)	5.665	0.017
There are few training institutions in China. (false statement)	188 (64.4%)	428 (49.3%)	19.938	<0.001
There is one training institution you know in your local district. (correct statement)	120 (41.1%)	164 (18.9%)	57.253	<0.001
There is a lack of knowledge training regarding ASD among professionals in China. (correct statement)	286 (97.9%)	820 (94.5%)	5.945	0.015

The bold numbers means statistically significance.
ASD, autism spectrum disorder.

**Table 3** Correlation between scores in response to diagnostic questions and age, gender, academic degree, practice years and specialties (multivariate linear regression analysis)

Variables	β	95% CI	P value
Age (years)	0.114	-0.123 to 0.351	0.346
Gender (ref: male)	0.486	0.173 to 0.799	0.002
Academic degree	-0.171	-0.408 to 0.066	0.158
Institution level	0.052	-0.158 to 0.261	0.629
Practice years	0.094	-0.092 to 0.279	0.323
Paediatrics, psychiatry or psychology specialties (ref: other specialties)	0.537	0.894 to 0.180	0.003

have more knowledge of milestones or red flags of development in children.

Therefore, training and education should be targeted at physicians of all specialties, especially male physicians who have short years in practice. Physicians in all specialties who assess child development around China will be the crucial population for formal and direct training on ASD.

However, this study had some limitations. First, our cross-sectional study could not determine whether improving professionals' knowledge and beliefs about ASD could improve the diagnosis outcomes, which can be investigated in a longitudinal cohort later. Second, the present survey recruited voluntary participants, which was likely to produce a bias of sampling. This might make generalisation of the results difficult due to the voluntary nature. Third, our sample size was also limited, which might result in bias and could not power the conclusion. Moreover, the results of the study might not be representative of others' views. However, the results from this study can provide important data on knowledge and beliefs about ASD among physicians in mainland China.

CONCLUSION

The present study indicated that knowledge and beliefs about ASD symptoms, diagnosis and treatment are insufficient among physicians in China. Physicians from all specialties should be targeted for education and training programmes on this topic, especially for male physicians who have short years in practice.

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designed this study and modified the article. All authors have read the manuscript and have agreed to submit it in its current form for consideration for publication in the journal.

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Patient consent for publication Not required.

Ethics approval This study involves human participants and was approved by the Ethical Committee of Affiliated Hangzhou First People's Hospital, Zhejiang University School of Medicine (ZN-2015-055). Participants gave informed consent to participate in the study before taking part.

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