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AUTISM SPECTRUM DISORDERS KNOWLEDGE: RESULTS FROM AN ITALIAN NURSING STUDENTS MULTICENTER CROSS-SECTIONAL STUDY

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ABSTRACT

Introduction: Autism spectrum disorders (ASD) represent a constantly evolving neurodevelopmental condition that requires specific preparation by the entire multidisciplinary team. However, multiple scientific evidences report little training on ASD in nursing degree courses. The study above aims to assess the level of theoretical knowledge of Italian students regarding autism in pediatric age.

Materials and Methods: A multicenter cross-sectional study was conducted on 104 students enrolled in the Nursing degree programme, regularly enrolled in the 2nd and 3rd years of the course at different Italian universities, with or without previous experience in pediatric or mental health services. Knowledge was assessed by administering a validated questionnaire, the Knowledge About Childhood Autism Among Healthcare Workers (KCAHW). Sociodemographic variables and information on training and placement experience with children with ASD were collected. Data were analysed using descriptive and inferential statistics.

Results: The average score obtained on the KCAHW was 9.5 out of 19 (SD = 2.78), indicating an insufficient level of knowledge. Scores were significantly higher among students with direct experience with children with ASD (median: 11.0 vs. 9.3; p=0.015) and among female students than male students (mean: 9.9 vs. 8.7; p=0.016). Theoretical training and age were not significantly different.

Discussion: The results indicate the existence of a vital training gap. Direct clinical experience proves to be decisive in the improvement of theoretical knowledge. Integrating compulsory modules and structured ASD training in nursing education is recommended to ensure competent, small patient-centred care.

Keywords: Autism Spectrum Disorder (ASD); nursing education; undergraduate nursing students; theoretical knowledge; KCAHW questionnaire.

INTRODUCTION

Autism spectrum disorders (ASD) are a neurodevelopmental disorder that is steadily evolving worldwide. According to the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition (DSM-5) [1], ASD symptoms are defined "persistent deficits in social communication and social interaction across multiple contexts […] restricted, repetitive patterns of behaviour, interests, or activities", moreover, the DSM-5 frames ASD as a single spectrum condition, replacing previous categorical subtypes and recognizing both the clinical variability and the differing levels of support individuals may need. In 2022, the World Health Organisation (WHO)'s International Classification of Diseases, 11th Revision (ICD-11) provided a similar definition, highlighting the symptoms' pervasive nature and clinical variability [2]. The global prevalence is estimated at around 0,6%. A recent meta-analysis estimated the global prevalence of ASD to be around 1% [3]. Data from the Global Burden of Disease Study estimates that approximately 1 in 127 individuals is affected by an autism spectrum disorder, corresponding to approximately 61.8 million people [4]. In Italy, a national study on children between 7 and 9 years old has identified a prevalence between male and female genders of 4.4:1 [5,6]. These data, gathered from surveys conducted across the entire school-age population in three Italian regions, confirm trends consistent with global trends [5]. The early increase in diagnosis has been attributed to improved screening procedures and greater social awareness. Despite the high prevalence of autism spectrum disorders and the complexity of care they entail, numerous studies show a significant lack of specific training among nurses and, more generally, among healthcare professionals. According to a systematic review, most healthcare professionals report low self-efficacy, a low level of theoretical knowledge and relational difficulties when interacting with patients with ASDs [7]. The results indicate that both undergraduate education on autism is highly heterogeneous and often not mandatory, leading to educational gaps that translate into suboptimal quality of care. An Italian study revealed that more than 60% of pediatric nurses did not receive any specific training on autism spectrum disorders during their academic career [8].

Furthermore, less than 40% consider themselves prepared to manage the nursing care of a child with ASD in both hospital and community settings [8]. Critical issues include lacking communication skills, difficulty using specific behavioural strategies, and limited knowledge of augmentative alternative communication (AAC) tools. This situation is also confirmed internationally. A pilot study on educational programs in the USA has shown that only 10-15% of nursing degree courses include compulsory modules on ASD [9]. A survey of nursing professors pointed out that in most nursing schools, there are no structured courses on autism and, when they are present, they are often limited to short theoretical references [10]. However, more recent studies have confirmed these critical issues internationally. Various studies have shown that, in clinical simulation settings, students show difficulties in emotional and communicative management with patients with ASD [11]. In addition, further studies report that both nurses and students are still partially prepared, underlining the need for specific and standardised training programmes between universities [12-14]. Further studies have confirmed that barriers to caring for patients with ASD are amplified by poorly structured training and poor communication skills among health professionals [7,15]. A systematic review has also highlighted critical issues in health services and communication between professionals, patients and caregivers [16]; in addition, the Italian Ministry of Health provides official information and materials aimed at families and professionals [17]. The guidelines issued by the Italian National Institute of Health (ISS) are now a key reference point for diagnosing and managing autism in Italy. On World Autism Awareness Day, the ISS released data and promoted awareness initiatives. The study highlights the urgent need to include specific content on autism in university programmes, combining a theoretical approach with practical experience in specialist contexts, to ensure safe, competent and truly person-centred care. Despite the obvious clinical and care relevance of autism in Italy, studies assessing nursing students' knowledge of ASD are still lacking. Most research focuses on pediatric nurses already in the working context, while there is little evidence analysing basic training during the university course. This study was conceived to respond to this deficiency to assess Italian nursing

students' knowledge of pediatric autism, using a validated instrument, the KCAHW, and involving several university venues throughout Italy. The study intends to offer an up-to-date overview of students' awareness and preparation by highlighting educational inhomogeneities among the various universities and verifying the consistency between internship experiences and the competence acquired on the topic. In summary, this study contributes to the scientific and academic debate on integrating autism training into nursing curricula, with potential implications for the practical training of healthcare professionals and, indirectly, the quality of care provided to pediatric patients with autism.

MATERIALS AND METHODS

Study Designed

A cross-sectional study was conducted to assess the level of knowledge among nursing students about autism spectrum disorders. The aforementioned study design involved the administration of a validated questionnaire, the Knowledge About Childhood Autism Among Healthcare Workers (KCAHW), to a heterogeneous sample of undergraduate students in a single period to replicate the students' theoretical background acquired during their education. Using a validated tool such as the KCAHW aligns with recent methodological approaches that use paediatric simulations or standardised patients with ASD to evaluate training effectiveness [11,20,21]. The KCAHW contains 19 questions divided into four domains:

1. Domain 1: 8 questions on inappropriate social interactions in children with ASD;
2. Domain 2: 1 question on impaired communication and language development;
3. Domain 3: 4 questions on obsessive-compulsive, repetitive and stereotypical behaviours;
4. Domain 4: 6 questions on comorbidity and age of onset of the disorder.

Each item has three answer options, only one of which is correct. Correct answers are worth 1 point,

while incorrect answers or “don't know” answers are worth 0 points. The total score ranges from 0 to 19, with higher scores indicating greater knowledge. In the literature, a cut-off of 60% correct answers has been proposed to identify a minimum basic level of knowledge. Previous studies have reported satisfactory internal consistency (Cronbach's α =0.97) and adequate content validity for the KCAHW [22].

Study site

The survey was administered online using Google Forms in July 2024. Students who were enrolled in ten nursing degree courses throughout Italy were involved. The universities involved were: Sapienza University of Rome, “Aldo Moro” of Bari, University “del Salento” of Lecce, “Federico II” of Naples, University of Palermo, “Gabriele D'Annunzio” of Chieti-Pescara, "Bicocca" of Milan, and the Universities of Bologna, Firenze and Trieste.

Participants

The sample was composed using a combination of convenience and snowball sampling strategies. Participants were first recruited through convenience sampling, as this approach allowed us access to readily available individuals willing to participate. Then, a snowball sampling strategy was applied to expand the sample and include participants who might otherwise have been difficult to reach, whereby early respondents enrolled additional eligible participants through diffusion of the survey link (direct access to the Google Form platform). The final sample consisted of 104 students enrolled in the nursing degree programme, chosen according to the following inclusion criteria: Enshrined in the second or third year of the degree programme. Previous experience in paediatric or child mental health services was not considered an inclusion criterion but was recorded as a descriptive variable. For analytical purposes, age was categorized into three groups (18-20, 20-22, ≥23 years). This classification was not intended to represent clinical thresholds but was based on the distribution of

the sample and on the typical progression within the nursing degree programme (early years, middle years and delayed or outside prescribed time students).

Ethical considerations

This study adhered to the ethical standards outlined in the Helsinki Declaration and complied with General Data Protection Regulation-EU Regulation 679/2016 (GDPR). According to the Regulation for the functioning of the "Comitato Etico per la Ricerca Transdisciplinare (CERT)" of Sapienza University (Protocol 103110, 31 May 2024), anonymous, non-interventional studies that do not involve the collection of sensitive personal data are exempt from formal ethical approval. As our study fulfilled these criteria, no ethical review was required. Indeed, no sensitive personal data was collected; the questionnaire was designed to gather only general, non-identifiable information. The Google Forms platform, as set by the authors, did not collect any e-mail addresses and automatically anonymised responses with progressive numeric codes, so no personal identification was possible. The participation in the study through questionnaire response implied the acceptance of informed consent to participate, where characteristics and all data collection modalities were reported. Moreover, responders could abandon the survey at any time if the questions were deemed too personal or inappropriate, without any partial responses being collected. The authorisation of the survey administration to students was obtained from the Director of the nursing degree programme, following a previous evaluation of the survey items, structure, and questions.

Statistical analysis

Quantitative variables were described as mean ± standard deviation (SD) if normally distributed, or as median and interquartile range (IQR) if not. Categorical variables were presented as absolute frequencies and percentages. The normality of distributions was verified using the Shapiro-Wilk test, while the homogeneity of variances was verified using Levene's test. Comparisons between two

independent groups were performed using the t-test for independent samples when the assumptions of normality and homoscedasticity were met; otherwise, the non-parametric Mann-Whitney U test was applied. Comparisons between more than two groups were performed using one-way ANOVA only in the presence of normal distribution and homoscedasticity; otherwise, the Kruskal-Wallis test was used. Box plots were used for the graphical representation of scores: the horizontal line inside the box represents the median, the box limits correspond to the 25th and 75th percentiles (IQR), and the whiskers indicate the minimum and maximum values. All tests with p-values < 0.05 were considered significant. The internal consistency of the KCAHW was assessed using Cronbach's α coefficient, calculated on the overall sample. To conclude descriptive statistics were used to summarise the socio-demographic characteristics of the sample. All analyses were performed using IBM SPSS Statistics, version 27.0.

RESULTS

The study included 104 nursing students. The highest response rate was found among the Sapienza University students of Rome, representing approximately 71% of the total participants. The majority were female (71%), with a relatively even age distribution between the groups, 20-22 years (48%) and over 22 (48%). Only 21.1% reported that they had received specific training on ASD during their training, while 14.4% stated that they had cared for children with autism during their internship experience. The average score on the questionnaire was 9.5 out of 19 (SD=2.78), with values ranging from 1 to 15 (Table 1).

Mean	Standard deviation (SD)	Minimum value	Maximum value	Median
9.5	2.78	1.0	15.0	10.0

Table 1. *KCAHW descriptive statistics*

The distribution of the score suggests an insufficient general level of knowledge on the subject of

autism in paediatric age. Table 2 shows the distribution of KCAHW scores across the four domains and the total score. Students scored highest in domain 1 (social interaction; mean=4.63, median=5) and domain 3 (repetitive behaviours; mean=2.45, median=3). The lowest performance was observed in domain 2 (communication; mean=0.40, median=0). Domain 4 (comorbidity and age of onset) showed a mean of 2.86 (median=3). The mean total score was 10.35 (SD=3.08, median=10; range 1-17), indicating overall insufficient knowledge.

Domain	Items (n)	Standard deviation (SD)	Mean	Minimum value	Maximum value	Median
Domain 1 social interaction	8	1.80	4.63	0	8	5
Domain 2 communication	1	0.49	0.40	0	1	0
Domain 3 Repetitive behaviours	4	1.10	2.45	0	4	3
Domain 4 Comorbidity and onset	6	1.24	2.86	0	5	3
Total score	19	3.08	10.35	1	17	10

Table 2. *Distribution of scores across the four domains and total score KCAHW*

Statistical tests were then conducted to assess the association between socio-demographic variables and the score obtained (Table 3).

Comparison	Statistical test	Statistical value	p-value
ASD training (yes or no)	Mann-Whitney U	U=1245.0	0.261
Internship experiences with children affected by ASD (yes or no)	Mann-Whitney U	U=1080.0	0.015
Sex (female-male)	t-test	t=2.47	0.016
Age groups (18-20/20-22/≥23)	Kruskal-Wallis	H=0.49	0.612
Note: Parametric tests (t-test, one-way ANOVA) were applied only when assumptions of normality and homoscedasticity were met; otherwise, non-parametric alternatives (Mann–Whitney U, Kruskal–Wallis) were used.			

Table 3. *Statistical test results*

Students who had previously had placement experience with children with ASD scored significantly

higher (median: 11.0 vs. 9.3; Mann-Whitney U=1080.0; p=0.015). Similarly, a difference in performance between students with and without clinical experience was also found in a study conducted in 2024, confirming the formative impact of internship activities [13].

Female gender was associated with a significantly higher score (mean: 9.9 vs. 8.7; t=2.47; p=0.016). There was no significant difference between those who had received specific training on autism spectrum disorders and those who had no organised courses on this topic in their curricula (Mann-Whitney U=1245.0; p=0.216). Age did not significantly impact the overall score statistically (Kruskal-Wallis H=0.49; p=0.612).

The scores obtained from the questionnaire were represented graphically as a function of training and clinical-practical internship experience. The box plots show greater variability and a higher median in the groups who have had training placement experience with children with autism spectrum disorders than in those who have not had clinical practice experience in this area. The internal consistency of the KCAHW, assessed through Cronbach's α, was 0.54 in this sample, in line with other studies on student populations and confirming the multidimensional nature of the tool.

The box plot (Figure 1 and 2) represents the median (horizontal line inside the box), the interquartile range (IQR) (25th-75th percentile; extremes of the box), and the minimum and maximum values (whiskers).

In Figure 1, students who had received specific training on ASD reported higher median scores and less variability than those without training.

In Figure 2, students with internship experience with children with ASD obtained higher scores and a more compact distribution, indicating a generally higher and more homogeneous level of knowledge than the group without direct experience.

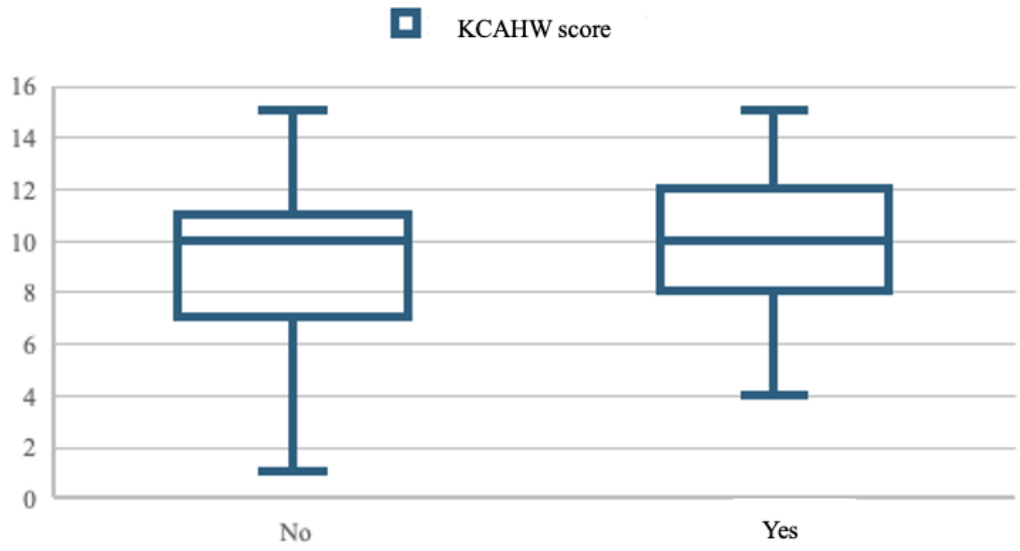

Figure 1. *Distribution of KCAHW scores based on ASD training*

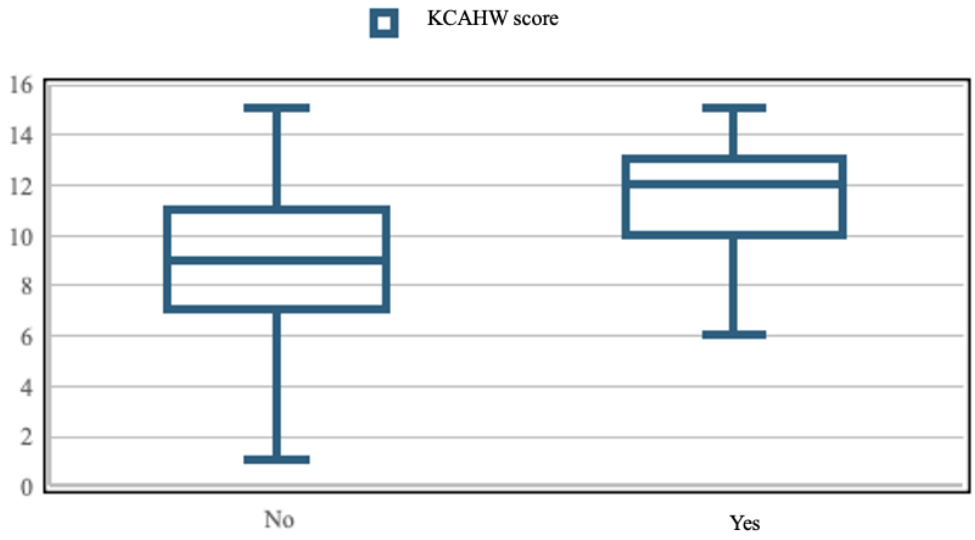

Figure 2. *Distribution of KCAHW scores based on internship experience*

DISCUSSION

The study analysed the level of theoretical knowledge about autism in developmental age among students in a nursing degree program using a validated instrument, the KCAHW. The results show insufficient knowledge, with an average of less than half of the maximum achievable score. The

domain analysis also showed that the lowest scores were obtained in the area of communication (domain 2), while relatively higher scores were found in social interaction (domain 1) and repetitive behaviours (domain 3). These results suggest that the communicative aspects of autism remain particularly underestimated among nursing students, highlighting a specific gap that training curricula should address. This finding is in line with what is reported in the international literature, where a general inadequacy of basic nursing education concerning neurodevelopmental disorders, particularly those of the autistic spectrum, is emphasised [7,10]. One of the most significant pieces of evidence that emerged concerns the positive association between internship experience with children with ASD and a higher score on the questionnaire. This result confirms the effectiveness of clinical-practical learning as a fundamental tool for consolidating theoretical knowledge and developing specific communication and relational skills [9]. In line with these findings, several studies have highlighted how direct field experience is associated with improved professional preparedness and safety [10,12,13]. Realistic simulation is also an effective educational strategy, as some studies have observed improvements in post-simulation communication skills [11,21]. The presence of field experience allows students to consciously confront the complexity of care related to autism spectrum disorders, favouring a less stereotypical approach. This finding aligns with numerous results that show that the perception of nurses' competencies is mainly linked to clinical experience and not only to theoretical training [14,26]. Also of great importance is the significant difference found in gender, with female students reporting higher average results than male students. This datum, already highlighted in other training contexts, could be linked to psycho-social variables such as a greater predisposition to helping relationships or a different motivation in the in-depth study of themes related to the behavioural and relational sphere. Contrary to expectations, the presence or absence of basic theoretical training on ASD did not show statistically significant differences in the scores obtained. This may reflect the poor systematisation and heterogeneity of the content available in the various courses of study and the predominantly theoretical nature of these training modules, which are not

supplemented with practical experience. Similarly, the age of the students was not found to be predictive of the level of knowledge, suggesting that the accumulation of academic years does not necessarily guarantee greater competence on the subject. Some researchers propose the integration of new technologies in nursing education. Numerous studies highlight the effectiveness of virtual reality in training students in interactions with patients with autism spectrum disorders [27]. In contrast, others focus on using artificial intelligence to support healthcare professionals in managing ASDs [28]. Several qualitative studies based on clinical simulation have also highlighted areas for improvement in nursing education on autism spectrum disorders [29]. These new perspectives open up different scenarios for the training of healthcare professionals and deserve further investigation. The collected data show a substantial training gap within the Italian nursing curricula. A recent observational study found limited knowledge of nurses regarding autism spectrum disorders [30]. In light of the increasing prevalence of ASD and the growing need for healthcare professionals competent in the management of this population [31], there is an urgent need for the integration of structural, multidisciplinary and experience-based education. Some recent experiments suggest the integration of immersive technologies and intelligent tools to enhance the effectiveness of teaching. Virtual reality, in particular, has proven helpful in improving students' social and relational skills in simulated settings with patients with ASD [27]. Furthermore, the use of artificial intelligence to support early diagnosis and care planning is growing [28], with good results also in training healthcare professionals [32]. Finally, a following step forward is the specific training of pediatric nursing staff on common aggressive behaviours in children with ASD, as reported by several researchers who conducted a pilot RCT showing how simulation increases staff safety and operational skills [33].

Limitations

The study’s main limitations include the small sample size (n=104), the relatively low response rate across the ten university courses involved, and the non-probabilistic nature of the sampling, which

limits the generalizability of the results to the entire Italian nursing student population. The low response rate may reflect the voluntary and self-administered nature of the survey, as well as the variability in students' availability and motivation to participate. This aspect could have introduced a further selection bias, as the students who responded may have been more interested or sensitised to the topic compared to those who did not. The choice of the sample was based on the availability and accessibility of students at specific university sites, introducing a possible selection bias. Secondly, a self-administered questionnaire may have exposed the results to social desirability bias or subjective interpretations of the questions, even though the KCAHW is internationally validated. Another limitation is the purely theoretical assessment of knowledge without in-depth exploration of practical or attitudinal expertise or the ability to apply the acquired knowledge in real clinical contexts. Furthermore, the training received was investigated with a single closed question without a qualitative-quantitative assessment of the training content addressed. Finally, as this is a cross-sectional study, it is impossible to establish causal relationships between the analysed variables, but only statistical associations. Forward-looking longitudinal studies could help us understand how knowledge evolves and the real impact of training programmes on acquiring specific competencies. Overall, the findings suggest that nursing students show insufficient knowledge of autism and limited attitudinal preparedness for managing children with ASD. This highlights the need for nursing curricula to include not only theoretical content, but also experiential and practical training aimed at improving students' attitudes, confidence, and readiness to interact with autistic patients and their families

CONCLUSION

In conclusion, the study highlights the need for a more comprehensive theoretical education in ASD for nursing students, focusing on developing skills in the clinical setting. Educational strategies should therefore address both theoretical knowledge and students' attitudes toward autism, fostering

more adequate preparedness for clinical practice. The absence of statistical significance for the theoretical training received suggests a potential fragmentation and inhomogeneity of the content delivered in degree courses that would merit systemic reflection at an academic and institutional level. In light of the increase in the prevalence of ASD and the growing complexity of care that this condition entails, there emerges an urgent need to integrate specific, up-to-date content applicable in clinical practice into nursing education courses. In particular, it would be better if supervised internship experiences in specialist settings accompany the adoption of mandatory modules on autism within academic programmes. Further multicentre research and larger samples will be necessary to validate these results and further investigate the effectiveness of training interventions in terms of their practical-assistance spin-offs, with a view to continually improving the quality of care for the paediatric population with autism spectrum disorders. Finally, as highlighted in the international literature, an up-to-date and multidisciplinary understanding of autism spectrum disorders is fundamental to improving the quality of care and reducing inequalities in access to care [34]. However, in light of the sustainability of training programmes, it does not seem realistic to envisage the introduction of specific modules for each individual clinical condition. Rather, it would be appropriate to promote cross-cutting strategies aimed at enhancing students' preparation, motivation and attitude before each internship experience, so as to strengthen the link between theory and practice and promote more effective learning in different clinical contexts.

Conflicts of interest and sources of funding

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Author contributions

MC designed the study, collected the data, and wrote the first draft of the manuscript. FP and SC

collected and analysed the data and critically reviewed the paper. MDM and EDS co-supervised the work, contributed to data analysis, and critically reviewed the content. AM supervised the study, and critically reviewed the manuscript. All authors participated in the final revision of the manuscript and approved the submitted version.

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