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Status and influencing factors of clinical nurses' disaster nursing competency: a multicenter cross-sectional study

Di Zhu[1], Yingjin Li[2], Qiuju Chen[1*], Juqing Ke[1], Yinyin Fan[1], Xiaojuan Sheng[1], Ling Yuan[1] and Yan Chen[1]

Abstract

Objectives This study aimed to assess the competency of clinical nurses in disaster nursing in Jiangsu Province, China.

Background Clinical nurses represent the largest proportion of the healthcare workforce and often serve as the primary responders in disaster management. Their competencies in disaster nursing play a pivotal role in ensuring the quality and accuracy of disaster-related care. However, evidence regarding the disaster nursing competency of clinical nurses remains limited. Therefore, this study aims to assess the current status of clinical nurses' disaster nursing competencies and analyze the factors influencing it to provide actionable strategies to enhance their disaster nursing competence.

Methods This was a cross-sectional study, which used a convenience sampling method to recruit clinical nurses from 121 hospitals in Jiangsu Province, China. Data were collected using a sociodemographic questionnaire and a nurse's disaster nursing competencies evaluation tool. Descriptive statistics, t-test, one-way analysis of variance (ANOVA) and multiple stepwise regression analysis were used to exploring factors influencing clinical nurses' disaster nursing competencies.

Results In total, 1073 participants completed the survey. The mean total disaster nursing competency score for clinical nurses was 221.41 ± 38.62 out of 275. Multiple stepwise regression analysis showed that professional titles, adaptability of existing knowledge and skills to disaster scenarios, prior disaster nursing training, and participation in disaster rescue and emergency drills significantly influenced the disaster nursing competency of the clinical nurses ($F = 50.626$, $p < 0.001$, $R^2 = 15.6\%$).

Conclusions Clinical nurses in China need more disaster nursing education, especially in the areas of prevention and preparedness. In addition, focusing on developing the practical skills of clinical nurses in disaster relief, developing a more systematic disaster education and training programme, and conducting regular disaster training and emergency drills for nurses at different levels should be considered as novel ways to improve the disaster nursing competency of clinical nurses in China.

Clinical trial number Not applicable.

*Correspondence:
Qiuju Chen
mysky_mydream@163.com

Full list of author information is available at the end of the article

Keywords Disaster nursing, Disaster preparedness, Disaster response, Competency-based education, Nursing education

Introduction

Over the past two decades, the frequency, magnitude, and economic impact of disasters have escalated significantly [1]. According to the Global Disaster Data Platform [2], 966 disasters were reported worldwide in 2023, affecting approximately 2 billion individuals and resulting in economic losses of 6 trillion US dollars. These events profoundly threaten human life, health, and property [3]. As the world's largest developing country, China is among the nations most severely affected by natural disasters, with the frequency of such events gradually increasing in recent years [4]. In addition to natural disasters, the country has experienced a high incidence of accidents, public health emergencies, and social security incidents [5]. The growing number of factors affecting public safety in China has presented significant challenges to the protection of lives, property, and national security. As a result, disaster emergency management has become a critical component of China's national governance system.

Disaster nursing competencies involves the systematic and flexible application of nurses' specialized knowledge and skills during disasters, enabling them to collaborate with other disciplines to complete essential tasks and mitigate further risks to public safety [6]. In China, clinical nurses represent the largest group of healthcare professionals and play an indispensable role in emergency response during disasters [7]. They have been instrumental in responding to events such as the SARS outbreak, dengue fever, the Wenchuan earthquake, Ebola, H1N1 influenza, and COVID-19 [8], serving in roles such as triage, physical and mental health care, health education, and the dissemination of public health information.

Disaster response is characterized by its suddenness, unpredictability, and urgency [9], requiring nurses to possess advanced disaster nursing competencies [10]. The level of disaster nursing competence directly affects the efficiency and success of disaster relief efforts, with important implications for immediate response, recovery, and post-disaster reconstruction [10]. To ensure that disaster nursing core competencies evolve with current demands, the International Council of Nurses (ICN) released the Core Competencies in Disaster Nursing Version 1.0 (CCDN V1.0) in 2009. Its well-structured and comprehensive design has become the most widely adopted theoretical framework guiding disaster nursing practice and application worldwide [11].

Currently, although many studies have explored disaster nursing competencies in nurses [12, 13], evidence specifically focused on the disaster nursing competency of clinical nurses remains limited. Assessing the disaster nursing competence of clinical nurses can help evaluate disaster nursing education and provide guidance for continuing education programs in Chinese clinical organizations. Therefore, this study utilizes the assessment tool [14] developed by West China College of Sichuan University, based on the ICN Core Competencies 1.0, to investigate the current status of clinical nurses' disaster nursing competence and analyze its influencing factors. The results will offer further countermeasures to enhance clinical nurses' disaster care competence.

Methods

Study design and settings

This anonymous cross-sectional study was conducted in July 2022 in Jiangsu Province, China. A convenience sampling approach was used to select 121 hospitals for data collection. Ethical approval for the study was obtained from the Ethics Committee.

Participants

The sample size was calculated using G-Power software v3.1.9.7 [15] based on a linear multiple regression test with an alpha error of 5%, a power of 95%, and 13 predictors in the model. The required sample size was 189. Accounting for invalid questionnaires, 20% was added to the calculated sample size, meaning the final sample size needed to be larger than 227.

Registered nurses with more than 1 year of work experience were selected. Practical nurses, training and regulation nurses, nurses with mental illnesses, psychological disorders, nurses taking psychotropic medication, nurses who had not been on the job for 3 months, or nurses who had retired for any reason were excluded from the survey.

Incomplete questionnaires, questionnaires that took less than 200 s or more than 1800 s to complete, and questionnaire options that were all the same were excluded. All participants gave informed consent and participated in this study on a voluntary basis.

Measurements

General characteristics of participants

A self-administered questionnaire was used to collect sociodemographic and professional data. The variables included gender, age, professional titles, professional level, education level, position, years of nursing experience, hospital size, prior disaster nursing training, participation in disaster rescue and emergency drills, adaptability of existing knowledge and skills to disaster

scenarios, experience with disaster events, and involvement in disaster relief efforts.

Nurse's disaster nursing competencies evaluation tool

The Nurse's Disaster Nursing Competency Evaluation Tool [14] was originally developed in Chinese by Hengwang in 2016, to measure the disaster nursing competence of clinical nurses in China. It was employed to assess disaster nursing competencies across four dimensions: disaster reduction/prevention capability (8 items), disaster preparedness capability (20 items), response capability (22 items), and recovery/reconstruction capability (5 items). The tool comprises a total of 55 items, scored on a 5-point Likert scale ranging from 1 ("performing very poorly") to 5 ("performing very well"), with a total score range of 55 to 275 points. A higher score indicates better disaster nursing competencies. This tool has been widely used in nursing research and had a Cronbach's α coefficient of 0.974 when applied to a group of nurses [16]. In this study, the Cronbach's α coefficient for the scale was 0.989, demonstrating excellent reliability. The total and dimension scores of disaster nursing competencies were calculated using standard scores, defined as Standard Score = Average Score/Total Score × 100% [17]. The standard scores were categorized as < 33.3, low level; 33.3 ~ 66.6, medium level; > 66.6, high level [18].

Data collection

Data for this study were collected using the Wenjuanxing platform (https://www.wjx.cn), an online survey platfor m. Respondents were alerted to missing responses when submitting the questionnaire, as submission was only permitted after completing all items. A pre-survey was conducted to identify and address potential issues with the questionnaire. Following revisions, survey links or QR codes were distributed to the nursing departments of participating hospitals. Only one questionnaire submission per IP address was permitted to maintain data integrity. Researchers provided standardized instructions, including detailed explanations of relevant concepts, methods for completion, and precautions, to ensure the accuracy and completeness of responses.

Ethical considerations

Ethical approval was obtained from the Ethics Committee of Nanjing Drum Tower Hospital (Approval No. 2024-499-01). The study adhered to the principles outlined in the Declaration of Helsinki, ensuring anonymity, confidentiality, and voluntary participation. The investigation was conducted using a self-administered, anonymous questionnaire. Before participation, informed consent was obtained from all clinical nurses involved in the study. All collected information was encrypted and stored on the Wenjuanxing platform. Access to the data was secured, with the researcher logging in using a project-authorized account and password to review the questionnaire responses.

Data analysis

Survey data were exported from the Wenjuanxing platform (https://www.wjx.cn) and analyzed using SPSS 26.0. Descriptive statistics were calculated, including frequencies, percentages, means, standard deviation (SD). Multivariate stepwise regression analysis was used to determine the relevant factors affecting participants' disaster nursing competencies. Univariate analysis was performed using independent sample *t*-tests and one-way ANOVA. Variables with a p-value < 0.05 in the univariate analysis were included in the multivariate stepwise regression analysis. During multivariate stepwise regression analysis, nominal variables were converted into dummy variables, such as position (without position=(1,0,0), responsible group leader=(0,1,0), leader of clinical nursing teacher=(0,0,1), and charge nurse=(0,0,0)). A p value of < 0.05 was considered statistically significant.

Results

Sample characteristics

A total of 1073 clinical nurses participated in the study, of whom 93.3% (n = 1001) were female. The majority of participants had 6 to 20 years of work experience. Regarding the characteristics of their workplaces, 77.9% (n = 836) of participants were from tertiary Grade 3B hospitals or higher. Further details of the participants' general characteristics are shown in Table 1.

Scores of nurses' disaster nursing competencies (n = 1073)

The score of the 1073 participants' disaster nursing competencies was 221.41 ± 38.62, which was at the high level. The score of the 4 dimensions was presented in Table 2. Among the 4 dimensions, the lowest score was observed in disaster reduction/prevention (average score: 3.92 ± 0.79), while the highest score was in disaster preparedness (average score: 4.07 ± 0.70). The score of each item on the scale was sorted, and the 10 items with the lowest score are listed in Table 3.

Univariate analysis

Univariate analysis revealed that several factors significantly influenced the disaster nursing competency of clinical nurses. These factors included age, professional titles, professional level, education level, position, prior disaster nursing training, participation in disaster rescue and emergency drills, adaptability of existing knowledge and skills to disaster scenarios, experience with disaster events, and involvement in disaster relief efforts (p < 0.05) (Table 1).

Table 1 Demographic characteristics and univariate analysis of disaster nursing competencies in clinical nurses ($n = 1073$)

Variables	*n* (%)	Average score (Mean ± SD)	t/F	*p*	Post-hoc text	*p*
Age (years)			2.847[b]	0.037		
①≤29	421(39.2)	224.40 ± 38.32			①>④	0.007
②30–34	285(26.6)	222.78 ± 39.73			②>④	0.040
③35–39	171(15.9)	218.58 ± 38.58				
④≥40	196(18.3)	215.43 ± 37.06				
Professional titles			4.595[b]	0.001		
①Nurse	204(19.0)	227.93 ± 38.51			①>③	0.001
②Senior nurse	390(36.3)	224.52 ± 38.64			①>④	0.002
③Supervisor nurse	374(34.9)	216.87 ± 38.59			②>③	0.006
④Associate professor of nursing	95(8.9)	213.15 ± 36.37			②>④	0.010
⑤Professor of nursing	10(0.9)	215.00 ± 33.43				
Professional level			3.317[b]	0.010		
①N0	69(6.4)	220.94 ± 39.38			②>④	0.002
②N1	242(22.6)	226.38 ± 39.18			②>⑤	0.041
③N2	383(35.7)	223.78 ± 38.40			③>④	0.007
④N3	299(27.9)	215.82 ± 38.66				
⑤N4	80(7.5)	216.26 ± 34.63				
Education level			5.051[b]	0.002		
①Technical secondary school education	12(1.1)	200.83 ± 35.68			②>①	0.009
②Associate degree	176(16.4)	230.66 ± 36.78			②>③	0.001
③Bachelor's degree	879(81.9)	219.83 ± 38.77				
④Master's degree or above	6(0.6)	221.50 ± 33.92				
Position			4.523[b]	0.004		
①Without position	638(59.5)	224.01 ± 38.83			①>④	<0.001
②Responsible group leader	150(14.0)	218.82 ± 36.86			③>④	0.014
③Leader of clinical nursing teacher	165(15.4)	221.73 ± 40.16				
④Charge nurse	120(11.2)	210.34 ± 35.66				
Prior disaster nursing training			8.701[a]	<0.001		
Yes	747(69.6)	227.96 ± 36.50				
No	326(30.4)	206.39 ± 39.20				
Participation in disaster rescue and emergency drills			9.197[a]	< 0.001		
Yes	711(66.3)	228.86 ± 36.90				
No	362(33.7)	206.77 ± 37.76				
Adaptability of existing knowledge and skills to disaster scenarios			12.107[a]	< 0.001		
Yes	764(71.2)	229.92 ± 36.15				
No	309(28.8)	200.35 ± 36.43				
Experience with disaster events			3.753[a]	< 0.001		
Yes	361(33.6)	227.58 ± 36.82				
No	712(66.4)	218.27 ± 39.15				
Involvement in disaster relief efforts			2.948[a]	0.003		
Yes	439(40.9)	225.57 ± 38.00				
No	634(59.1)	218.52 ± 38.81				

Note: *t* = independent sample t-test; *F* = One-way ANOVA; a = *t* value; b = *F* value

Table 2 Scores of nurses' disaster nursing competencies, ranked by dimensional item scores ($n = 1073$)

Dimensions	Number of items	Average score (Mean ± SD)	Standard score (Mean ± SD)
A disaster reduction/prevention capability	8	31.36 ± 6.33	78.40
D recovery/reconstruction capability	5	19.91 ± 3.85	79.64
C response capability	22	88.83 ± 15.79	80.75
B disaster preparedness capability	20	81.31 ± 14.09	81.83
Total score	55	221.41 ± 38.62	80.51

Table 3 The 10 lowest-scoring items, ranked from lowest to highest ($n = 1073$)

Items	Average score (Mean ± SD)	Dimension
Preparing a personal disaster preparedness package	3.74 ± 0.99	B disaster preparedness capability
Participating in disaster preparedness education within the community	3.77 ± 0.95	A disaster reduction/prevention capability
Promoting disaster-related research	3.83 ± 0.93	B disaster preparedness capability
Participating in the development of workplace disaster plans	3.85 ± 0.93	A disaster reduction/prevention capability
Developing individual and family disaster preparedness plans	3.85 ± 0.91	B disaster preparedness capability
Understanding the signs and symptoms of human exposure to chemical, biological, radiological, explosive, and nuclear substances and identifying potential disease outbreaks	3.85 ± 0.87	C response capability
Quickly assessing disaster situations	3.86 ± 0.88	C response capability
Understanding the tasks of nurses at different stages of a disaster	3.87 ± 0.91	A disaster reduction/prevention capability
Being familiar with disaster-related terminology	3.87 ± 0.89	B disaster preparedness capability
Identifying individual roles in disaster planning and effectively communicating them to team members	3.92 ± 0.89	A disaster reduction/prevention capability

Table 4 Results of Stepwise regression analysis

Variables entered	B	SE	β	t	*p*
(Constant)	284.302	4.869		58.391	< 0.001
Adaptability of existing knowledge and skills to disaster scenarios	-22.463	2.691	-0.264	-8.349	< 0.001
Participation in disaster rescue and emergency drills	-8.293	2.932	-0.102	-2.829	0.005
Professional titles	-5.184	1.181	-0.123	-4.389	< 0.001
Prior disaster nursing Training	-8.146	2.992	-0.097	-2.722	0.007

Note: $R^2 = 0.159$, adjusted $R^2 = 0.156$, $F = 50.626$, $p < 0.001$

Stepwise regression analysis

Stepwise regression analysis was conducted with the disaster nursing competency of clinical nurses as the dependent variable and the variables with statistically significant differences in the univariate analysis (age, professional titles, professional level, education level, position, prior disaster nursing training, participation in disaster rescue and emergency drills, adaptability of existing knowledge and skills to disaster scenarios, experience with disaster events, and involvement in disaster relief efforts) as the independent variables. The multiple stepwise regression analysis identified professional titles, adaptability of existing knowledge and skills to disaster scenarios, participation in disaster rescue and emergency drills, and prior disaster nursing training as key factors influencing the disaster nursing competency of clinical nurses ($R^2 = 0.159$, $F = 50.626$, $p < 0.001$) (Table 4).

Discussion

In this cross-sectional study, the Nurse's Disaster Nursing Competency Evaluation Tool was used to assess the disaster nursing competency of clinical nurses. Among the 1073 clinical nurses investigated, the average disaster nursing competency score was 221.41 ± 38.62, higher than the score (199.07 ± 34.31) reported by Xu et al. [19]. In addition, the scores in two key dimensions of disaster nursing competencies—response capability and disaster preparedness capability—were significantly higher than those reported by Xu et al. [19]. This difference may be attributed to the timing of the study, as data were collected during the COVID-19 pandemic. During this period, clinical nurses were crucial as frontline responders, managing many patients, including critically ill cases, and gaining extensive experience in disaster response, in-hospital emergency resuscitation, and follow-up care. As a result, the disaster nursing competency scores of clinical nurses may have been elevated during this study. However, further research is necessary to confirm this finding.

In contrast, the dimension of disaster reduction/prevention capability received the lowest score. The lowest-scoring items within this dimension included "Participating in disaster preparedness education within the community", "Participating in the development of workplace disaster plans", "Understanding the tasks of nurses at different stages of a disaster" and "Identifying individual roles in disaster planning and effectively communicating them to team members". One possible explanation for this finding is the gap between disaster education and practical disaster response needs in China. A previous survey indicated that disaster nursing education in China related to natural disasters, such as earthquakes and tsunamis, primarily focuses on trauma care, while nursing education related to infectious diseases

emphasizes infection prevention and control [20], This finding suggests enhancing disaster nursing education should be a top priority to bridge this gap and improve nurses' competencies in disaster reduction and prevention. Second, there is role confusion among clinical nurses in disaster response. A national survey found that 78% of advanced practice nurses in the United States did not fully understand their roles during disaster response [21], and 42% perceived role confusion within disaster response teams [22]. To address this issue, the ICN released a new version of the Disaster Core Competency Framework, which further clarifies the tasks and responsibilities of clinical nurses during disaster response and provides guidance on role definition and positioning. Third, the current state of disaster nursing in China shows that most clinical nurses have not been involved in the development and formulation of disaster-related policies and plans. It is recommended that clinical nurses be invited to participate in policy and plan development to bridge this gap. Additionally, the five lowest-scoring items in this study included "Preparing a personal disaster preparedness package", "Promoting disaster-related research," and "Developing individual and family disaster preparedness plans". These findings indicate that clinical nurses also lack some of the disaster nursing competency related to preparedness. Songwathana et al. [23] reviewed nurses' disaster preparedness in developing countries, showing that nurses generally exhibited weak-to-average or low-to-moderate levels of preparedness. Similar trends have been highlighted in studies from many other countries [24–27]. Therefore, it is critical for managers, hospital leaders, and authorities to increase funding and strengthen their focus on disaster preparedness. Effective strategies for improving disaster preparedness include promoting disaster nursing research, developing comprehensive disaster nursing educational packages, providing well-structured training manuals, and supporting nurses' participation in disaster drills or actual disaster events [23].

This study found that junior professional nurses scored significantly higher in disaster nursing competencies than senior professional nurses, which contrasts with the findings of Jang et al. [28]. The difference may be attributed to the fact that, during the COVID-19 pandemic, junior nurses played a key role as the main support force for emergency medical teams across the country. They gained firsthand experience at disaster sites and better-understood disaster nursing-related knowledge and skills. This finding suggests that disaster nursing competence does not necessarily increase with professional title but is largely influenced by practical disaster-related experience, consistent with the findings of other studies [29, 30]. Nursing administrators should prioritize enhancing clinical nurses' disaster rescue practice through hands-on training and encouraging active participation in disaster response activities. In addition, N1-level nurses scored significantly higher than N3-level nurses ($p < 0.05$). These results suggest that workplace experience alone, without continuous training to refresh and update professional knowledge, may not increase disaster nursing competencies in mid-level and senior nurses [31]. Therefore, regular and continuous disaster training and education should be provided to nurses at all levels to improve their competencies and ensure they are adequately prepared to respond effectively to disasters.

This study also identifies participation in disaster relief emergency drills as a critical factor influencing the disaster nursing competency of clinical nurses, which has been confirmed by many studies in other countries [32, 33], However, only 66.3% of the clinical nurses surveyed had participated in such drills. Evidence suggests that regular emergency drills significantly enhance disaster nursing competencies [34]. Given that nursing care at disaster relief sites differs substantially from clinical care in hospital settings, we recommend incorporating computer-based virtual simulation exercises that simulate casualty care scenarios during different disaster phases to help familiarize nurses with disaster conditions.

The results of the multiple linear regression analyses indicate that the adaptability of existing knowledge and skills to disaster scenarios, along with prior disaster nursing training, are the most important variables influencing disaster nursing competencies. However, only 71.2% of clinical nurses reported that their current knowledge and skills could be adapted to rescue work, and 69.6% had received professional disaster nursing training. This participation rate was lower than that reported in previous studies [35]. Many disaster nursing training programs rely on online teaching methods to address time, location, and cost constraints, however, most of these programs focus primarily on the response phase of the disaster cycle [36] which does not fully meet the comprehensive knowledge and skill requirements of clinical nurses. Disaster response requires the collaboration of multiple disciplines, including medicine, social sciences, social work, psychology, geography, and government agencies [37], Therefore, it is recommended that relevant departments and healthcare organizations develop systematic disaster education and training programs in collaboration with multidisciplinary teams. These programs should be designed to meet clinical nurses' growing education and training needs across the entire disaster cycle. Moreover, this study highlights that clinical nurses who perceive their knowledge and skills as adaptable to disaster scenarios score higher in disaster nursing competencies. Research has shown that values, interests, and positive occupational self-efficacy stimulate initiative and potential in the workplace [38]. Therefore, nurse

managers and authorities can enhance nurses' disaster preparedness by promoting self-efficacy through targeted training and supportive work environments.

Limitations and recommendations

Our study has several limitations that should be acknowledged.

Firstly, this study relied on self-reported data to assess the disaster nursing competency of clinical nurses. Some participants may have inflated their competencies scores due to recall bias or fear of potential criticism. Therefore, the competency levels may be lower than indicated in the survey results. Future research should integrate subjective and objective assessment methods—self-reports, informant ratings, and observational approaches—to provide a more comprehensive and accurate evaluation.

Secondly, data for this study were collected using the Wenjuanxing platform, which offers great convenience but poses potential challenges related to data security and the risk of participants misinterpreting research questions. To protect participants' privacy, measures should be taken to ensure data security during the research process, and any misunderstandings should be promptly clarified.

Thirdly, due to funding and time constraints, this study utilized convenience sampling and collected data from hospitals in Jiangsu Province, which may limit the generalizability of the findings. Future research should aim to expand the sample size by including hospitals from diverse regions to validate further and strengthen the conclusions.

Conclusions

This study provides important insights into the disaster nursing competency of clinical nurses. The findings indicate that the overall disaster nursing competence level among participants was high. However, among the dimensions of disaster nursing competencies, disaster reduction/prevention were the lowest-scoring dimensions, and clinical nurses also lack some of the disaster nursing competency related to preparedness. Moreover, the study identified key factors influencing clinical nurses' disaster nursing competencies, including professional titles, adaptability of existing knowledge and skills to disaster scenarios, prior disaster nursing training, and participation in disaster rescue and emergency drills. We recommend that relevant departments and nursing administrators enhance disaster education for clinical nurses, particularly in disaster prevention and preparedness. Additionally, they should prioritize the development of clinical nurses' practical skills in disaster relief by designing more systematic disaster education and training programs. Regular disaster training sessions and emergency drills tailored to nurses at different levels should be conducted to strengthen their disaster response capabilities further.

Abbreviations

ICN International Council of Nurses

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Author contributions

Qiuju Chen, Di Zhu, Yan Chen, and Ling Yuan have made substantial contributions to the conception and design of the work; Yingjin Li, Juqing Ke and Xiaojuan Sheng have made contributions to the acquisition of data, Di Zhu and Yingjin Li have made contributions to the analysis; Di Zhu, Qiuju Chen, Yingjin Li and Yinyin Fan have drafted the work; Di Zhu, Qiuju Chen have made substantively revised it. All authors have approved the submitted version and All authors have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work, even ones in which the author was not personally involved, are appropriately investigated, resolved, and the resolution documented in the literature.

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Data availability

The data that support the findings of this study are not openly available due to reasons of sensitivity and are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

The study was ethically reviewed by the Ethics Committee of Nanjing Drum Tower Hospital (No. 2024-499-01). The study followed the Declaration of Helsinki and ensured the ethical principles of anonymity, confidentiality, and voluntary participation. All the participants agreed to take part and gave their informed consent.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

Author details

[1]Present address: Nanjing Drum Tower Hospital, Affiliated Hospital of Medical School, Nanjing University, No. 321, North Zhongshan Road, Nanjing, Jiangsu 210008, China
[2]School of Nursing, Nanjing University of Chinese Medicine, Nanjing 210023, China

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