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Psychometric properties of the Chinese version of difficulty scale for nurses who care for patients with delirium in the intensive care unit

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Abstract

Background Intensive Care Unit (ICU) nurses experience many difficulties and challenges in caring for delirium patients. Identifying and measuring these difficulties experienced by nurses is critical for implementing precise interventions. We currently lack a standard tool for assessing the level of difficulty faced by ICU nurses in caring for delirium patients that fits the nursing context in China. This study aimed to translate the Difficulty Scale for Nurses who Care for Patients with Delirium in the Intensive Care Unit (DSNCPD-ICU) into Chinese (C-DSNCPD-ICU) and psychometrically validate the translated scale.

Methods The English version of DSNCPD-ICU consisted of a main scale with eight factors and an additional scale of one factor. It was translated in strict accordance with Brislin's translation model to yield the Chinese versions. Using a convenience sampling method, 477 ICU nurses from ten general hospitals were recruited for online survey, which collected sociodemographic information, scores on C-DSNCPD-ICU and the Strain of Care for Delirium Index. Subsequent psychometric attributes of the C-DSNCPD-ICU were also tested by the validity and reliability.

Results There were 437 valid responses. The content validity index was calculated as 0.96. Cronbach's alpha for the total scale and each factor were 0.919 and 0.705–0.878, respectively. Exploratory factor analysis verified an eight-factor scale and an additional scale structure with cumulative variance contributions of the factors of 63.78% and 57.62%, respectively. Confirmatory factor analysis showed that all data-model fits were acceptable.

Conclusions The C-DSNCPD-ICU validated in this study showed satisfactory psychometric properties. This will help Chinese nurse managers to accurately assess the degree of difficulty and identify the causes of precise barriers in

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caring for patients with delirium. Using the scale, nurse managers can determine what kind of measures should be taken, including formulating effective and tailored educational programs and providing more resources to support nurses.

Keywords Delirium, Intensive care units, Nurse, Scale, Validity, Reliability

Introduction

Delirium is a common and reversible neuropsychiatric syndrome in the intensive care unit (ICU), which is characterized by inattention, disorders of the sleep-wake cycle, fluctuating impairment of cognition, and varying degrees of perceptual disturbance [1]. Delirium can be categorized into three main subtypes: hyperactive, hypoactive and mixed [2]. Historically, delirium has been reported in 31.8% of ventilated and nonventilated ICU patients [3] and generally in 50–70% of mechanically ventilated patients [4]; this is higher than the 23% of medical inpatients [5]. Negative impacts of delirium in ICU patients include prolonged mechanical ventilation duration, extended hospital stays, increased healthcare expenses, increased safety incidents, and elevated mortality risk [6, 7]. It is thus pertinent to optimize care and minimize the impact of adverse consequences for patients with delirium by early identification and active and effective interventions.

Current evidence-based guidelines and expert consensus have recommended prioritizing a multicomponent nondrug approach to the management of delirium, such as the pain, agitation, and delirium guidelines [8, 9]. Furthermore, these multicomponent interventions are associated with positive outcomes, including decreased delirium incidence, mortality, hospital costs, and improved functional status [10, 11]. Nurses, who have continuous contact with patients, play a leading role in applying these guidelines, including identifying risk factors for delirium, performing preventive measures, delirium assessment, optimizing the patient's environment, monitoring their condition and facilitating recovery for patients [12, 13].

Nurses participate in all stages of delirium management and are the first responders to the onset of delirium [14]. Nurses need to constantly monitor patients to prevent adverse incidents, such as bed falls and extubation, while maintaining their own safety, which is a very arduous task and challenge [15–17]. Nurses can develop emotional and physical exhaustion due to high pressure, heavy workloads, safety issues, and occupational injuries associated with caring for delirium patients [18]. However, there is usually a dearth of resources to support nurses who have difficulty caring for delirium patients, such as emotional support and managerial assistance [19, 20]. These perceived burdens have a negative impact on nursing practice [21], which in turn may affect the recovery and prognosis of patients. Therefore, assessing the challenges faced by ICU nurses who care for delirium patients is imperative, as they allow hospital administrators to develop targeted interventions for nurses.

To date, the only instrument used for this purpose is the Strain of Care for Delirium Index (SCDI) [22], which was first introduced in China in 2021 and translated into Chinese (Mandarin) by Li et al. [23]. The SCDI evaluates the difficulty management level of each subtype of delirium but ignores many other barriers to delirium care, such as previously described challenges in assessing delirium [24] and the use of screening tools [19], management of delirium cooperation barriers between professionals [16, 20], safety problems of patients and nurses [25], difficulty in attaining family understanding and involvement [26], difficulty deciding to use medicine [27], and lack of resources and support [17, 20].

In view of the above deficiencies, Nana Owaki et al. developed the Difficulty Scale for Nurses who Care for Patients with Delirium in the Intensive Care Unit (DSNCPD-ICU), aimed at comprehensively gauging the difficulties faced by ICU nurses in caring for patients with delirium, which has been proven to have good reliability and validity [28]. The scale consisted of main scale with eight factors of 33 items and an additional scale of one factor with four items. The main scale was constructed to assess the challenges in caring for patients with delirium and an additional scale to assess the difficulty of using delirium screening tools. As stated by the original author, nursing managers can use this scale to identify comprehensively the difficulties and barriers faced by ICU nurses in delirium care, thereby formulating targeted interventions. However, the key question is whether the tool can be used by ICU nurses in China. Hence, the objectives of this research were to translate the DSNCPD-ICU into Chinese and to determine its psychometric characteristics with a view toward providing an effective tool for Chinese managers to evaluate the level of difficulty faced by ICU nurses in caring for delirium patients, clarifying the cause of specific barriers and introducing precise educational interventions and relevant support resources for nurses.

Methods

Study design and sample

This manuscript was prepared based on the STROBE checklist guidelines.

An anonymous and self-administered survey was conducted on the WeChat-incorporated Wen-Juan-Xing

platform (https://www.wjx.cn/). A convenience sample was chosen to receive the survey invitation via WeChat. The inclusion criteria were (i) registered ICU nurses and (ii) who had worked for 1 year in the investigated department. The exclusion criteria included nurses who were absent during the investigation due to maternity, sick or vacation leave or further education, etc.

Based on the sample size estimation method, it was recommended that each item be allocated a sample size of 5–10 participants for Exploratory Factor Analysis (EFA) [29]. The main scale of the DSNCPD-ICU is composed of 33 items, and the additional scale is composed of four items. The confirmatory factor analysis (CFA) should include more than 200 cases [30]. As a result of invalid questionnaires, the sample size increased by 10%, requiring a minimum of 405 participants. Ten general hospitals of different levels in Taizhou, Zhejiang Province were invited to participate in this study. Of 660 staff nurses, 477 completed the questionnaire (response rate: 72.2%). Questionnaires with illogical content or incomplete information were removed. Finally, data from a total of 437 participants were eligible for analysis. Two independent samples were utilized for EFA and CFA. According to recommended sample size of general guidelines, the sample size for EFA should be no fewer than 100 participants, while that for CFA should exceed 200 [30, 31]. Among them, 212 questionnaires were randomly selected for exploratory factor analysis (EFA), while the remaining 225 were designated for confirmatory factor analysis (CFA).

Translation procedure

Forward and back translation

After obtaining authorization from Nana Owaki, the original author, the DSNCPD-ICU was translated in strict accordance with Brislin's translation model [32]. First, two native Chinese students with a Ph.D. in nursing and overseas study experience independently translated the scale and generated two first translation drafts. Then, the researchers made records, compared and integrated the two versions of the scale, and discussed the differences with the two translators until a consensus was reached to synthesize the C-DSNCPD-ICU 1. Second, two college English teachers who had not been contacted for the original scale were selected to translate the C-DSNCPD-ICU 1 back into English separately. The researchers synthesized their results and created the back version of the DSNCPD-ICU 1. Then, the research team compared the DSNCPD-ICU 1 with the original English version and made appropriate modifications to the C-DSNCPD-ICU 1. Any inconsistencies were resolved by contacting the original authors for advice. Then, we created the C-DSNCPD-ICU 2 through discussion with the team members and modifications.

Cultural adaptation

In this study, a total of 6 experts were invited to make expert consultations on the C- DSNCPD-ICU 2. This panel comprised of one psychologist, two experts in ICU nursing, two clinical delirium specialists, and one English teacher, all of whom had cultural adaptation experience and had worked for more than 10 years. Experts evaluated the semantic equivalence, cultural relevancy, conceptual equivalences and clarity of the scale items and proposed corresponding modifications according to different knowledge fields. Based on the opinions of experts, the Chinese version of the scale, namely C-DSNCPD-ICU-3, was developed and subsequently subjected to pilot testing.

Pilot testing

For the pilot test, we recruited 30 ICU nurses using a convenience sampling method. Our research team members collected and recorded nurses' feedback on the clarity and comprehension of the scale items and the time required to complete the scale. Based on the feedback results, we revised some content to form the final Chinese version of the DSNCPD-ICU (C-DSNCPD-ICU) (see Supplementary Material 1).

Measures

DSNCPD-ICU

The DSNCPD-ICU was developed by Nana Owaki et al. [28] in 2021 and was designed to measure the difficulties faced by ICU nurses in caring for patients with delirium. The scale consisted of a main scale with eight factors; delirium assessment (six items), delirium management by multidisciplinary team (five items), ensuring safety (five items), dealing with and involvement in hypoactive delirium (four items), dealing with stress and distress (five items), adjustment of medication (four items), involvement of family (two items), and lack of resources (two items), and an additional scale of one factor; the difficulty using delirium screening tools (four items). Notably, the main scale and the additional scale were independent from each other. The additional scale was completed by ICU nurses who had used delirium screening tools. Scoring was performed using a 4-point Likert interval of 1 (disagree), 2 (moderately disagree), 3 (moderately agree), and 4 (agree), with a total score of 33–132. The additional scale about the difficulty using delirium screening tools was scored separately and has a rating range of 4–16. The higher the score was, the higher the difficulty.

SCDI

The SCDI was originally developed in 2004 by Koen Milisen et al. [22] to measure the degree of difficulty in coping with each delirium subtype. The scale consisted of 4 factors with 20 items, including hypoactive behavior,

hypoalert behavior, fluctuating course and psychoneurotic behavior, and hyperactive/hyperalert behavior. Responses were measured on a 4-point Likert scale from "very easy" to "very difficult", with higher scores reflecting a greater burden. The total score ranged from 20 to 80. A Cronbach's alpha of 0.88 was reported in the original study. The SCDI was translated by Li et al. [23] in China and has good reliability and validity; Li et al. [23] reported that the Cronbach's α was 0.894, and test-retest validity was 0.898. The results of the scale were then used to test the concurrent validity of the C-DSNCPD-ICU.

Data collection

The survey, which collected sociodemographic information, scores on C-DSNCPD-ICU and SCDI, was conducted from January 2023 to February 2023. We sent an online link to each ICU head nurse. The head nurse then sent each nurse a link through the WeChat group, explaining the voluntary nature of participation and the precautions. The test-retest reliability of the scale was assessed by randomly selecting 79 participants who voluntarily retained their contact information and consented to retesting with the questionnaire. Two weeks after completing the initial survey, the electronic questionnaire was dispatched to the same participants via WeChat.

Statistical analysis

The characteristics of the participants were summarized using descriptive statistical analysis. Confirmatory factor analysis (CFA) was conducted using IBM SPSS AMOS 21.0 (IBM Corp., Armonk, NY), while other analyses were executed using IBM SPSS Statistics 25.0 (IBM Corp., Armonk, NY).

The content validity of the C-DSNCPD-ICU was evaluated using the content validity index (CVI) by six experts in different domains. All items were evaluated by an expert using a 4-point Likert scale (1 = not relevant, 4 = highly relevant). The item-level CVI (I-CVI) was calculated by dividing the number of experts who gave a rating of 3 or 4 by the total number of experts. Similarly, the scale-level CVI/universal agreement (S-CVI/UA) was calculated by dividing the items with an I-CVI equal to 1 by the total number of items, while the scale-level CVI/average (S-CVI/Ave) was the mean of all I-CVI [33]. The content validity was deemed acceptable if the I-CVI was ≥ 0.78, the S-CVI/UA was ≥ 0.80, and the S-CVI/Ave was ≥ 0.90 [34].

The construct validity of the C-DSNCPD-ICU was assessed by exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). Principal component analysis (PCA) with varimax rotation was performed for EFA. If the Kaiser–Meyer–Olkin (KMO) value was > 0.7 and Bartlett's spherical test was significant ($P < 0.05$), the data was suitable for EFA [35, 36]. Factors with a factor load > 0.40 and an eigenvalue > 1.0 were extracted. The CFA employed maximum likelihood estimation (MLE) and structural equation model (SEM) to test the goodness of fit of the model for C-DSNCPD-ICU. The cutoff criteria for fit indices were as follows: chi-square and the degrees of freedom ($\chi 2/df$) ≤ 2; root mean square error of approximation (RMSEA) < 0.08; standardized root mean square residual (SRMR) < 0.1; comparative fit index (CFI) > 0.9; Tucker–Lewis index (TLI) > 0.90; and incremental fit index (IFI) > 0.9 [37, 38].

For the concurrent validity study, the correlations between the C-DSNCPD-ICU and SCDI were evaluated using Spearman's coefficients for SCDI scores with a skewed distribution. Low, moderate, and strong correlations were defined by correlation coefficients of 0.10–0.29, 0.30–0.49, and 0.50–1.00, respectively [39].

It is hypothesized that younger ICU nurses might experience more difficulties in caring for delirium patients. Known-group validity was calculated in this study by using 5 years of ICU work experience as a cutoff. We selected 5 years as the cutoff value because it is generally accepted in China that junior nurses, referred to as registered nurses, are those who graduated from nursing school and have worked for ≤ 5 years [40]. A t test was used to compare the scores in each factor between the two groups for these data that fit a normal distribution.

The reliability of the C-DSNCPD-ICU was examined using Cronbach's alpha and test-retest reliability. If the Cronbach's alpha value was > 0.70, the reliability was considered good [41]. The test–retest reliability was estimated using the intraclass correlation coefficient (ICC) to examine temporal stability of the scores in a two-week interval between the initial test and the retest. The ICC estimates, along with their corresponding 95% confidence intervals, were computed using IBM SPSS Statistics 25.0, employing a mean of two measurements, absolute agreement, and a two-way mixed-effects model [42]. The reliability of the test-retest was classified as "excellent" for ICC values exceeding 0.75, "good" for ICC values ranging from 0.60 to 0.74, "fair" for ICC values between 0.40 and 0.59, and "poor" for ICC values at or below 0.40 [43].

Ethical considerations

This cross-sectional study received ethical approval from the Ethics Committee of Taizhou Hospital, Zhejiang Province, with the assigned approval number K20221229. The study adhered strictly to the ethical principles articulated in the Declaration of Helsinki. Informed consent was obtained from all participants, who were thoroughly briefed on the study's objectives, privacy protocols, and voluntary participation.

Results

Sample characteristics

Among the 437 ICU nurses, the mean age was 29.8 years (SD, 5.16). Among the participants, the majority were female (90.2%), 67% had a primary title of nurse, 81.7% were undergraduates, 54.9% were married, 92.9% worked at a tertiary-level hospital, 83.1% worked in general ICUs, and 84.9% were registered nurses. The average length of work experience as a nurse was 7.92 years (SD, 5.17), and in the ICU, it was 6.11 years (SD, 4.77). More details are summarized in Table 1.

Translation and cultural adaptation

To maximise the understanding of the DSNCPD-ICU for Chinese ICU nurses, this study combined expert consultation, pilot test results, and discussions with the original authors of the DSNCPD-ICU to adapt the scale for China. The modifications were as follows: "It is difficult to spend time evaluating delirium" in Item 6 was translated into "Clinical care is so busy that…". In addition, the phrase "by utilizing records evaluated by nurses regarding patients' delirium" in Item 11 was adapted to "utilize the delirium of patients assessed by nurses as effective information". The phrase "falling out of bed" was added to Item 12. The expression "problems" in Item 13 was changed to "adverse events". The phrase "how to control the behavior" in Item 15 was modified to "what method should be chosen to control the behavior". The phrase "hypoactive delirium" in Item 18 was adapted to "when the patient suffers from hypoactive delirium". The expression "facilitate" in Item 20 was translated into "encourage". The phrase "such as pro re nata (PRN) orders" was incorporated into Item 27 as a supplementary explanation for ease of understanding. The phrase "such as colleagues" was added to Item 33 to improve its understanding. The revised C-DSNCPD-ICU was in line with the original intention of the author and Chinese culture.

Table 1 Characteristics of the sample of ICU nurses in China (N = 437)

Characteristics	*n* (%)/m ± SD
Age	29.8 ± 5.16
Gender	
Male	43 (9.8)
Female	394 (90.2)
years of experience as a nurse	7.92 ± 5.17
years of experience in the ICU	6.11 ± 4.77
Title	
Primary title	293 (67)
Intermediate title	128 (29.3)
Senior title	16 (3.7)
Education	
Junior college	78 (17.8)
Undergraduate	357 (81.7)
Postgraduate or above	2 (0.5)
Marital status	
Unmarried	197 (45.1)
Married	240 (54.9)
hospital level	
the second-level hospital	31 (7.1)
the tertiary-level hospital	406 (92.9)
Affiliated department	
General intensive care unit	363 (83.1)
Emergency intensive care unit	51 (11.7)
Surgical intensive care unit	23 (5.3)
Position	
registered nurse	371 (84.9)
chief nurse/teaching nurse	54 (12.4)
head nurse or above	12 (2.7)

Abbreviations: m, mean; SD, standard deviation

Content validity

The results of content validity showed that the I-CVI ranged from 0.83 to 1.000 in the C-DSNCPD-ICU, the S-CVI/UA was 0.81, and the S-CVI/Ave was 0.96, thus indicating acceptable content validity.

Construct validity

Exploratory factor analysis

The results showed that the KMO value of the main scale was 0.872, and Bartlett's test was significant ($\chi2 = 3119.998$, $P < 0.001$). The KMO value of the additional scale was 0.773, and Bartlett's test was significant ($\chi2 = 172.656$, $P < 0.001$). This indicated that these data were suitable for EFA. Eight factors were extracted from the main scale, which explained 63.78% of the cumulative variance contribution rate. One factor was extracted from the additional scale that explained 57.62% of cumulative variance contribution rate. The factor loadings of these 37 items were all > 0.4, and no cross-loading was observed. The factor structure was in line with the original DSNCPD-ICU. According to the significance of the items, the eight factors of the main scale and the additional scale were named, which was the same as the original study (see Tables 2 and 3).

Confirmatory factor analysis

CFA showed that the model fit parameter values of the main scale were $\chi2/df = 1.447$, RMSEA = 0.045, SRMR = 0.053, CFI = 0.948, TLI = 0.941, IFI = 0.949, indicating that the data showed an acceptable fit to the original model. However, the initial model of the additional scale fit poorly, with results of $\chi2/df = 3.150$, RMSEA = 0.100, SRMR = 0.027, CFI = 0.977, TLI = 0.930, and IFI = 0.977. To achieve a parsimonious and optimal model, the initial model was modified by adding significant paths between e3 and e4 based on the model modification indices. After revision, the structure had a suitable model fit, as evidenced by $\chi2/df = 1.604$, RMSEA = 0.053,

Table 2 Factor loadings of the 33-item C-DSNCPD-ICU (N = 212)

									N = 212
Item	**Factor 1**	**Factor 2**	**Factor 3**	**Factor 4**	**Factor 5**	**Factor 6**	**Factor 7**	**Factor 8**	**Cronbach's α**
Factor 1: Delirium assessment									
1. I do not know how to evaluate delirium, A1	0.665								
2. I am not confident in my evaluation of delirium, A2	0.665								
3. It is difficult to assess delirium in patients who are intubated or unable to communicate in a conversation, A3	0.579								
4. It is difficult to assess delirium in patients who are sedated, A4	0.702								α = 0.871
5. It is difficult for me to assess whether the patient's symptoms are due to delirium or other causes (dementia, other neuropsychiatric disorders, cerebrovascular disease), A5	0.710								
6. Clinical care is so busy that it is difficult to spend time evaluating delirium, A6	0.685								
Factor 2: Delirium management by multidisciplinary team									
7. It is difficult to understand the need for delirium patient management, because the perception and priorities for delirium differ among various occupations, A7		0.579							
8. It is difficult for other types of occupations to understand that patients have symptoms of delirium, because such symptoms fluctuate, A8		0.743							
9. It is difficult to cooperate and coordinate with members from other occupations in delirium patient management, A9		0.608							α = 0.866
10. It is difficult to set goals for managing patients with delirium in a multidisciplinary team, A10		0.762							
11. It is difficult for multidisciplinary team to utilize the delirium of patients assessed by nurses as effective information, A11		0.687							
Factor 3: Ensuring safety									
12. It is difficult to prevent patients with delirium from falling or falling out of bed, A12			0.610						
13. It is difficult to manage and prevent adverse events associated with drains and catheters, due to unexpected behaviors of patients with delirium, A13			0.609						
14. It is difficult to control behavior of excited patients with delirium, A14			0.582						α = 0.705
15. It is difficult to determine what method should be chosen to control the behavior of a patient with delirium, A15			0.715						
16. It is difficult to care for patients with delirium while maintaining the safety of the nurse, A16			0.660						
Factor 4: Dealing with and involvement in hypoactive delirium									
17. It is difficult to identify hypoactive delirium, A17				0.769					
18. It is difficult to realize when the patient suffers from hypoactive delirium, A18				0.800					
19. I do not know how to approach a hypoactive delirium patient, A19				0.723					α = 0.781
20. It is difficult to encourage patients with hypoactive delirium to engage in early mobilisation, A20				0.711					
Factor 5: Dealing with stress and distress									
21. It is difficult to carry out the necessary care for medical treatment of patients with delirium who refuse to receive care, A21					0.721				
22. It is difficult to meet the needs of patients with delirium, given the limitations of treatment, A22					0.675				
23. I do not know what kind of care methods are recommended for patients with delirium, A23					0.747				α = 0.865
24. It is difficult for nurses to control their own emotions, due to continuously caring for the patient, A24					0.696				

Table 2 (continued)

Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Factor 6	Factor 7	Factor 8	*N* = 212 Cronbach's α
25. It is difficult for nurses, who care for patients with delirium, to get support for their own stress, A25					0.745				
Factor 6: Adjustment of medication									
26. I do not know who to consult when unsure if the medicine prescribed for a patient with delirium is appropriate, A26						0.721			
27. It is difficult to decide whether to use a medicine that has been prescribed for delirium patients' restlessness or insomnia, such as pro re nata (PRN) orders, A27						0.687			
28. It is difficult to evaluate the effects and side effects after administration of drugs used to alleviate symptoms of delirium, A28						0.830			α = 0.856
29. It is difficult to set management goals for analgesia and sedation in patients with delirium, A29						0.751			
Factor 7: Involvement of family									
30. It is difficult to explain what the family can do for patients with delirium so that they can understand (e.g., the importance of family presence and how to relate to the patient), A30							0.830		
31. It is difficult to explain what delirium is in a way that families can understand, A31							0.844		α = 0.878
Factor 8: Lack of resources									
32. It is difficult to receive feedback and expert advice for delirium patient management, A32								0.683	
33. It is difficult to get help from other people, such as colleagues, who are needed to care for delirium patients, A33								0.738	α = 0.737

Note: Factors with loadings < 0.40 were eliminated

SRMR = 0.014, CFI = 0.997, TLI = 0.980, and IFI = 0.997. Good correlations between the items and the corresponding subdimensions are shown in Figs. 1 and 2.

Concurrent validity

Regarding concurrent validity, Spearman correlation analysis revealed that the correlation coefficient for the total scores between the C-DSNCPD-ICU and SCDI was 0.612 (95% CI: 0.549–0.669; $P < 0.001$), and the correlations between each factor of this scale and the total score of the SCDI ranged from 0.129 (95% CI: 0.026–0.224; $p = 0.007$) to 0.549 (95% CI: 0.474–0.617; $P < 0.001$) (Table 4).

Known-group validity

Regarding known-group validity, the results showed that the group with less than five years' experience in the ICU scored higher, had more difficulty, than the group with five or more years' experience in terms of factors 1, 2, 4, 5, 6, and 7, while factors 3 and 8 were not significantly different (Table 5).

Reliability

The Cronbach's alpha of the total scale was 0.919. For each factor of the C-DSNCPD-ICU, the Cronbach's alpha ranged from 0.705 to 0.878 (Tables 2, 3). For test-retest reliability, the ICC sum score of the main scale was 0.712 (95% CI: 0.517–0.825). Each factor of the main scale scored between 0.481 (95% CI: 0.294–0.633) and 0.688 (95% CI: 0.552–0.789) (Table 6).

Discussion

To our knowledge, this is the first study to use the DSNCPD-ICU in a Chinese hospital to assess the difficulties faced by ICU nurses in caring for delirium patients and report the psychometric properties of the scale. Our findings demonstrated that the C-DSNCPD-ICU had a stable factor structure, good internal consistency and acceptable data-model fit, which concurred with the psychometric testing of the original version of the DSNCPD-ICU developed by Nana Owaki et al. [28], thus indicating that the C-DSNCPD-ICU is a reliable and viable quantitative instrument suitable for implementation among ICU nurses in China.

In this study, Cronbach's alpha coefficients were all above the required threshold, indicating favorable internal consistency. In addition, the results of the I-CVI, S-CVI/UA and S-CVI/Ave showed that the C-DSNCPD-ICU has an acceptable level of content validity.

In terms of test-retest reliability, although the ICC sum score of the main scale reached a good rating, each factor ranged from fair to good ratings. Notably, the ICC values for the "Ensuring Safety" and "Lack of Resources" factors were comparatively low, which may be attributed to the

Table 3 Factor loadings of additional scale about the difficulty using delirium screening tools (N = 198)

		N = 198
Item	**Factor 1**	**Cronbach's α**
1. It is difficult to evaluate delirium using delirium screening tools, B1	0.735	
2. It is difficult to interpret and respond if the results of delirium screening tools do not match the nurse's assessment, B2	0.754	
3. It is difficult to trust the results of delirium screening tools, because different evaluators have different results, even if the patient's situation remains similar, B3	0.781	α = 0.747
4. It is difficult to utilize the results of delirium screening tools for effective delirium patient management, B4	0.766	

variability in the conditions of ICU patients and fluctuations in organizational resources.

Regarding concurrent validity, a strong correlation coefficient between the total score of the C-DSNCPD-ICU and the total score of the SCDI was found. Meanwhile, all other factors ranged from moderate to high correlation ratings, with the exception of "Ensuring safety" (Factor 3), "Dealing with and involvement in hypoactive delirium" (Factor 4) and "Lack of resources" (Factor 8) where the correlation coefficients were particularly low. A possible explanation for the low correlation coefficients may be due to nurses' general concern for the safety of patients with delirium, limited organizational resources, and difficulties in identifying and managing hypoactive delirium. Another possible explanation for this is that the heterogeneity of the subjects measured by the two scales led to the low correlation of these factors. The SCDI measures the challenges of managing each subtype of delirium, while the C-DSNCPD-ICU measures the difficulties experienced by ICU nurses in caring for these patients.

The principal component factor analysis showed that the factor structure was in line with the original DSNCPD-ICU [28]. All items had factor loadings above 0.4, which was considered ideal. Regarding CFA, our main scale model structure was suitable. Nevertheless, the model of the additional scale did not initially exhibit a good fit. Therefore, the additional scale model was improved based on the model modification indices, and error covariance between e3 and e4 was established. This change resulted in a significantly better model fit. We thus retained this model as the final model.

For known-group validity, higher scores on factors 1, 2, 4, 5, 6, and 7 among nurses with less than 5 years of ICU work experience indicate that these nurses experienced more difficulties and had competency deficits in delirium care, such as delirium assessment, medication management, and family involvement. Conversely, no association with experience level in "Ensuring safety" (Factor 3) and "Lack of resources" (Factor 8), which was consistent with the findings of Nana Owaki et al. [28] In terms of "Ensuring safety", previous studies indicated that nurses expressed concern for delirium patients' safety by giving primacy to position. With aggressive behavior and unexpected safety incidents among delirium patients, nurses need to be constantly present and closely monitored to maintain their own and patient safety. This is such a difficult task that nurses are extremely worried and often physically and mentally exhausted [18, 44]. With poor working conditions, severe medical staff shortages and excessive workloads [45], Chinese nurses, regardless of working years, may experience more safety problems when caring for delirium patients. With respect to "Lack of resources", several studies have shown that delirium patients put a heavy workload on nurses, but they have difficulty getting help from other personnel. Without anyone to consult, nurses feel isolated and helpless [17, 24]. In addition, a qualitative meta-analysis illustrated that due to the lack of educational training and knowledge and insufficient resources to support the care of patients with delirium, nurses learn how to care for delirium patients by observing other nurses, regardless of seniority [15]. Our study supports this finding. However, regarding "Dealing with and involvement in hypoactive delirium" (Factor 4), this outcome was contrary to that of Nana Owaki et al. [28], who found that "Dealing with and involvement in hypoactive delirium" was not related to experience level, which may be explained by the lack of work experience and formal training in managing hypoactive delirium among young nurses compared with senior nurses in China. Nurses with fewer qualifications find it difficult to identify patients with hypoactive delirium without any hyperactivity symptoms [18]. Consequently, we recommend that nurse managers introduce more relevant support resources and educational programs to address the causes of nurses' difficulties.

Limitations

Some limitations in the literature are worth mentioning as well in our study. First, we put forward an important caveat about translation. Although our study was conducted with the permission of the original authors, we did not use the original Japanese version but the translated English version. Second, the participants came only from Taizhou, Zhejiang Province and most of them came from tertiary hospitals, which resulted in the sample of our study not being sufficiently representative. Furthermore, the use of self-assessment questionnaires may have

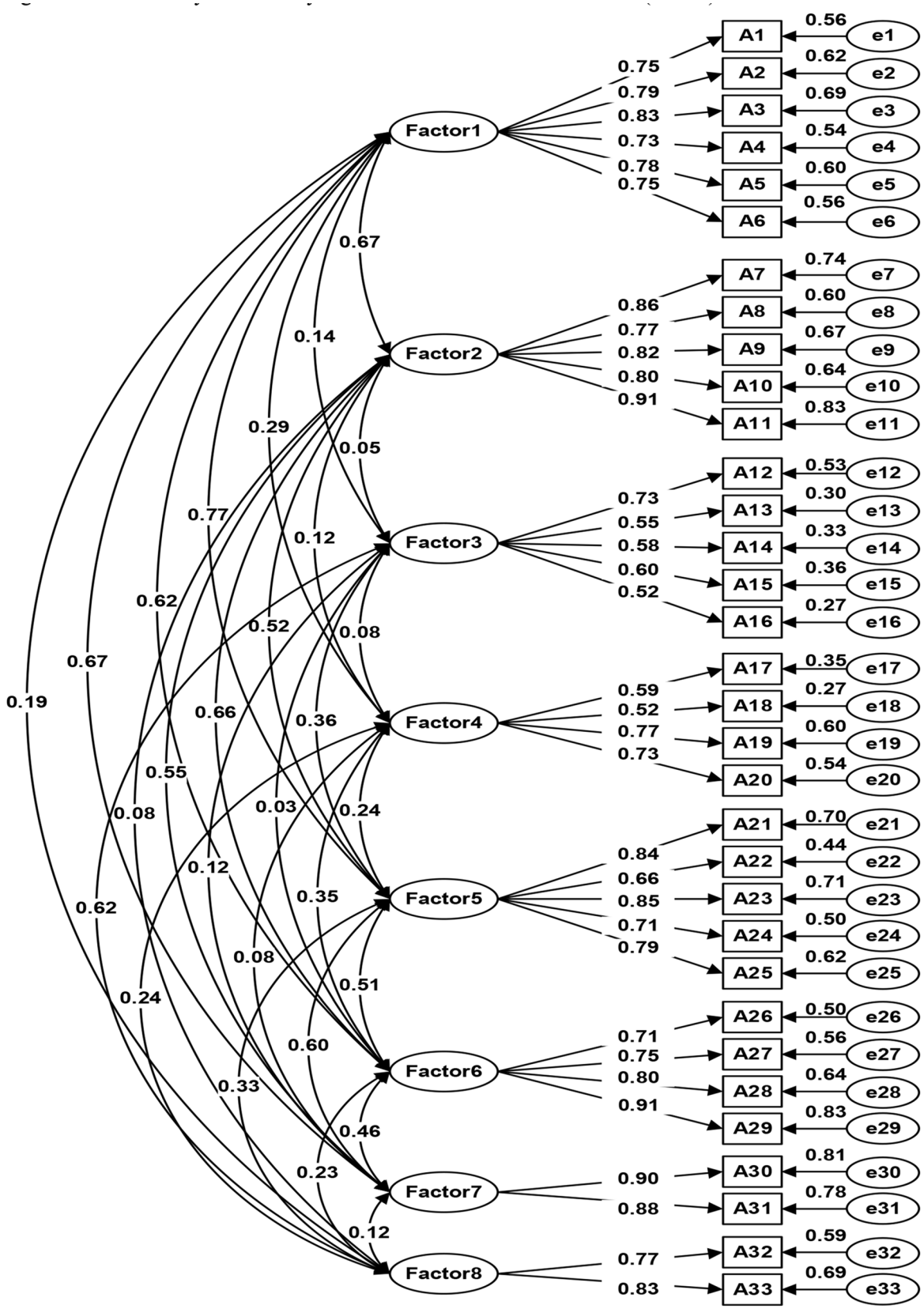

Fig. 1 Confirmatory factor analysis of the 33-item C-DSNCPD-ICU (n=225). Note: Factor 1: Delirium assessment; Factor 2: Delirium management by multidisciplinary team; Factor 3: Ensuring safety; Factor 4: Dealing with and involvement in hypoactive delirium; Factor 5: Dealing with stress and distress; Factor 6: Adjustment of medication; Factor 7: Involvement of family; Factor 8: Lack of resources

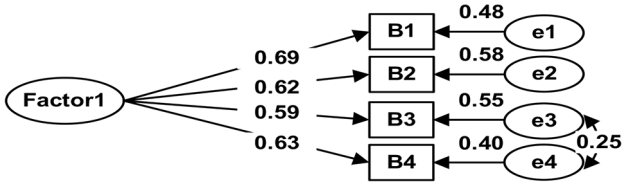

Fig. 2 Confirmatory factor analysis of the additional scale (n=214). Note: Factor1: Use of screening tools

Table 4 Spearman correlation between the C-DSNCPD-ICU (and factors) and the SCDI (N = 437)

	The total score of SCDI	p
The total score of C-DSNCPD-ICU	0.612 [0.549–0.669]	<0.001
Factor 1 Delirium assessment	0.549 [0.474–0.617]	<0.001
Factor 2 Delirium management by multidisciplinary team	0.530 [0.459–0.590]	<0.001
Factor 3 Ensuring safety	0.042 [−0.056–0.126]	0.385
Factor 4 Dealing with and involvement in hypoactive delirium	0.231 [0.134–0.322]	<0.001
Factor 5 Dealing with stress and distress	0.390 [0.304–0.468]	<0.001
Factor 6 Adjustment of medication	0.505 [0.425–0.570]	<0.001
Factor 7 Involvement of family	0.438 [0.351–0.511]	<0.001
Factor 8 Lack of resources	0.129 [0.026–0.224]	0.007

Abbreviations: C-DSNCPD-ICU, the Chinese version of difficulty scale for nurses who care for patients with delirium in the intensive care unit; SCDI, strain of care for delirium index

[a]r [95% confidence interval]

led to social desirability bias. The ICU nurses may have given answers to meet the expectations of hospital leadership and society.

Implications for clinical practice

The C-DSNCPD-ICU validated in this study will help Chinese nurse managers to accurately assess the degree of difficulty and identify the causes of precise barriers in caring for patients with delirium. Using the scale, nurse managers can determine what kind of measures should be taken, including formulating effective and tailored educational programs and providing more resources to support nurses, such as human resources and emotional support. The C-DSNCPD-ICU can also provide a basis for evaluating the effectiveness of education and training and the implementation of interventions. Furthermore, nurses can utilize this scale to comprehensively understand the barriers and deficiencies in their delirium care practice, enhancing their subjective initiative for further learning. Finally, this will likely further improve the quality of care for patients with delirium and, consequently, outcomes for patients.

Table 5 Known group comparisons by years of experience in the ICU

		N = 241		*N* = 196		*N* = 437
		5 or more years (ICU)		Less than 5 years (ICU)		
Factor		**Mean**	**SD**	**Mean**	**SD**	***p***
Factor 1	Delirium assessment	13.44	2.66	18.46	1.76	0.000
Factor 2	Delirium management by multidisciplinary team	9.59	1.65	13.52	2.60	0.000
Factor 3	Ensuring safety	14.57	1.68	14.29	1.99	0.108
Factor 4	Dealing with and involvement in hypoactive delirium	11.67	1.72	12.42	1.14	0.000
Factor 5	Dealing with stress and distress	11.07	2.25	14.62	1.92	0.000
Factor 6	Adjustment of medication	7.42	1.65	10.64	2.23	0.000
Factor 7	Involvement of family	3.68	1.47	5.57	1.12	0.000
Factor 8	Lack of resources	5.84	0.90	5.77	0.89	0.404

ICU, intensive care unit; SD, standard deviation

Table 6 Intraclass correlation coefficient (ICC) for test–retest reliability of C-DSNCPD-ICU (and factors) (N = 79)

	The score of ICC	95%CI		*p*
		Lower	Upper	
The ICC sum score of C-DSNCPD-ICU	0.712	0.517	0.825	< 0.001
Factor 1 Delirium assessment	0.638	0.348	0.792	< 0.001
Factor 2 Delirium management by multidisciplinary team	0.580	0.414	0.709	< 0.001
Factor 3 Ensuring safety	0.516	0.291	0.677	< 0.001
Factor 4 Dealing with and involvement in hypoactive delirium	0.585	0.410	0.717	< 0.001
Factor 5 Dealing with stress and distress	0.688	0.552	0.789	< 0.001
Factor 6 Adjustment of medication	0.618	0.450	0.741	< 0.001
Factor 7 Involvement of family	0.676	0.537	0.780	< 0.001
Factor 8 Lack of resources	0.481	0.294	0.633	< 0.001

Abbreviations: C-DSNCPD-ICU, the Chinese version of difficulty scale for nurses who care for patients with delirium in the intensive care unit

Conclusions

This study developed the C-DSNCPD-ICU, a self-reported scale that can comprehensively measure the difficulty faced by ICU nurses in caring for delirium patients. The C-DSNCPD-ICU showed satisfactory psychometric properties and can provide a tool for Chinese nurse managers to assess and understand the degree of difficulty and identify the cause of specific barriers. Using the scale, nurse managers can determine what kind of measures should be taken, including formulating effective and tailored educational programs and providing more resources to support nurses.

Abbreviations

ICU	Intensive Care Unit
SCDI	Strain of Care for Delirium Index
DSNCPD-ICU	Difficulty Scale for Nurses who Care for Patients with Delirium in the Intensive Care Unit
EFA	Exploratory Factor Analysis
CFA	Confirmatory factor analysis
CVI	Content validity index
PCA	Principal component analysis
KMO	The Kaiser–Meyer–Olkin
RMSEA	Root mean square error of approximation
SRMR	Standardized root mean square residual
CFI	Comparative fit index
TLI	Tucker–Lewis index
IFI	Incremental fit index

Supplementary information

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Supplementary Material 1: The Chinese version of the difficulty scale for nurses who care for patients with delirium in the intensive care unit

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Author contributions

TXJ: Conceptualization, data analysis, interpretation of the data, writing-original draft & revising. NW: Data collection, resource, study supervision, project administration. HYC: Data collection, study supervision, project administration. WYY: Data collection, resource, project administration. YCW: Data analysis, interpretation of the data. All authors read and approved the final manuscript.

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Data availability

All data for this study are available from the corresponding authors upon reasonable request.

Declarations

Ethics approval and consent to participate

This study received ethical approval from the Ethics Committee of Taizhou Hospital, Zhejiang Province, with the assigned approval number K20221229. The study adhered strictly to the ethical principles articulated in the Declaration of Helsinki. Informed consent was obtained from all participants, who were thoroughly briefed on the study's objectives, privacy protocols, and voluntary participation.

Consent for publication

Not applicable.

Clinical trial number

Not applicable.

Competing interests

The authors declare no competing interests.

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