REVALIDATION OF THE CHINESE VERSION OF THE RESILIENCE SCALE FOR MEDICAL STAFF'S VALIDITY AND RELIABILITY

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ABSTRACT: To evaluate the reliability and validity of the Chinese version of the Resilience Scale for medical staff and to establish a basis for assessing nurses' resilience following workplace violence. A total of 307 nurses who experienced workplace violence in a tertiary hospital in Jiangsu Province were selected as study participants using the convenience sampling method. Data were collected using the Stress Resilience Scale, and reliability analyses were conducted using SPSS 27.0 and AMOS 28.0. The overall internal consistency reliability of the scale was 0.955. The internal consistency reliabilities of its dimensions were 0.914, 0.900, 0.858, and 0.851. The split-half reliabilities of the dimensions ranged from 0.808 to 0.920, while the retest reliability of the scale was 0.939. The scale demonstrated robust convergent and discriminant validity. Confirmatory factor analysis results indicated that the model fit the data well: χ^2/df was 2.852, RMSEA was 0.078, and the fit indices met the required standards. The AVE and CR values ranged from 0.635 to 0.706 and 0.872 to 0.913, respectively. Correlation coefficients among the scale's dimensions were all below 0.5, and the square roots of the average variance extracted (AVE) for the dimensions were between 0.797 and 0.840. The Chinese version of the Resilience Scale is a reliable and valid instrument for assessing nurses' resilience levels, particularly following exposure to workplace violence.

Keywords: Resistance, Nurse, Reliability and Validity, Scale.

1. Introduction

Workplace violence (WPV) in healthcare has emerged as a significant global concern, presenting a considerable threat to the health workforce, particularly nurses, due to their frequent interactions with patients. WPV is defined as any instance where a worker is verbally abused, intimidated, or physically assaulted in the workplace, posing an explicit or implicit threat to their safety, well-being, or health (Di Martino, 2003). WPV encompasses verbal aggression, threats, or physical attacks that can result in severe physical and psychological trauma. The repercussions of WPV extend beyond the immediate victims and perpetrators, impacting the broader healthcare system. These consequences include increased staff turnover, reduced job satisfaction, and compromised quality of patient care (Yusoff et al., 2023). Frontline healthcare workers, particularly nurses, are disproportionately affected by WPV, with incidence rates in primary healthcare facilities worldwide ranging from 45.6% to 90% (Lim et al., 2022). Following incidents of WPV, nurses often experience a range of physical and psychological issues, including pain, fatigue, anger, depression, despair, and post-traumatic stress disorder. Such conditions significantly degrade their professional quality of life, exacerbate job dissatisfaction, and contribute to the high turnover rates within the nursing workforce (Wang et al., 2022).

From the perspective of positive psychology, increasing scholarly attention has been directed towards resilience as a physical and mental adjustment strategy for nurses who experience workplace violence (Bitar et al., 2024; Southwick et al., 2014). Resilience is considered a crucial attribute, enabling nurses to achieve professional success and manage workplace stress effectively (Hollywood & Phillips, 2020). Consequently, a timely understanding of the psychological resilience of nurses affected by workplace violence is essential for nursing managers to develop strategies that enhance nurses' ability to cope with occupational stress. Existing questionnaires used to assess resilience among nurses are predominantly generic. The most widely used tool is the Connor-Davidson Resilience Scale (CD-RISC), developed by American researchers to evaluate individuals' positive psychological attributes and their capacity to navigate challenging circumstances (Connor & Davidson, 2003). Another frequently employed tool is the Resilience Scale for Adults (RSA), developed by Friborg et al. (2006). The RSA focuses on the recovery process from adversity, influenced by personal traits, family environment, and social networks, and was validated on a sample of university students (Friborg et al., 2006).

However, these scales are not specifically tailored to nurses. While some resilience scales have been developed for nurses in the United States and Turkey, the unique stressors and cultural contexts of Chinese nurses differ significantly from those in foreign healthcare environments, limiting the applicability

of these tools (McCoy, Sauer, & Sha, 2023; Ucan & Avci, 2023). Recognising this gap, Zhu Houqiang and colleagues developed a resilience scale specifically for Chinese healthcare workers (Zhu et al., 2016). This culturally sensitive scale incorporates dimensions such as decision-making, interpersonal affiliation, logical control, and adaptability. These factors address the specific psychological and professional challenges faced by Chinese nurses, offering a more accurate measure of their resilience (Zhu et al., 2016).

Unlike global scales, Zhu's framework incorporates the cultural dimensions of collectivist society and the strict hierarchical structure characteristic of Chinese healthcare organisations. This makes it a particularly useful instrument for assessing resilience within this specific context. Resilience plays a crucial role in mitigating the impact of WPV; therefore, understanding its cultural and systemic aspects is essential. Strengthening the resilience of nurses not only equips them to cope with the pressures of their work environment but also enhances the capacity and reliability of the healthcare system to deliver high-quality care that meets patients' needs. To this end, the validity and reliability of the Chinese version of the Healthcare Worker Resilience Scale were tested. This effort aimed to develop a scientifically robust and effective tool for evaluating the resilience levels of nurses who have experienced workplace violence.

2. Literature Review

Resilience, often referred to as the stress response and the ability to recover or adapt in the face of adversity, is increasingly recognised as a critical factor in healthcare, particularly for nurses. Over the years, numerous scales have been developed to measure resilience, each offering unique perspectives on its components and applications. Among the most widely utilised are the CD-RISC, the RSA, and Zhu Houqiang's more recent scale, which was specifically designed to address the resilience of healthcare workers in the Chinese context.

2.1. Comparing Resilience Scales

The CD-RISC, developed by Connor and Davidson (2003), was the first tool designed to measure resilience. Comprising 25 items across five dimensions—ego-ability, gut feel, positive regard towards change, power, and spirituality—it focuses on personal attributes and resources, making it useful for understanding how individuals handle stress (Connor & Davidson, 2003). However, it lacks specificity for occupation-related stressors, such as those faced by nurses in emergency and intensive care units. The RSA, developed by Friborg et al. (2006), expands on the CD-RISC by incorporating ten additional items addressing social and environmental factors. It emphasises personal and social resources, family organisation, and support, making it more applicable to team-based professions like nursing. Nonetheless, RSA has limitations when applied to culturally diverse or specialised populations, as it was primarily derived from Western samples (Friborg et al., 2006).

Zhu Houqiang's scale, developed in 2016, offers a broader conceptual framework tailored specifically for healthcare workers. It focuses on four domains: mental health eligibility, information processing, decision-making and coping, interpersonal relationships, and both formal and informal problem-solving, supported by dynamic self-regulation (Zhu et al., 2016). These dimensions reflect the psychological and professional demands of healthcare employees, particularly nurses working under high stress, dealing with workplace violence, and making critical decisions. Unlike the CD-RISC and the RSA, Zhu's scale addresses the unique hierarchical and cultural characteristics of the Chinese healthcare system. For example, its emphasis on interpersonal relationships aligns with China's collectivist culture, while its focus on rationality and adaptability equips nurses to handle uncertain and rapidly changing situations common in nursing practice.

The CD-RISC and RSA scales provide foundational theories of resilience, while Zhu Houqiang's scale is specifically designed to address the comprehensive resilience of healthcare workers in China. By incorporating domains such as decision-making, interpersonal factors, and operational flexibility, it offers practical utility for addressing the challenges faced by nurses. Targeted tools like Zhu's scale enable healthcare organisations to better address human resource challenges, enhance capacity, and improve both staff and patient outcomes. The decision-making and coping style components of Zhu's scale align closely with Bandura's (1997) self-efficacy theory, which emphasises the belief in one's ability to perform effectively in specific contexts. Self-efficacy influences how individuals handle challenges, including workplace pressures. For nurses, high self-efficacy fosters resilience by promoting productive behaviours, such as problem-solving and seeking social support, instead of counterproductive responses to workplace violence (Bandura, 1997). In this regard, Zhu's decision-making component reflects nurses' confidence in managing workplace stressors, particularly in critical incidents typical of healthcare settings.

Interpersonal connection, as a source of social support, aligns with Lazarus and Folkman's (1984) cognitive appraisal theory, which posits that individuals evaluate stressors through a dual process: assessing whether they pose a threat or a challenge and determining the resources required to respond. In the context of WPV, this ability is crucial for nurses to manage stress effectively. Interpersonal relationships with peers, managers, or family members act as moderator variables, mitigating the impact of WPV on negative emotions. Nurses who adopt assertiveness in such situations are better equipped to engage with colleagues and exchange recovery strategies, enhancing their resilience.

Zhu's scale measures logical thinking through the lens of cognitive flexibility theory, a key component of cognitive resilience models. Cognitive flexibility involves the ability to switch between concepts or to consider multiple concepts simultaneously (Arici-Ozcan, Cekici, & Arslan, 2019). For nurses, the ability to think rationally and make quick decisions during critical moments is vital. Cognitive flexibility enables nurses to adapt their thinking, assess situations objectively, and solve problems rapidly in the unpredictable healthcare environment. This mental adaptability is crucial for maintaining coping capacity, allowing nurses to respond effectively to WPV and other stressors in the workplace.

The self-adaptation dimension in Zhu's scale is conceptually linked to psychological flexibility, defined as the ability to adjust to situational demands and maintain functioning despite adversity, while persistently pursuing goals (Kashdan & Rottenberg, 2010). In this context, increased psychological flexibility enhances emotional regulation, stress processing, and resilience. For nurses, flexibility involves adapting strategies and perceptions when responding to dynamic situations or challenges. Nurses with high psychological flexibility are better equipped to manage stress, recover quickly from setbacks, and maintain performance with minimal work-related impairment during critical incidents of workplace violence.

2.2. Relevance to Nursing

All three scales—CD-RISC, RSA, and Zhu's scale—offer valuable insights, but Zhu Houqiang's scale is the most suitable for improving resilience in nurses. Nurses face numerous acute stressors, including managing emergencies, interacting with patients, and coping with demanding schedules. In this context, resilience is not solely about individual strength; it also involves the ability to make sound decisions, maintain interpersonal relationships, and adapt strategies in response to new challenges (McCoy et al., 2023). Resilience is closely linked to professional success, including higher job satisfaction, reduced burnout, and improved patient outcomes. According to Hollywood and Phillips (2020), greater resilience in medical personnel enhances coping mechanisms, teamwork, and reduces turnover rates. From an organisational perspective, resilience interventions lead to more stable human capital, lower turnover, and improved healthcare outcomes (Yusoff et al., 2023).

2.3. Organizational Implications

Enhancing nurse resilience has significant implications for healthcare management. Training programs aimed at improving resilience can enhance coping skills, communication, and job satisfaction. Stress reduction initiatives and supportive workplace structures can mitigate the negative effects of workplace violence (Southwick et al., 2014). Thus, integrating Zhu Houqiang's scale into organisational assessments in China offers a culturally appropriate method for identifying resilience gaps and developing targeted interventions to address them.

3. Research Methodology

3.1. Participants

From January to May 2024, nursing staff from tertiary hospitals in Jiangsu Province were conveniently selected for this survey. Following conventional guidelines for scale measurement research, the sample size should be at least ten times the number of items on the scale. Given that the scale consists of 18 items, a minimum sample size of 180 was required. To account for potential dropouts, the sample size was increased by 20%, bringing the final required sample size to at least 216 (Romero-García et al., 2018). A total of 350 questionnaires were distributed, 43 of which were excluded due to missing data, resulting in 307 valid responses, with a valid recovery rate of 87.71%.

3.1.1. Inclusion Criteria

a. Nursing qualification certificate, in-service registered nurses;
b. Working experience of more than 1 year;
c. Nurses who are not willing to participate in this research;
d. Experience WPV within 1 year.

3.1.2. Exclusion Criteria

a. Maternity, leave, and outside training and nurses were on long leave during the data collection;
b. Nurses in training;
c. Nurses who are not willing to participate in this research.

3.2. Research Tools

3.2.1. Survey for Gathering Basic Information

A self-designed questionnaire was developed to collect general information, including the hospital bed ratio, age, education level, department, job title, years of work experience, and marital status.

3.2.2. Stress Resistance Scale for Medical Staff

In 2016, Zhu Houqiang and his colleagues developed the Resilience Scale for Medical Staff, building on previous research (Zhu et al., 2016). This scale assesses the resilience of healthcare personnel across four domains: decision-making and coping (6 items), interpersonal connection (4 items), logical thinking (4 items), and flexible self-adaptation (4 items), with a total of 18 items. The scale uses a 5-point Likert scale, where a rating of 5 indicates "complete agreement," 4 indicates "mostly agreement," 3 represents "uncertain," 2 indicates "leaning towards disagreement," and 1 indicates "complete disagreement." Higher scores on the scale reflect higher resilience levels in healthcare workers.

3.2.3. Questionnaire Design

For assessing resilience, this study utilised the Resilience Scale for Medical Staff, developed and validated by Zhu et al. (2016). The scale was selected due to its cultural relevance and high reliability, as demonstrated in previous research on Chinese healthcare workers. Given its alignment with the study's objectives, particularly in addressing resilience in the context of WPV, this instrument is deemed suitable for the research. The scale comprises 18 items, organised into four key dimensions: decision-making and coping, interpersonal relationships, rational thinking, and adaptability to changing situations. Responses are recorded on a five-point Likert scale: 1 = strongly disagree; 2 = disagree; 3 = neutral; 4 = agree; 5 = strongly agree. Higher scores on the scale indicate a higher level of resilience.

1. Decision-Making and Coping (Items 1–6)

This dimension assesses how nurses manage stress and make judgments regarding events such as WPV. It reflects self-efficacy theory and cognitive resilience, with the core idea being that effective stress management relies on the confidence individuals have when making decisions.

Sample Items:

"In the case of an emergency, the first thing that went through my mind was the stick of responsibility."

"At work, even sacrificing my own interests, I will ensure the patient's life and health."

"I will respond positively to all the challenges and pressures in my work."

2. Interpersonal Connection (Items 7–11)

The interpersonal connection dimension evaluates how well nurses maintain interpersonal relationships and seek social support during times of stress. This dimension is grounded in cognitive appraisal theory, which suggests that social support acts as a moderator of stress.

Sample Items:

"I have a strong sense of accomplishment in helping others to reduce their pain and successfully complete medical tasks."

"I am willing to communicate with my peers on a regular basis."

"I would like to discuss problems in a timely manner with colleagues, relatives, or friends."

3. Logical Thinking (Items 12–15)

The logical thinking dimension measures a nurse's ability to remain rational and apply appropriate logical thinking when confronted with multiple challenges, such as those encountered during WPV incidents or when problem-solving. It is based on cognitive flexibility theory, which suggests that individuals can adapt their thinking in response to new and changing scenarios.

Sample Items:

"When patients and their families are emotional, I can deal with them rationally and flexibly."

"I think patients and their families questioning my job motivates and inspires me."

"I can correctly understand negative public opinion about medical staff and maintain peace of mind."

4. Flexible Self-Adaptation (Items 16–18)

The final dimension, flexible self-adaptation, assesses nurses' ability to adjust to changing contexts or face challenges. This dimension is based on psychological flexibility theory, which highlights the concept of recovery after trauma and the ability to maintain functionality despite adversity.

Sample Items:

"Because of work needing frequent overtime, I can handle work-life balance."

"I can quickly forget the unhappiness of work and shift my attention to other things."

"In my medical work, when confronted with uncertainty, I usually hope for the best."

3.2.4. Development of the Scale

The scale was developed through mixed-methods research, involving multiple iterations with healthcare workers in China. Zhu and colleagues applied resilience theories to address this issue and adapted the Connor-Davidson Resilience Scale for local contexts (Zhu et al., 2016). The development of the scale aimed to identify the psychological traits and professional competencies that enable healthcare workers to manage organizational pressures in stressful healthcare environments.

3.2.5. Suitability for the Chinese Context

Zhu's scale is particularly suited for China due to its focus on the cultural and systemic aspects of the healthcare field. Most Chinese nurses work within bureaucratic, unstable, and hierarchical systems, characterised by high-stress environments with stressors such as large patient numbers, social demands, and limited resources. Unlike other common scales designed in Western contexts, Zhu's scale accounts for these cultural differences, making it more effective for measuring resilience in this population (McCoy et al., 2023). For example, the interpersonal connection domain is rooted in China's collectivist cultural values, which emphasise teamwork and relationships in professional life. Similarly, the flexible self-adaptation domain addresses the dynamic environment of the Chinese healthcare system, including policy changes and unpredictable demands for healthcare services.

3.2.6. Application in this Study

The use of Zhu's scale in this study facilitated an analysis of resilience levels among nurses who had reported at least one incident of workplace violence. By focusing on traits specific to the nursing profession, the collected data was both relevant and practical. Furthermore, the mixed-method approach provided a more detailed understanding, allowing insights not only into how nurses cope with stress and adversity, but also the factors that enable them to do so within the context of China.

3.2.7. Justification for the Instrument

Zhu's scale was preferred over other widely used tools such as the CD-RISC and the RSA due to its specificity and cultural sensitivity. While global scales apply to the general population, their broad focus does not consider the unique aspects of the Chinese healthcare context. In contrast, Zhu's scale is better suited to the goals of this study, as it provides a culturally appropriate conceptual model for measuring resilience in nurses exposed to workplace violence (Yusoff et al., 2023; Zhu et al., 2016).

3.3. Data Collection

The consent and support of the person in charge of each hospital were obtained prior to the survey. Following training from the research team, the researcher visited each hospital to administer the questionnaire. The purpose and content of the research, along with instructions for completing the questionnaires, were explained to the nurses. After obtaining informed consent, the questionnaires were distributed. The survey was anonymous, and the nurses filled in the questionnaires themselves. The researcher collected the completed questionnaires on-site to check for completeness and correct any missing data or errors. Items that did not align with the four resilience dimensions were identified and excluded during the validation process.

3.4. Statistical Analysis

Data from the questionnaire survey were entered using Excel software and then analysed with SPSS version 27 and AMOS 28.0. Frequency counts and component ratios were used to describe the general information. The reliability of the scales was evaluated through internal consistency coefficients, re-test reliability, and pre-post split-half reliability. The validity of the scales was tested using factor analysis, while feasibility was assessed by measuring validity rates and response times.

4. Result

4.1. General Information of Research Subjects

A total of 350 questionnaires were distributed, with 307 completed questionnaires returned, resulting in an effective response rate of 87.71%. The average age of the participants was 32.87 ± 7.40 years, and all participants were female (307, 100%). Further details regarding the basic demographic information of the participants are presented in Table 1.

Table 1: Demographic Characteristics of the Participants.

Characteristic	Classification	Number	Proportion (%)
Hospital Bed Ratio	0-500	25	8.1
	500-1000	91	29.6
	≥1000	191	62.2
Department	Internal Medicine	111	36.2
	Surgery	115	37.5
	Outpatient and Emergency Care	31	10.1
	ICU	12	3.9
	Other	38	12.4
Ages	≤30	128	41.7
	31-39	121	39.4
	40-49	48	15.6
	≥50	10	3.3
Work Experience (Years)	≤5	84	27.4
	6-10	76	24.8
	11-15	79	25.7
	≥16	68	22.1
Education Level	Junior College and Below	51	16.6
	Bachelor	251	81.8
	Master and Above	5	1.6
Professional Title Level	Junior	132	43.0
	Intermediate	139	45.3
	Senior	36	11.7
Marital Status	Single	95	30.9
	Married	209	68.1
	Others(Divorced, Cohabiting, Widowed)	3	1.0

4.2. Reliability Test of the Measurement Instrument

Reliability is a crucial metric for assessing the consistency of a questionnaire. In this study, the reliability of the questionnaire was evaluated using the coefficient of internal consistency, re-test reliability, and split-half reliability methods (Kishore et al., 2021).

4.2.1. Internal Consistency

Typically, an alpha coefficient above 0.700 is regarded as acceptable (Bujang, Omar, & Baharum, 2018; Tavakol & Dennick, 2011). The questionnaire in this study demonstrated an overall alpha coefficient of 0.955, with the coefficients for the individual dimensions exceeding 0.800. This indicates a high level of internal consistency for the questionnaire (Table 2).

Table 2: Internal Consistency Reliability of the Scale.

Subscale	Entries	Cronbach's Alpha
Decision-Making Response	6	0.914
Interpersonal Connection	4	0.900
Rational Thinking	4	0.858
Flexible Self-Adaptation	4	0.851
Internal Consistency of the Scale	18	0.955

4.2.2. Split-Half Reliability

Split-half reliability involves dividing the questionnaire into two parts based on the odd and even-numbered items to assess the stability between the entries (Pronk et al., 2022). The scale demonstrated an overall split-half reliability of 0.871, with the reliability for each dimension ranging from 0.808 to 0.920 (Table 3).

Table 3: Split-Half Reliability of the Scale.

Subscale	Entries	Split-Half Reliability
Decision-Making Response	6	0.857
Interpersonal Connection	4	0.920
Rational Thinking	4	0.808
flexible Self-Adaptation	4	0.851
Split-Half Reliability of the Scale	18	0.871

4.2.3. Retest Reliability

Test-retest reliability measures the temporal stability of the questionnaire by conducting repeated surveys on the same subjects (Lamb et al., 2022; Saumur et al., 2021). In this study, 30 participants were assigned specific numbers, and after a two-week interval, they were surveyed again. The retest reliability of the scale was found to be 0.939 ($p < 0.001$), indicating that the questionnaire demonstrates strong temporal stability.

4.3. Validity Test of the Assessment Instrument

4.3.1. Structural Validity

The study assessed the structural validity of the scale using Confirmatory Factor Analysis (CFA). Key indicators included the chi-square to degrees of freedom ratio, Root Mean Square Error of Approximation (RMSEA), Goodness-of-Fit Index (GFI), Comparative Fit Index (CFI), Normed Fit Index (NFI), Incremental Fit Index (IFI), and Tucker-Lewis Index (TLI) (Stacciarini & Pace, 2017; Yoshikawa & Smith, 2019). AMOS 28.0 software was employed for the validation factor analysis. Based on the corrections suggested by AMOS, the results showed that $\chi^2/df = 2.852$, RMSEA = 0.078, with all fit indices falling within the acceptable range. These findings indicate good structural validity for the scale (see Table 4), confirming that the four factors are a suitable fit as a resilience assessment tool for nurses.

Table 4: Results of Confirmatory Factor Analysis (N=307).

Inspection Volume	Results	Criteria (Adaptation Indicators)			Is it up to Standard?
		Excellent	Good	Poor	
χ^2	308.057		-		-
df	108		-		-
χ^2 /*df*	2.852	<2	<3	>5	Yes
RMSEA	0.078	<0.05	<0.08	>0.10	Yes
GFI	0.906	>0.90	>0.80	<0.10	Yes
CFI	0.958	>0.90	>0.80	<0.10	Yes
NFI	0.937	>0.90	>0.80	<0.10	Yes
IFI	0.958	>0.90	>0.80	<0.10	Yes
TLI	0.941	>0.90	>0.80	<0.10	Yes

4.3.2. Convergent Validity

The AVE and the CR values for the dimensions in this study ranged from 0.635 to 0.706 and from 0.872 to 0.913, respectively. The standardized estimates were statistically significant ($P < 0.05$), with all factor loadings for each item (standardized) exceeding 0.50. These results indicate that the convergent validity of the scale is satisfactory (see Table 5 for details).

Table 5: Parameters for the Four-Factor Model of the Scale (N=307).

Path			Estimate	S.E.	C.R.	P	AVE	CR
Q1	<---	F1	.676				0.638	0.913
Q2	<---	F1	.711	.084	14.072	***		
Q3	<---	F1	.844	.073	15.313	***		
Q4	<---	F1	.873	.083	13.663	***		
Q5	<---	F1	.831	.097	13.122	***		
Q6	<---	F1	.839	.088	13.220	***		
Q7	<---	F2	.817				0.706	0.906
Q8	<---	F2	.799	.074	15.265	***		
Q9	<---	F2	.885	.057	18.684	***		
Q10	<---	F2	.857	.063	17.818	***		
Q11	<---	F3	.866				0.635	0.872
Q12	<---	F3	.880	.046	20.615	***		
Q13	<---	F3	.812	.060	17.750	***		
Q14	<---	F3	.597	.088	11.446	***		
Q15	<---	F4	.835				0.663	0.887
Q16	<---	F4	.799	.073	15.529	***		
Q17	<---	F4	.830	.064	16.673	***		
Q18	<---	F4	.793	.066	11.652	***		
Note:***P<0.01								

4.3.3. Discriminant Validity

The dimensions of the scale exhibited positive correlations ($r < 0.5$), and the square root of the AVE for each dimension was greater than 0.6, as presented in the table. Furthermore, the correlation coefficients between the dimensions were smaller than the square root of the AVE values, indicating high discriminant validity for each dimension (see Table 6 for details).

Table 6: Discriminant Validity of the Scale (N=307).

Subscale	Decision-Making Response	Interpersonal Connection	Rational Thinking	Flexible Self-Adaptation
Decision-Making Response	0.638			
Interpersonal Connection	0.244***	0.706		
Rational Thinking	0.294***	0.339***	0.635	
Flexible Self-Adaptation	0.275***	0.314***	0.442***	0.663
Square Root of AVE Value	0.798	0.840	0.797	0.814
Note:***P<0.01				

5. Discussion

5.1. The Scale Demonstrates High Dependability

The reliability of the scale is crucial in determining its accuracy and the degree to which it can be trusted. In this study, the reliability of the questionnaire was assessed using three methods: internal consistency, split-half reliability, and retest reliability.

5.1.1. Internal Consistency

In this study, the reliability of the questionnaire was evaluated using Cronbach's α coefficient. It is widely accepted that a questionnaire demonstrates excellent reliability when its internal consistency coefficient exceeds 0.9, good reliability when it exceeds 0.8, and acceptable reliability when it falls between 0.7 and 0.8 (Melchior, Beyreuther, & Teichmann, 2024; Tavakol & Dennick, 2011). Alpha coefficients ranging from 0.6 to 0.7 are considered acceptable, whereas those below 0.6 may require revision. The Cronbach's alpha coefficient for the questionnaire was 0.955, indicating a high level

of internal consistency. Moreover, the coefficients for the other dimensions exceeded 0.800, further supporting the questionnaire's strong internal consistency.

5.1.2. Split-Half Reliability

The study employed a split-half reliability method, dividing the questionnaire into two sections based on odd and even-numbered items, and calculating the correlation between these parts. A higher correlation suggests greater reliability. The findings revealed that the questionnaire exhibited strong split-half reliability, with an overall coefficient of 0.871. Furthermore, the reliability of the individual dimensions ranged from 0.808 to 0.920, reinforcing the questionnaire's overall reliability.

5.1.3. Retest Reliability

Retest reliability values above 0.7 are generally considered to indicate a strong correlation, values between 0.4 and 0.7 suggest a moderate correlation, and values below 0.4 are seen as indicating a poor correlation (Matheson, 2019). In this study, the retest reliability was found to be 0.846 ($p < 0.001$), indicating that the questionnaire demonstrates strong temporal stability.

5.2. The Validity of this Scale is Good

5.2.1. Structural Validity

Validity assesses how well the measurements align with the expected results. In this study, factor validation analysis was used to confirm the structural validity of the questionnaire. The analysis showed the following fit indices: $\chi 2/df = 2.852$, RMSEA = 0.078, GFI = 0.906, NFI = 0.937, IFI = 0.958, CFI = 0.958, and TLI = 0.941, all within acceptable ranges. These results confirm the stability and consistency of the 4-factor framework, demonstrating good structural validity. The scale's dimensions focus on personal coping in a workplace violence context, with particular emphasis on interpersonal connection as an intrinsic psychological trait (Knekta, Runyon, & Eddy, 2019). The "Rational Thinking" dimension highlights the impact of a nurse's cognitive processing on their psychological resilience when facing stressors, distinguishing it from other universal resilience scales. In contrast, the "Flexible Adaptation" dimension assesses the extent of a nurse's psychological resilience and their ability to adjust in the face of adversity. This focus on adaptability and rationality reflects the unique demands of nursing in high-stress environments such as those impacted by workplace violence.

5.2.2. Convergent Validity

Convergent validity refers to the degree to which different research tools or measures correlate when assessing the same concept or feature (Raykov, Al-Qataee, & Dimitrov, 2020). The higher the correlation between variables, the better the convergent validity in reflecting the underlying concept (Carlson & Herdman, 2012). Average Variance Extracted (AVE) and Composite Reliability (CR) are common indicators of aggregation validity. An AVE > 0.5 and CR > 0.7 indicate strong aggregation validity, though an AVE between 0.36 and 0.50 is also acceptable (Cheung et al., 2024). These results suggest that the scale demonstrates strong convergent validity.

5.2.3. Discriminant Validity

Discriminant validity refers to the distinction between different concepts measured by various assessment methods. For good discriminant validity, the correlation coefficients between factors should be lower than the square root of the AVE values (Rönkkö & Cho, 2022). In this study, the AVE values for each dimension ranged from 0.44 to 0.57, while the CR values were between 0.75 and 0.88. Additionally, the correlation coefficients for each dimension were lower than the square root of the AVE values, indicating that the measure demonstrates strong discriminant validity.

5.3. The Feasibility of the Scale is Satisfactory

The acceptance rate, completion rate, and completion time of a scale are key indicators of its feasibility (Galesic & Bosnjak, 2009; Teresi et al., 2022). Although the acceptability of the scale could not be assessed due to data collection via the Questionnaire Star platform, the completion rate and completion time suggest that the scale is feasible. An effective recovery rate of ≥85% indicates a good completion rate, while an average response time of less than 20 minutes typically suggests that the scale is appropriately designed and does not cause irritation or distraction. In this study, 15 randomly selected participants assessed the provisional version of the scale, with completion times ranging from 4 to 12 minutes and an average response time of 6 minutes. These results suggest that the scale's length is suitable and its feasibility is high (Galesic & Bosnjak, 2009).

6. Conclusion

This study supports the reliability and validity of Zhu Houqiang's Resilience Scale for Medical Staff, demonstrating its effectiveness in measuring the resilience of nurses with experience of workplace violence. The findings underscore the importance of the scale's four dimensions—decision-making, interpersonal relationships, logical thinking, and adaptation—highlighting a comprehensive model of how nurses navigate workplace violence in high-pressure healthcare environments. The results confirm that the Zhu scale is robust in terms of internal consistency, split-half reliability, and retest reliability, making it a dependable tool for both longitudinal and cross-sectional research. Additionally, the CFA results verify the scale's good structural validity, further supporting its multifactorial approach to resilience measurement within the Chinese nursing context. Unlike other international resilience scales, such as CD-RISC and RSA, Zhu's scale is culturally sensitive, emphasizing relational and learned interpersonal characteristics specific to the Chinese healthcare setting.

6.1. Broader Implications for Healthcare Management

The findings of this study extend beyond the individual evaluation of resilience, highlighting the importance of broader organizational strategies. Resilience plays a crucial role in managing work-related outcomes arising from WPV, including psychological stress, low job satisfaction, and high turnover rates. By promoting nurse resilience, healthcare organizations can improve nurse well-being, enhance patient care outcomes, and reduce the financial burden associated with staff turnover (Yusoff et al., 2023). Healthcare managers should view resilience as a dynamic capability shaped by both individual demographics and the organizational environment. Focused efforts to cultivate resilience could also strengthen an organization's culture, which is essential for improving retention of qualified nurses and providing better healthcare outcomes for the broader population.

6.2. Recommendations

Based on the findings, the following actionable recommendations are proposed:

- Resilience Training Programs: Develop and implement training programmes focused on building adaptive coping skills, particularly in decision-making under stress, managing interpersonal communication, and addressing workplace violence. These programmes should incorporate scenario-based learning and role-play exercises tailored to real-world WPV situations.
- Support Systems: Establish peer-support networks and mentoring services to promote ongoing interpersonal interaction among staff. Creating safe spaces for nurses to share their experiences and receive emotional support can help them better manage stress and improve resilience in the workplace.
- Organizational Policy Improvements

Anti-WPV Policies: Implement strict anti-violence policies, including a zero-tolerance stance on physical violence, conflict management training for staff, and clear, efficient reporting mechanisms for incidents of workplace violence.

Workload Management: Address structural factors, such as nurse-to-patient ratios and mandatory overtime, which contribute to stress and impact resilience. Negotiating staffing levels and working hours can reduce stress and enhance resilience among nurses.

Access to Mental Health Resources: Provide accessible counselling and psychological support services for nurses affected by workplace violence, ensuring timely intervention and support as needed.

- Integration of Resilience Assessment: Include Zhu's Resilience Scale in regular evaluations to identify nurses who may be vulnerable to burnout or those who might require additional support to persist in their roles. This data can inform targeted interventions and guide organizational approaches to better support staff well-being and performance.

Zhu Houqiang's Resilience Scale for Medical Staff is a reliable and valid tool for measuring resilience in Chinese nurses. Beyond its theoretical and empirical foundations, it is effectively utilised in healthcare management as a decision-making instrument that provides valuable insights into resilience building. When WPV is recognised as a multifactorial issue, healthcare organisations can focus on enhancing resilience, thereby reducing WPV risk factors and addressing challenges related to nurse turnover and working conditions.

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Not Applicable.

6.3.1. Credit Authorship Contribution Statement

Jing Sun played a role in developing the ideas, designing the research methods, ensuring the accuracy of the results, analysing the data, conducting the investigation, and organizing the data. The activities encompassed in this project

comprise composing the initial document, evaluating and amending the writing, and overseeing the project administration. Faridah Mohd Said played a role in the development of ideas, the detailed examination of the project, the writing process (including reviewing and editing), the allocation of resources, and the oversight of the project. Tan Beng Geok played a significant role in the development, design, verification, statistical analysis, and oversight of the project.

6.3.2. Declaration of Competing Interest

The authors assert that they do not possess any identifiable conflicting financial interests or personal ties that could have potentially influenced the findings presented in this paper.

Reference

Arici-Ozcan, N., Cekici, F., & Arslan, R. (2019). The Relationship between Resilience and Distress Tolerance in College Students: The Mediator Role of Cognitive Flexibility and Difficulties in Emotion Regulation. *International Journal of Educational Methodology, 5*(4), 525-533. https://doi.org/10.12973/ijem.5.4.525

Bandura, A. (1997). *Self-Efficacy: The Exercise of Control*. W. H. Freeman.

Bitar, Z., Fekih-Romdhane, F., Mahfoud, D., Fawaz, M., Hallit, S., & Obeid, S. (2024). The Mediating Effect of Post-Traumatic Growth on the Relationship Between Personality Traits and Resilience Among a Sample of Lebanese Adults. *PloS One, 19*(5), e0298043. https://doi.org/10.1371/journal.pone.0298043

Bujang, M. A., Omar, E. D., & Baharum, N. A. (2018). A Review on Sample Size Determination for Cronbach's Alpha Test: A Simple Guide for Researchers. *The Malaysian Journal of Medical Sciences, 25*(6), 85-99. https://doi.org/10.21315/mjms2018.25.6.9

Carlson, K. D., & Herdman, A. O. (2012). Understanding the Impact of Convergent Validity on Research Results. *Organizational Research Methods, 15*(1), 17-32. https://doi.org/10.1177/1094428110392383

Cheung, G. W., Cooper-Thomas, H. D., Lau, R. S., & Wang, L. C. (2024). Reporting Reliability, Convergent and Discriminant Validity with Structural Equation Modeling: A Review and Best-Practice Recommendations. *Asia Pacific Journal of Management, 41*(2), 745-783. https://doi.org/10.1007/s10490-023-09871-y

Connor, K. M., & Davidson, J. R. T. (2003). Development of a New Resilience Scale: The Connor-Davidson Resilience Scale (CD-RISC). *Depression and Anxiety, 18*(2), 76-82. https://doi.org/10.1002/da.10113

Di Martino, V. (2003). *Relationship Between Work Stress and Workplace Violence in the Health Sector*. ILO Geneva. https://www.worktrauma.org/health/wv_management_victims.pdf

Friborg, O., Hjemdal, O., Rosenvinge, J. H., Martinussen, M., Aslaksen, P. M., & Flaten, M. A. (2006). Resilience as a Moderator of Pain and Stress. *Journal of Psychosomatic Research, 61*(2), 213-219. https://doi.org/10.1016/j.jpsychores.2005.12.007

Galesic, M., & Bosnjak, M. (2009). Effects of Questionnaire Length on Participation and Indicators of Response Quality in a Web Survey. *Public Opinion Quarterly, 73*(2), 349-360. https://doi.org/10.1093/poq/nfp031

Hollywood, L., & Phillips, K. E. (2020). Nurses' Resilience Levels and the Effects of Workplace Violence on Patient Care. *Applied Nursing Research, 54*, 151321. https://doi.org/10.1016/j.apnr.2020.151321

Kashdan, T. B., & Rottenberg, J. (2010). Psychological Flexibility as a Fundamental Aspect of Health. *Clinical Psychology Review, 30*(7), 865-878. https://doi.org/10.1016/j.cpr.2010.03.001

Kishore, K., Jaswal, V., Kulkarni, V., & De, D. (2021). Practical Guidelines to Develop and Evaluate a Questionnaire. *Indian Dermatology Online Journal, 12*(2), 266-275. https://doi.org/10.4103/idoj.IDOJ_674_20

Knekta, E., Runyon, C., & Eddy, S. (2019). One Size Doesn't Fit All: Using Factor Analysis to Gather Validity Evidence When Using Surveys in Your Research. *CBE—Life Sciences Education, 18*(1), rm1. https://doi.org/10.1187/cbe.18-04-0064

Lamb, J. R., Schultz, S. A., Scholp, A. J., Wendel, E. R., & Jiang, J. J. (2022). Retest Reliability for Complete Airway Interruption Systems of Aerodynamic Measurement. *Journal of Voice, 36*(1), 27-33. https://doi.org/10.1016/j.jvoice.2020.02.024

Lazarus, R. S., & Folkman, S. (1984). *Stress, Appraisal, and Coping*. Springer.

Lim, M. C., Jeffree, M. S., Saupin, S. S., Giloi, N., & Lukman, K. A. (2022). Workplace Violence in Healthcare Settings: The Risk Factors, Implications and Collaborative Preventive Measures. *Annals of Medicine and Surgery, 78*, 103727. https://doi.org/10.1016/j.amsu.2022.103727

Matheson, G. J. (2019). We Need to Talk About Reliability: Making Better Use of Test-Retest Studies for Study Design and Interpretation. *PeerJ, 7*, e6918. https://doi.org/10.7717/peerj.6918

McCoy, T. P., Sauer, P. A., & Sha, S. (2023). Resilience in Nurses: The Reliability and Validity of the Resilience Scale. *Journal of Nursing Measurement.* https://doi.org/10.1891/JNM-2022-0019

Melchior, F., Beyreuther, K., & Teichmann, B. (2024). Translation, Validation, and Comparison of Genetic Knowledge Scales in Greek and German. *Frontiers in Genetics, 15*, 1350308. https://doi.org/10.3389/fgene.2024.1350308

Pronk, T., Molenaar, D., Wiers, R. W., & Murre, J. (2022). Methods to Split Cognitive Task Data for Estimating Split-Half Reliability: A Comprehensive Review and Systematic Assessment. *Psychonomic Bulletin & Review, 29*(1), 44-54. https://doi.org/10.3758/s13423-021-01948-3

Raykov, T., Al-Qataee, A. A., & Dimitrov, D. M. (2020). Examining Validity-Related Correlations and Their Differences Under Assumption Violations. *Educational and Psychological Measurement, 80*(2), 389-398. https://doi.org/10.1177/0013164418822703

Romero-García, M., de la Cueva-Ariza, L., Benito-Aracil, L., Lluch-Canut, T., Trujols-Albet, J., Martínez-Momblan, M. A., et al. (2018). Nursing Intensive-Care Satisfaction Scale [NICSS]: Development and validation of a patient-centred instrument. *Journal of Advanced Nursing, 74*(6), 1423-1435. https://doi.org/10.1111/jan.13546

Rönkkö, M., & Cho, E. (2022). An Updated Guideline for Assessing Discriminant Validity. *Organizational Research Methods, 25*(1), 6-14. https://doi.org/10.1177/1094428120968614

Saumur, T. M., Mathur, S., Nestico, J., Perry, S. D., Mochizuki, G., & Mansfield, A. (2021). Test-retest Reliability of Force Plate-Derived Measures of Reactive Stepping. *Journal of Biomechanics, 115*, 110185. https://doi.org/10.1016/j.jbiomech.2020.110185

Southwick, S. M., Bonanno, G. A., Masten, A. S., Panter-Brick, C., & Yehuda, R. (2014). Resilience Definitions, Theory, and Challenges: Interdisciplinary Perspectives. *European Journal of Psychotraumatology, 5*(S4), 25338. https://doi.org/10.3402/ejpt.v5.25338

Stacciarini, T. S., & Pace, A. E. (2017). Confirmatory factor analysis of the Appraisal of Self-Care Agency Scale - Revised. *Revista Latino-Americana de Enfermagem, 25*, e2856. https://doi.org/10.1590/1518-8345.1378.2856

Tavakol, M., & Dennick, R. (2011). Making Sense of Cronbach's Alpha. *International Journal of Medical Education, 2*, 53-55. https://doi.org/10.5116/ijme.4dfb.8dfd

Teresi, J. A., Yu, X., Stewart, A. L., & Hays, R. D. (2022). Guidelines for Designing and Evaluating Feasibility Pilot Studies. *Medical Care, 60*(1), 95-103. https://doi.org/10.1097/MLR.0000000000001664

Ucan, E., & Avci, D. (2023). Turkish Adaptation of the Nursing Student Academic Resilience Inventory: A Validity and Reliability Study. *Nurse Education Today, 126*, 105810. https://doi.org/10.1016/j.nedt.2023.105810

Wang, J., Zeng, Q., Wang, Y., Liao, X., Xie, C., Wang, G., et al. (2022). Workplace Violence and the Risk of Post-Traumatic Stress Disorder and Burnout Among Nurses: A Systematic Review and Meta-Analysis. *Journal of Nursing Management, 30*(7), 2854-2868. https://doi.org/10.1111/jonm.13809

Yoshikawa, A., & Smith, M. L. (2019). Mediating Role of Fall-related Efficacy in a Fall Prevention Program. *American Journal of Health Behavior, 43*(2), 393-405. https://doi.org/10.5993/AJHB.43.2.15

Yusoff, H. M., Ahmad, H., Ismail, H., Reffin, N., Chan, D., Kusnin, F., et al. (2023). Contemporary Evidence of Workplace Violence Against the Primary Healthcare Workforce Worldwide: A Systematic Review. *Human Resources for Health, 21*(1), 82. https://doi.org/10.1186/s12960-023-00868-8

Zhu, H., Wan, J., Shi, K., & Li, H. (2016). Scale Design and Research on Composition of Resilience of Medical Staff. *Statistics &. Information Forum, 31*(2), 107-112. https://doi.org/10.3969/j.issn.1007-3116.2016.02.017