

## Research Article

# An Assessment of Pediatric Nurses Awareness and Perceived Knowledge of Autism Spectrum Disorders: A Gulf State Survey

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**Background.** The purpose of this study was to determine pediatric nurses' knowledge of autism spectrum disorders (ASD). **Methods.** We conducted a population-based online survey of 273 pediatric nurses in eastern Saudi Arabia using convenience sampling method. Perceived knowledge was assessed using the knowledge of childhood autism among Health Professionals Questionnaire (KCAHW) that was translated into Arabic. We used multivariate regression analysis to determine the influence of demographic factors on the perceived knowledge. Using Pearson's correlation analysis, we assessed the correlation between the outcome variables and the predictor variables. **Results.** ASD knowledge is generally higher among pediatric nurses with higher academic qualifications ( $r = 0.29$ ,  $p < 0.001$ ). They scored higher on general knowledge ( $M = 21.5$ ,  $SD = 5.7$ ) and lower on signs and symptoms ( $M = 15.2$ ,  $SD = 4.3$ ), diagnosis ( $M = 13.8$ ,  $SD = 3.9$ ), and management of ASD ( $M = 12.4$ ,  $SD = 4.1$ ). A significant correlation was found between mean KCAHW and age ( $r = 0.12$ ,  $p = 0.029$ ), sex ( $r = 0.18$ ,  $p = 0.003$ ), years of experience ( $r = 0.25$ ,  $p < 0.001$ ), education level ( $r = 0.34$ ,  $p < 0.001$ ), and hospital type ( $r = 0.21$ ,  $p = 0.001$ ). Predictors of knowledge and understanding were level of education ( $\beta = 0.23$ ,  $p = 0.001$ ), formal training ( $\beta = 0.16$ ,  $p = 0.012$ ), and years of experience ( $\beta = 0.19$ ,  $p = 0.005$ ). The majority could not define ASD or recognize early signs and symptoms or associated comorbidities. Lack of social and emotional reciprocity and impaired language development have been reported, as well as the perception of ASD as a neurodevelopmental disorder. **Conclusion.** Higher academic qualifications are associated with high general knowledge of ASD; however, nurses in this cohort performed poorly in ASD sign and symptom recognition, diagnosis, and management.

## 1. Introduction

Autism spectrum disorder (ASD) is a complex neurodevelopmental disorder that affects a person's social communication, behavior, and cognitive abilities [1, 2]. The prevalence of ASD has increased worldwide. Recent estimates suggest a prevalence rate of 1 in 54 children in the United States [3]. Particularly, in Saudi Arabia, the prevalence rate of ASD is unknown due to a lack of research on this topic [4]. Also, studies have reported that the incidence of ASD is increasing in the Middle East, with rates ranging

from 1 in 300 to 1 in 150 children [5, 6]. ASD is characterized by a wide range of signs and symptoms that affect individuals in different ways. Common signs and symptoms of ASD include impaired social interaction, difficulties in verbal and nonverbal communication, restricted and repetitive behavior patterns, sensory sensitivities, and atypical motor skills [2, 7]. The severity and combination of these symptoms can vary considerably in individuals with ASD, resulting in a spectrum of levels of functioning and support [8–10]. Therefore, early diagnosis and evaluation of ASD are critical for several reasons. First, early identification allows for early

intervention, which has been shown to improve outcomes for children with ASD [7, 11].

Nurses' knowledge of ASD is essential for early identification, referral, and treatment of children with ASD [12, 13]. Their knowledge might be influenced by the level of education, training, and exposure to ASD [14]. Pediatric nurses play a crucial role in the care of children with ASD [15], as they are responsible for providing support and education to families [16], assisting in the diagnosis and assessment of ASD, and implementing interventions and treatments for the disorder [17]. The literature suggests that nurses and other health professionals do not seem to have a clear understanding of this issue [12]. There is substantial evidence that healthcare professionals are inadequately educated and knowledgeable about ASD, which results in delays in diagnosis and intervention [18]. It is crucial, however, to identify and intervene early if a child has an ASD in order to achieve optimal outcomes [19]. The prevalence of autism spectrum disorder has increased in the gulf state of Saudi Arabia over the last few years [20], but health professionals and researchers are less aware of the prevalence [21]. In particular, Saudi Arabia has a higher prevalence of autism spectrum disorder than most countries, with 2.51% in 2020. However, the kingdom has not adequately explored the level of perceived knowledge and awareness of ASD [22]. Nurses not only play an important role in the identification and treatment of children with autism spectrum disorders but are also an integral part of the healthcare team. Therefore, it is important to assess their perceived knowledge and awareness, which could be a solid basis for future planning and action [23].

Research suggests that early motor skill interventions can have positive effects on motor skills, physical activity levels, and socialization in young children with ASD [9]. Early intervention also enables families to access appropriate support services and therapies, which can help to address developmental delays, improve communication and social skills, and enhance overall quality of life [8]. Effective management of ASD involves a multidisciplinary approach, with healthcare professionals playing a critical role. Pediatric nurses have a unique position in the care of children with ASD. They provide support and education to families, assist in the diagnosis and assessment process, and implement interventions and treatments for the disorder. Management strategies for ASD may include behavioral therapies, speech and language therapy, occupational therapy, and pharmacological interventions when necessary [10]. It is important for nurses to have knowledge and understanding of these management approaches to provide optimal care and support to children with ASD and their families [7].

Although previous research has examined pediatric nurses' experiences and knowledge of ASD, it is still unclear what factors might predict their knowledge and understanding and associated correlates [24]. Furthermore, the available study was conducted in a European society (Italy) with a different cultural and religious background than the current study setting [24], which probably leads to different results. There appears to be a paucity of data on perceived knowledge and awareness of ASD specifically in Saudi

Arabia [20], and nurses have very limited knowledge of ASD management, with an average score of 4.34 out of 10 on a knowledge test [24]. It is not known how well pediatric nurses in this country understand and know autism spectrum disorders [25]. This indicates that there is a growing need for nurses and other healthcare professionals who have knowledge and skills in caring for children with ASD [26]. Thus, the aim of this study is to investigate the perceived knowledge of ASD among pediatric nurses working in Saudi Arabian hospitals, specifically in relation to the four knowledge domains: (1) general knowledge of ASD, (2) the signs and symptoms of ASD, (3) diagnosis and assessment of ASD, and (4) management of ASD. In addition, we will explore how nurses' educational background might influence their knowledge differences about ASD.

### 1.1. Research Hypotheses

H1. Pediatric nurses have low awareness and understanding of ASD

H2. Pediatric nurses who have received formal training on ASD may have a higher level of knowledge and understanding of the disorder compared with those who have not received such training

H3. Pediatric nurses with more years of experience have a higher level of knowledge and understanding of ASD compared to those with less experience

H4. Pediatric nurses who feel more confident in recognizing early signs of ASD have higher levels of knowledge and understanding of the disorder compared with those who do not feel confident

H5. Pediatric nurses need more training and education on ASD to improve their ability to recognize and treat the disorder

## 2. Methods

STROBE, the observational study checklist, served as a guide for this study.

2.1. *Study Design.* The design for conducting this study is a cross-sectional survey.

2.2. *Settings.* The study was conducted in four pediatric hospitals: Al-Ahsa (250 beds—private), Dammam (500 beds—public and for medical education), Hafr-Elbatin (200 beds—public), and ALMousa (50 beds—private) in the eastern region of Saudi Arabia. They are all under the Saudi Ministry of Health. Data were collected between January 2022 and May 2022.

2.3. *Participants.* A convenience sample was drawn to recruit pediatric nurses working in the selected hospitals. Based on power analysis, 300 nurses were determined as the sample. Hospital managers were contacted and asked to promote the study through social media, e-mail, and

WhatsApp. A link was provided for the online survey. A total of 326 nurses were approached via the social media platforms to participate. 273 nurses completed the survey and were included in the final sample. However, 53 nurses declined to participate or did not complete the survey and were excluded (Figure 1). The inclusion criteria include licensed pediatric nurses working in pediatric hospitals in the eastern region of Saudi Arabia who are able to read and write Arabic or English. However, pediatric nurses who are not licensed in Saudi Arabia or who work in nonpediatric hospitals or clinics and do not speak English or have already participated in similar studies, or who are unable to complete the questionnaire because of physical or psychological problems, or who have a personal relationship with individuals diagnosed with ASD that might influence their responses were considered ineligible.

#### 2.4. Data Collection Tools

**2.4.1. Sociodemographic.** The first section of the questionnaire collected demographic data of the participants. These include age, gender, work experience, education level (e.g., diploma, bachelor's, and master's), and hospital type (e.g., public, private, and academic).

**2.4.2. The Knowledge about Childhood Autism among Health Workers (KCAHW) Questionnaire.** For knowledge of childhood autism among healthcare workers, a questionnaire was developed by [19] on knowledge about childhood autism among health workers (KCAHW) aimed at improving the early identification of autism traits in children. This is a modified version of an earlier questionnaire used by ANPPCAN, the Nigeria Chapter, and the World Bank [27]. The questionnaire was translated and validated into the Turkish language [28]. It consists of 19 items related to the symptoms and characteristics of ASD, divided into four knowledge domains: (1) impairment in social interaction (e.g., impairment in the use of multiple nonverbal behaviors); (2) impairment of communication language (e.g., delay in spoken language); (3) repetitive patterns of behavior (e.g., stereotyped and repetitive use of language or motor movements); and (4) impairment of imagination and play (e.g., lack of spontaneous or make-believe play).

Participants were asked to rate each item as true (yes), false (no), or do not know. The correct answer for each item corresponded to a score of one, while the other two choices were scored as zero. The total score was calculated by summing the scores for all 19 items, with a range of 0–19 possible.

**(1) Validity and Reliability of the Arabic Version of the KCAHW Questionnaire.** The aim of this part of the study was to translate and validate the KCAHW questionnaire into Arabic to ensure its validity and reliability for assessing knowledge of childhood autism among healthcare workers.

The questionnaire was translated into Arabic using the recommended six-stage model for translations recommended by Helminen et al. [29]. Two independent bilingual

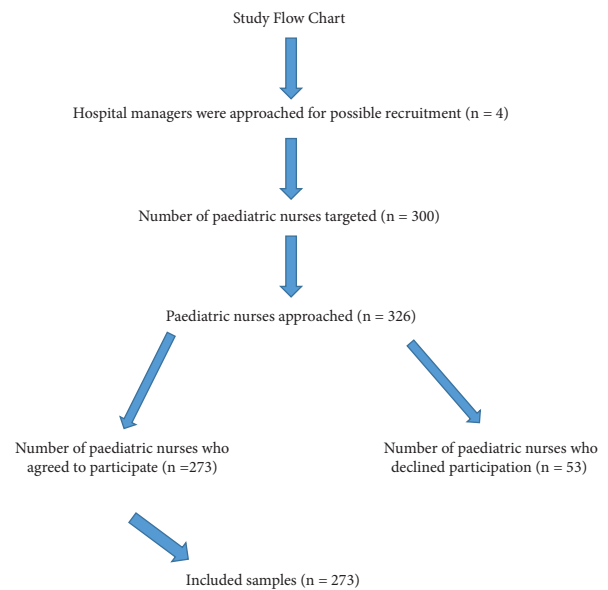


FIGURE 1: Study flowchart.

translators fluent in both Arabic and English were recruited to translate the tool. We constituted a panel of experts including three assistant professors of measurement and evaluation tool specialty, and two professors in pediatrics. This committee produced an Arabic version that was back-translated by two translators with no prior knowledge or involvement in forward translation. To ensure that the back-translated versions were accurate, a panel of experts was formed to review them for content accuracy and evaluate them individually. A discussion was held by the panel to resolve the discrepancies identified during translation. A panel of translators identified discrepancies during the translation process and resolved them further through discussion. They also identified areas for improvement and commented on the relevance of the items. The items were rated independently using a Likert scale. 1 and 2 scores were deemed irrelevant, whereas 3 and 4 scores were deemed relevant. Content validity (Item Content Validity Index) was calculated based on the proportion of relevant items. A score of 0.8 was deemed acceptable.

The total possible score was 30, with higher scores indicating greater knowledge about ASD. The final questionnaire was distributed to pediatric nurses via the Internet using the Survey Monkey online survey platform. Participants received a link to the survey and were asked to complete it in their own time. They were informed of their right to refuse to participate or withdraw from the study at any time.

After pretesting the KCAHW-Arabic with 30 pediatric nurses, the panel developed a prefinal version with a good overall internal consistency when the mean scores of the four domains were correlated with mean total scores (Cronbach's alpha = 0.96), and the test-retest reliability has an intra-cluster correlation coefficient of 0.82. The item-CVI was 0.8 which is considered acceptable. Therefore, the KCAHW-Arabic questionnaire demonstrated good validity and reliability for assessing the knowledge of childhood autism

among healthcare workers in the Arabic-speaking context. However, we must point out to the readers that the questionnaire was validated and tested for the purposes of this study. Further rigorous psychometric testing, particularly for construct and criterion validity, is needed to make it applicable in broader Arabic contexts and populations. Meanwhile, the questionnaire can be used as a valuable tool to measure knowledge levels and identify areas that require further training and education in the field of ASD among healthcare professionals.

**2.5. Ethical Approval.** Ethical approval was obtained from the King Faisal University Ethics Committee (KFU-REC-ETHICS720) before the study was conducted. Participants were informed of the purpose and objectives of the study and of their right to withdraw from the study at any time without penalty. Informed consent was obtained from all participants before enrollment in the study. Confidentiality and anonymity were maintained throughout the study by not collecting identifying information such as names or contact details. All data collected was stored securely and was accessible only to the research team. The study conformed to the ethical principles outlined in the Declaration of Helsinki and its subsequent revisions.

**2.6. Statistical Analysis.** The collected data from the socio-demographic and KCAHW questionnaires were analyzed using statistical software (SPSS version 26, IBM Corp, Armonk, NY, USA). Demographic characteristics and participant's knowledge were analyzed using descriptive statistics of frequency and percentages. For the KCAHW questionnaire, the scores of the 19 items are summed to obtain a total score for each participant. The mean and standard deviation were calculated for the total score and for each of the four knowledge domains. Inferential statistics were used to determine the relationship between participants' characteristics and their perceived knowledge of ASD. Specifically, a one-way analysis of variance was used to compare the independent variables. Multiple regression analysis was performed to determine the extent to which demographic characteristics predicted knowledge of ASD among pediatric nurses. Correlation between the predictor and outcome variables was carried out using the Pearson's correlation coefficient. A  $p$  value of less than 0.05 was considered statistically significant. Visual inspection of kurtosis and skewness on the Q-Q plot revealed whether the data were normally distributed, as normally distributed data can cluster in diagonal patterns [30, 31]. We verified the homoscedasticity assumption by examining the scatter plots for residual values against predictions [32]. Aside from (1) checking adequacy of samples, (2) making use of multicollinearity, and (4) checking for correlations, we examined other assumptions of singularity as well.

**2.7. Procedure.** Subjects were recruited using convenience sampling from five children in the eastern region of the Kingdom. Subjects were recruited through their hospital

managers, who were instructed to post the ads on their respective communication channels such as social media platforms (WhatsApp, Facebook, etc.), emails, and personal contacts and to invite pediatricians who met the stated inclusion criteria to participate in a study. We then sent a link to use the Survey Monkey platform designed for the study. A deadline of one week was set, during which two reminder messages were sent to the respective platforms. Subjects answered the demographic and KCAHW questions. The KCAHW questionnaire consists of 19 questions with four domains assessing impairment in social interaction, communication and language, repetitive behaviors, and impairment in imagination and play. Data collected in the survey were downloaded from the Survey Monkey platform and transferred to a password-protected computer for analysis.

### 3. Results

**3.1. Demographics.** As shown in Table 1, the majority of participants were female (75.82%) and between 18 and 50 years old with age range of 18–30 years (41.04%). The highest work experience and education level were less than 5 years (37.36%) and a diploma (42.86%). More than half work in public hospitals (59.67%).

**3.2. Pediatric Nurse's Awareness and Understanding of ASD.** As shown in Table 2, pediatric nurses scored the highest mean in domain 1, which reflects their general knowledge of ASD. However, mean scores for the other three domains (domains 2–4) were lower. Overall, pediatric nurses achieved an average total score of 19.78 out of 30, indicating that their knowledge of ASD can be improved.

**3.3. Influence of Formal Training on ASD.** Table 3 compares knowledge of ASD between nurses with different levels of education. Results from ANOVA show that there is a significant difference in knowledge scores between groups ( $F(2, 270) = 5.038, p = 0.007^*$ ). Nurses with a master's degree 21.5 (5.7) achieved the highest average knowledge level, followed by those with a bachelor's degree 20.2 (5.6) and those with a diploma 18.1 (5.6).

**3.4. Pediatric Nurses' Level of Confidence in Recognizing the Early Signs of ASD.** Table 4 shows the correlation matrix of the KCAHW subscales. The total score had the highest correlation with communication ( $r = 0.71$ ), followed by intervention ( $r = 0.69$ ) and causes ( $r = 0.68$ ). However, assessment had the lowest correlation with the total score ( $r = 0.60$ ).

**3.4.1. Comparison of the Mean KCAHW with Demographic Factors.** Table 5 compares mean KCAHW scores with demographic characteristics. The scores differed significantly between the different age groups, with the over 50 group achieving the highest average score. In addition, there was a difference in educational level, with the highest mean observed in the group with a master's degree. Differences

TABLE 1: Distribution of pediatric nurses' characteristics.

Characteristics	Frequency	Percentage (%)
Age (years)		
18–30	112	41.04
31–40	107	39.20
41–50	38	13.91
Over 50	16	5.85
Gender		
Male	66	24.18
Female	207	75.82
Years of experience		
Less than 5 years	102	37.36
5–10 years	84	30.77
11–15 years	43	15.76
More than 15 years	44	16.11
Level of education		
Diploma	117	42.86
Bachelor's degree	111	40.66
Master's degree	45	16.48
Hospital type		
Public	163	59.67
Private	110	40.33
Total	273	100

TABLE 2: Pediatric nurses' perceived knowledge about autism spectrum disorder (ASD).

Domain	Mean	SD
Domain 1: General knowledge about ASD	6.85	2.47
Domain 2: Knowledge about the signs/symptoms of ASD	4.52	2.22
Domain 3: Knowledge about diagnosis and assessment	4.07	1.78
Domain 4: Knowledge about the management of ASD	4.34	1.85
Total score (out of 30)	19.78	5.75

TABLE 3: Comparison of knowledge about ASD between nurses with different levels of education.

Level of education	Mean knowledge score (out of 30)	SD
Diploma	18.1	5.6
Bachelor's degree	20.2	5.6
Master's degree	21.5	5.7
ANOVA results	$F(2, 270) = 5.038, p = 0.007^*$	

\*Statistically significant at  $p < 0.05$ .

were also found between hospital types, with the highest mean observed in public hospitals. Finally, significant differences in mean scores were found by female gender and (11–15) years of experience.

**3.4.2. Pediatric Nurses' Knowledge about ASD.** Table 6 shows pediatric nurses' knowledge of ASD. The majority of participants incorrectly defined ASD (63.7%), failed to recognize early signs of ASD (67.8%), and was unaware of comorbidities associated with ASD (73.3%). Only 56% of respondents were aware of diagnostic tests for ASD; however, 57.6% were aware of treatments for ASD. Similarly,

only 31.9% of participants were aware of the association between ASD and vaccinations.

As shown in Table 7, the correct responses for social interaction (domain 1) ranged from 87.6% to 90.5%. The most frequently identified symptom was "lack of social or emotional reciprocity" (90.5%). However, the least frequently identified symptom was "staring into open space and not focusing on anything in particular," with only 28.2% of respondents correctly identifying this as an autism symptom.

In domain 2, which relates to language development, the statement "Delay or complete lack of development of spoken language" had the highest rate of correct responses at 82.4%, while "The child may appear to be deaf or mute" had the highest rate of incorrect responses at 71.8%.

In domain 3, which refers to behavior and interests, "Stereotypical and repetitive movements" had the highest rate of correct responses at 86.0%, while "May be associated with abnormal eating habits" had the highest rate of incorrect responses at 53.8%. It is important to note that while abnormal eating habits are not a core symptom of autism, some individuals with autism may exhibit such behaviors.

In domain 4, which refers to common misconceptions about autism, the statement "Autism is a neurodevelopmental disorder" had the highest rate of correct responses at 56.4%, while "Autism is childhood schizophrenia" had the highest rate of incorrect responses at 30.8%. These misconceptions might contribute to stigma and misunderstanding about autism.

**3.4.3. Factors Influencing Pediatric Nurses' Knowledge and Understanding of ASD.** As shown in Table 8, four of the six variables included in the model were statistically significant predictors of nurses' knowledge and understanding of ASD. These variables were level of education, years of experience, formal education received about ASD, and confidence level in identifying ASD. Educational level had the strongest effect, with a standardized coefficient of 0.218, followed by formal training on ASD (0.309), confidence level in identifying ASD (0.303), and years of experience (0.108). Gender and age were not significant predictors of nurses' knowledge and understanding of ASD.

## 4. Discussion

To the best of our knowledge, this study represents the first study conducted in the Gulf State of Saudi Arabia to assess the awareness and knowledge of autism spectrum disorders (ASD) among pediatric nurses.

The perceived knowledge of pediatric nurses regarding ASD was found to be average, indicating a need for improvement in this domain. The average level of knowledge displayed by individuals with higher educational backgrounds was higher than that exhibited by those with lower. Pediatric nurses displayed confidence in communication, intervention, and causes of ASD, which correlated positively with their overall knowledge. However, their performance in the assessment domain was reported to be poor. Those with postgraduate qualifications (master's degrees, for example) and

TABLE 4: Correlation matrix of KCAHW subscales.

	General knowledge	Causes	Recognition	Assessment	Intervention	Communication	Total score
General knowledge	1.00	0.23	0.22	0.23	0.40	0.34	0.56
Causes	0.23	1.00	0.57	0.51	0.56	0.53	0.68
Recognition	0.22	0.57	1.00	0.50	0.44	0.57	0.63
Assessment	0.23	0.51	0.50	1.00	0.29	0.47	0.60
Intervention	0.40	0.56	0.44	0.29	1.00	0.49	0.69
Communication	0.34	0.53	0.57	0.47	0.49	1.00	0.71
Total score	0.56	0.68	0.63	0.60	0.69	0.71	1.00

TABLE 5: Comparison of mean KCAHW scores based on demographic characteristics of pediatric nurses.

Characteristics	N	Mean KCAHW score	SD	Test statistics	<i>p</i> value
Age (years)	273				
(i) 18–30	112	9.14	2.41	<i>F</i> = 2.55	0.011
(ii) 31–40	107	10.03	2.69		
(iii) 41–50	38	10.39	2.90		
(iv) Over 50	16	11.63	3.19		
Gender	273				
(i) Male	66	9.47	2.63	<i>T</i> = 2.31	0.022
(ii) Female	207	9.98	2.62		
Years of experience	273				
(i) Less than 5 years	102	9.33	2.56	<i>F</i> = 2.22	0.027
(ii) 5–10 years	84	9.76	2.70		
(iii) 11–15 years	43	10.33	2.74		
(iv) More than 15 years	44	10.16	2.23		
Level of education	273				
(i) Diploma	117	9.34	2.49	<i>F</i> = 2.45	0.015
(ii) Bachelor's degree	111	9.87	2.63		
(iii) Master's degree	45	10.31	2.87		
Hospital type	273				
(i) Public	163	9.79	2.05	<i>T</i> = 2.51	0.013
(ii) Private	110	9.08	2.62		

TABLE 6: Pediatric nurses' knowledge about autism spectrum disorder.

Variable	Frequency	Percentage
Definition of autism spectrum disorder		
Correctly defined ASD	99	36.3%
Incorrectly defined ASD	174	63.7%
Early signs of ASD		
Could identify early signs of ASD	88	32.2%
Could not identify early signs of ASD	185	67.8%
Diagnostic tests for ASD		
Aware of diagnostic tests for ASD	120	44%
Not aware of diagnostic tests for ASD	153	56%
Comorbidities with ASD		
Aware of comorbidities associated with ASD	73	26.7%
Not aware of comorbidities associated with ASD	200	73.3%
Treatment for ASD		
Aware of treatments for ASD	157	57.6%
Not aware of treatments for ASD	116	42.4%
ASD and vaccination		
Aware of the association between ASD and vaccination	87	31.9%
Not aware of the association between ASD and vaccination	186	68.1

those over 50 years of age demonstrated higher knowledge. Furthermore, more than half of the participants considered it as a neurodevelopmental disorder, and they displayed

awareness of diagnostic tests and treatment options for ASD. ASD was not accurately defined, and early signs of ASD or associated comorbidities were not accurately identified by the

TABLE 7: Accuracy rate of the KCAHW questionnaire.

Domain	Stem	Correct response	Incorrect responses
Domain 1	1.1 Marked impairment in the use of multiple nonverbal behaviors such as eye-to-eye contact, facial expression, body postures, and gestures during social interaction?	239 (87.6%)	34 (12.4%)
	1.2 Failure to develop peer relationships appropriate for developmental age?	239 (87.6%)	34 (12.4%)
	1.3 Lack of spontaneous will to share enjoyment, interest, or activities with other people?	242 (88.6%)	31 (11.4%)
	1.4 Lack of social or emotional reciprocity?	247 (90.5%)	26 (9.5%)
	1.5 Staring into open space and not focusing on anything specific?	77 (28.2%)	196 (71.8%)
	1.6 The child can appear as if deaf or dumb?	196 (71.8%)	77 (28.2%)
	1.7 Loss of interest in the environment and surroundings?	212 (77.7%)	61 (22.3%)
	1.8 Social smile is usually absent in a child with autism?	223 (81.8%)	50 (18.2%)
Domain 2	2.1 Delay or total lack of development of spoken language?	225 (82.4%)	48 (17.6%)
Domain 3	3.1 Stereotyped and repetitive movement (e.g., hand or finger flapping or twisting)?	235 (86.0%)	38 (14.0%)
	3.2 May be associated with abnormal eating habit?	126 (46.2%)	147 (53.8%)
	3.3 Persistent preoccupation with parts of objects?	212 (77.7%)	61 (22.3%)
	3.4 Love for regimented routine activities?	182 (66.7%)	91 (33.3%)
Domain 4	4.1 Autism is childhood schizophrenia?	189 (69.2%)	84 (30.8%)
	4.2 Autism is an autoimmune condition?	194 (71.0%)	79 (29.0%)
	4.3 Autism is a neurodevelopmental disorder?	154 (56.4%)	119 (43.6%)
	4.4 Autism could be associated with Mental retardation?	135 (49.5%)	138 (50.5%)
	4.5 Autism could be associated with epilepsy?	76 (27.8%)	197 (72.2%)
	4.6 Onset of autism is usually in neonatal age, infancy, or childhood?	157 (57.6%)	

TABLE 8: Multivariate regression analysis of ASD knowledge.

Variables	Unstandardized coefficients	Standardized coefficients	t-value	p value
Age	0.015	0.027	1.73	0.084
Gender (male = 1, female = 0)	-0.069	-0.056	-1.69	0.093
Education level	0.322	0.218	4.86	<0.001
Years of experience	0.012	0.108	2.42	0.016
Received formal training on ASD	0.769	0.309	8.44	<0.001
Confidence level in identifying ASD	0.637	0.303	6.85	

majority of participants. In addition, stereotyped or repetitive movements related to eating habits were observed as well as an absence of social interaction, emotional reciprocity, and delayed or absent oral language development.

Previous evidence suggested pediatric nurses appear to possess an impressive level of general knowledge about autism spectrum disorders (ASD), as evidenced by their highest average score in domain 1 [33]. However, their mean scores in the remaining three domains were comparatively lower, indicating a relatively limited understanding of specific aspects of ASD [33]. Consistent with these findings, the present study underscores the need for improvement in pediatric nurses' awareness and comprehension of ASD. Studies have shown that nurses with higher levels of education possessed superior knowledge about ASD compared to those with lower levels of education, aligning with our current findings [20]. Pediatric nurses expressed confidence in communication, intervention, and causes of ASD. This is in line with the submission [25] who emphasized that these three aforementioned markers might serve as crucial pointers for predicting overall knowledge of ASD among pediatric nurses in the kingdom. We, therefore, recommended targeted educational interventions in these areas.

Systematic review evidence has shown that workshops, online training modules, and simulation-based training interventions have been found to enhance healthcare professionals' knowledge and attitudes towards ASD [32]. However, there is a recognized need for greater awareness and understanding of ASD among health professionals in general [27]. Although healthcare professionals express confidence in their ability to identify ASD, there are knowledge gaps regarding diagnostic criteria and appropriate treatment strategies for ASD [12]. This suggests that more comprehensive training programs are necessary for health professionals to not only improve their knowledge of ASD but also ensure the provision of appropriate care for individuals with ASD. Research has shown that specialized training in ASD has been associated with significantly higher knowledge scores among nurses compared to those without such training [34]. This highlights the importance of continuing education and training for healthcare professionals [34]. Yet, misconceptions and stigmatizing attitudes towards individuals with ASD still exist in the Gulf state of Saudi Arabia [20]. To reduce stigmatizing attitudes and improve access to necessary resources and services, there is a need for increased awareness and understanding of ASD among the

general public [35]. These underscore the need for ongoing nurse education and training for healthcare professionals to enhance their knowledge and skills in supporting individuals with ASD. By addressing these areas, healthcare professionals can provide optimal care, while the general public can foster a more inclusive and supportive environment for individuals with ASD.

**4.1. Implications.** Pediatric nurses and other healthcare professionals might find this study useful in planning care and health promotion interventions for ASD patients. It could also be adopted for health system policy formulation specifically in areas of planning, education/training requirements for nurses, and other healthcare professionals. Future research should compare perceived knowledge and awareness of ASD among general nurses who sometimes care for ASD patients and pediatric nurses.

**4.2. Limitations.** The study used convenience sampling, which only generates valid results for the sampled population and cannot be generalized. The study was a single-group cross-sectional survey, the results of which may not be interpreted with certainty. The study focused only on pediatric nurses, and the results may not be extrapolated to other health professions.

## 5. Conclusions

The results suggest that pediatric nurses have a good general understanding of ASD, but their knowledge in specific areas such as signs/symptoms, diagnosis and assessment, and management of ASD is inadequate. This underscores the need for ongoing education and training to ensure that pediatric nurses have the knowledge and skills necessary to effectively recognize and treat ASD in children. Nurses with higher levels of education generally had better knowledge of ASD than those with lower levels of education.

## Data Availability

Data are available upon reasonable request.

## Ethical Approval

This study was conducted upon the approval of the IRB at King Faisal University.

## Consent

Informed consent was obtained from all subjects involved in the study.

## Conflicts of Interest

The authors declare that there are no conflicts of interest.

## Authors' Contributions

M.M.A. and O.R. conceptualized the study. M.S.H., D.S., M.M.A., and O.R. developed methodology. S.I.A., D.S., and

A.A.T. performed formal analysis. N.A., D.S., and M.S. investigated the study. A.A. collected resources. A.A.T., S.I.A., O.R., and M.M.A. curated the data. O.R., M.M.A., and D.S. wrote the original draft. O.R. and M.M.A. supervised the manuscript. M.S.H. and A.A.T. administrated the project. All authors have read and agreed to the published version of the manuscript.

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