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Psychometric Evaluation of the Disaster Preparedness Evaluation Tool© (DPET) on Emergency Nurses in Mainland China: Two Cross-Sectional Studies

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Original Research

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Abstract

Background: Emergency nurses play a major role in disaster relief in mainland China, but there is no valid instrument to measure the extent of their disaster preparedness. The Disaster Preparedness Evaluation Tool© is a reliable instrument to assess the disaster preparedness of nurse practitioners. The tool has been translated and validated in Saudi Arabia, Taiwan, China and the United States of America.

Objectives: This study aimed at translating and adapting the Disaster Preparedness Evaluation Tool© (DPET) for emergency nurses in mainland China and determining its psychometric properties.

Design, Settings and Participants: A total of 2 cross-sectional online surveys were conducted in the emergency departments of 26 public grade III-A hospitals in Guangdong, mainland China. In the first study, 633 emergency nurses were recruited from May to August, 2018. In the second study, 205 were recruited in April 2019.

Methods: The instrument was adapted through rigorous forward-backward translation, face validity, and pre-test processes. Exploratory factor and parallel analyses were used in the first study. Confirmatory factor analysis, internal consistency and split-half reliability were used in the second study.

Results: Exploratory factor and parallel analyses extracted a 5-factor solution comprising of 34 items that accounted for 64.06% of the total variance. The fit indices indicated a good model fit. The reliability was good, as indicated by a Cronbach's alpha of 0.97 and a split-half reliability coefficient of 0.97.

Conclusion: The mainland China version of the DPET (DPET-MC) was a reliable and valid instrument and can be used in practice.

Introduction

Disaster refers to situations where the impact of natural and man-made phenomena exceed the capacity of the hazard-affected community to cope with it, thus leading to the destruction of normal conditions, the loss of life, and damage to property and the environment.[1] According to the International Disaster Database, from 2007 to 2012, 1931 natural disasters occurred in 117 countries, causing 610768 deaths, 1 billion injuries, and economic losses to the tune of 75 trillion dollars.[2,3]

Disaster preparedness is defined as "activities and measures taken in advance to ensure effective responses to disasters, including the issuance of early warnings and the emergency evacuation from threatened areas."[4] The well-prepared individuals and teams could take timely and effective measures to reduce the damage caused by disasters. Nurses play an indispensable role during disasters and are often the first responders in disaster relief operations.[5] When a disaster occurs, nurses should be able to evaluate and meet patients' needs, utilize available resources and collaborate with other professionals to deliver emergency care. Disaster nursing refers to the systematic and flexible application of knowledge and skills with the characteristics of the nursing discipline, and cooperates with other professional fields to carry out activities aimed at mitigating the hazards of disasters to human life and health. The International Council of Nursing (ICN) established a framework for disaster nursing core competencies in 2009, which comprised 4 areas that corresponded to different stages of a disaster, namely prevention, preparedness, response, and recovery.[6] Therefore, it is necessary to evaluate the disaster preparedness of nurses before preparing and implementing education and training programs on disaster nursing.

Background

Disasters have taken place frequently and have caused serious damage in mainland China. According to the China Earthquake Administration (CEA), over 100 earthquakes of magnitude 5 or above occurred in China between 2016 and 2019.[7] The Chinese government enacted the Response Plan for disasters, and prioritized sending the China Emergency Medical Team (CEMT), as well as doctors and nurses to designated areas after a disaster.[8] Emergency nurses are the largest group of disaster relief providers in mainland China. They operate as frontline health care providers, educators, mental health counsellors, and triage officers. Disaster relief work under dangerous and hard conditions requires emergency nurses with good health, psychological qualities, adaptability, and professional capacities.[9] Disaster nursing started late in mainland China, and the discipline system was not complete. The Disaster Nursing Committee of the Chinese Nursing Association was established in 2009; It gradually carried out disaster-related lectures and short-term courses. However, the demand of disaster nursing training for nurses is high and the overall disaster preparedness level is low at present. Some studies have reported that emergency nurses showed a low-to-moderate level of disaster preparedness in mainland China.[10] They said that they had not received systematic disaster nursing training and felt underprepared. Therefore, it is necessary to develop a suitable training program for emergency nurses in mainland China in order to help them respond to disaster better.

Although there are a few tools to measure nurses' disaster preparedness in English, most lack reliability, and validity tests and are not widely used.[11-13] The Disaster Preparedness Evaluation Tool© (DPET) is 1 of the most widely used scales to assess disaster preparedness and has good psychometric properties.[14] Moreover, the DPET measures the knowledge, skills, awareness, and management ability of disaster preparedness in the 3 stages before, during, and after a disaster, with the broadest coverage, and meets the definition of disaster preparedness. Since Bond and Tichy's initial study in 2009, the DPET has been used to evaluate different nursing populations around the world, including in Taiwan, China,[15] Saudi Arabia,[16] Japan,[17] Jordan,[18] Indonesia,[19] and America.[20]

Although a Taiwan's version of the DPET (DPET-C) has been adapted in Taiwan, China, a mainland China version is still necessary, considering the differences between the 2 places. First, the political backgrounds are different because of the implementation of the '1 country, 2 systems' policy. Second, there are cultural differences between the 2 places, resulting in different understanding and language habits. Third, the 2 studies focus on different population groups. The DPET-C was based on public health nurses while our study is based on emergency nurses. Fourth, both places differ in terms of terrain and climate, and each is vulnerable to different types of disasters and has different requirements when it comes to disaster preparedness.[21] In addition, researchers introduced the DPET into mainland China and translated it into Chinese in 2014.[22] However, this version was only a direct translation of the DPET, without a validity test, cultural adaptation and reliability. Therefore, it is necessary to translate and adapt a version of the DPET for mainland China.

Purpose

The purpose of our study was to translate and adapt the DPET in order to create a version for mainland China (DPET-MC), and to validate its psychometric properties.

Methods

Design

The translation and validation processes were performed in 3 phases. In phase 1, the DPET was translated from English into Chinese through a translation and back-translation process. In phase 2, a sample of 30 emergency nurses was pre-tested to establish the preliminary reliability of the DPET-MC. In phase 3, a psychometric evaluation of the DPET-MC was performed (Figure 1).

The Original DPET Questionnaire

The DPET was constructed by Bond and Tichy (2007) to assess the disaster preparedness of nurse practitioners (NPs) in America.[14] The DPET was developed based on the ICN framework of disaster nursing competencies by a respected academic institution. The instrument includes 68 items and 2 sections to measure NPs' perceptions of their disaster preparedness. Section 1, titled 'Introduction,' contains 47 Likert-type questions. The first 25 items discuss pre-disaster preparedness and the items are grouped into 3 categories, namely knowledge, disaster skills, and personal preparedness. The next 16 items discuss disaster response and the items are grouped into 2 categories, namely knowledge and patient management. The last 6 items discuss disaster recovery and the items are grouped into 2 categories, namely knowledge and management. Each item is rated on a 6-point Likert scale wherein 1 = 'strongly disagree,' 2 = 'disagree,' 3 = 'partly disagree,' 4 = 'partly agree,' 5 = 'agree,' and 6 = 'strongly agree.' Adding the score for each item produces a total score that can range from 47 to 282, with higher scores indicating a greater degree of disaster preparedness. The DPET has adequate internal consistency reliability. The Cronbach's alpha coefficients are 0.91, 0.93, 0.93, and 0.91 for the overall scale and 3 dimensions, respectively. Section 2, titled 'Demographic data' consists of 21 open-ended questions.

Phase 1: Translation and back-translation

The original version was translated into Chinese in keeping with the 'Process of Cross-Cultural Adaptation Guidelines.'[23] The translation was carried out by an emergency nurse and a medical teacher and the back-translation was carried out by a professional translator who had never seen the index before. A multidisciplinary committee panel reviewed the 3 versions of the DPET including the original, the translated, and the back-translated versions, consolidated the 3 versions, and developed a pre-test version for the pre-test stage. In order to evaluate the comprehensibility and universality of the final version, a face validation was conducted wherein 10 Chinese women, aged 25 to 45 years with normal literacy and comprehension levels, and without any medical background, were included to complete the questionnaire and undergo an interview. Comprehension problems, verbal errors, and unclear expressions were recorded and suitable modifications were made.

Phase 2: Pre-test

A pre-test was undertaken using the pre-test version of the DPET questionnaire with a convenience sample of 30 emergency nurses (sub-sample 1) in a third-grade hospital in Guangdong, China.[24] The internal consistency and test-retest reliabilities were analyzed using Cronbach's alpha coefficients and internal correlation coefficients (ICC).

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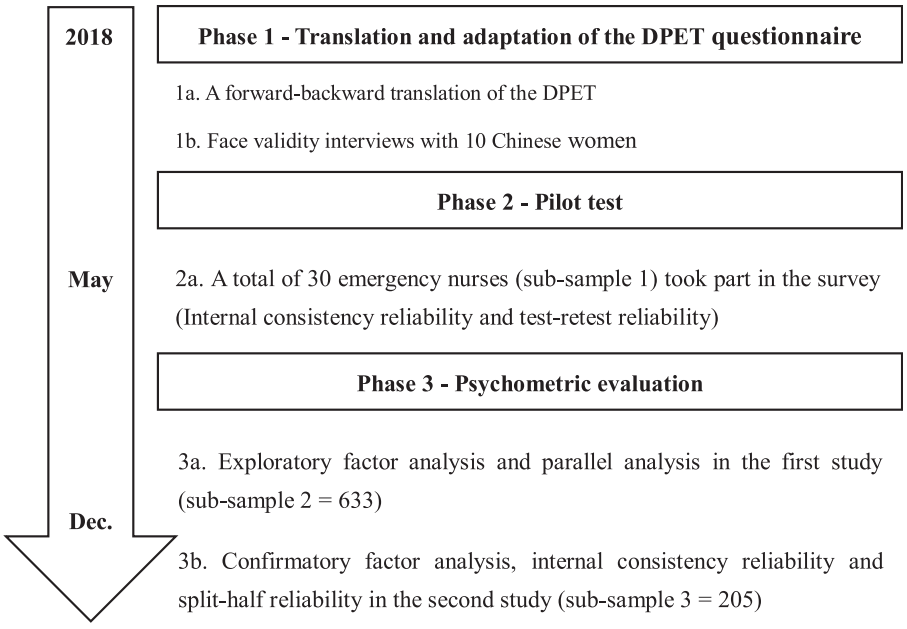

Figure 1. Translation and validation of the Disaster Preparedness Evaluation Tool (DPET).

Phase 3: Psychometric Evaluation

Study Design

A total of 2 cross-sectional studies were undertaken following the STROBE statement.[25] The former examined the construct validity of the DPET while the latter tested the model fit, internal consistency reliability and split-half reliability of the DPET-MC.

Participants and Settings

In this study, researchers selected 26 public hospitals in Guangdong province according to the convenient principle, surveyed nurses in emergency departments, and obtained 2 convenience samples. A sample of 633 emergency nurses was recruited in the first study between May and August, 2018. A sample of 205 emergency nurses was recruited in the second study in April 2019. The inclusive criteria were age (≥ 18 years) and willingness and ability to provide informed consent to participate in the study. Non-registered nurses and student nurses were excluded.

The sample size was determined by the requirements of exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). For EFA (sub-sample 2), the sample size was estimated to be at least 470 (for the 47-item version of the questionnaire), according to the recommendations that a minimum participant to variable ratio of 10:1 should be achieved.[26] For CFA (sub-sample 3); We used the guideline that for maximum likelihood estimation (MLR), at least 200 participants were required.[27]

Instruments

The first study used the DPET tool with the original 47 Likert-type questions. The second study used the DPET-MC tool after determining the construct validity by performing EFA. Furthermore, 6 questions on demographic data (age, gender, education, hospitals, years of work and previous experience of disaster relief) were filled by all participants.

Procedure and Data Collection

Both studies were based on an online questionnaire survey which followed every item of the 'CHERRIES' guidelines rendered via a software named 'Questionnaire Star' (Changsha Ranxing Information Technology Limited Liability Company, Changsha, China). The questionnaire had 2 sections. Section A focused on demographic and clinical background questions and Section B focused on the Likert-type questions. The questionnaire was distributed online through links and Quick Response (QR) codes, which were accessible without a password and took approximately 10 minutes to complete. To ensure active participation, researchers contacted head nurses of each hospital individually, asking them to help distribute questionnaires in their WeChat groups and monitor the whole process. Nurses who agreed to participate in the study were expected to open the questionnaire and submit it only after completing all questions. Participants would receive a small gift after completing the questionnaire. To avoid alter-time access in completing the questionnaire, an IP number was used for access restriction. The online survey would be available for 1 week. After the deadline, the system would close automatically and participants were unable to fill in and submit questionnaires. Completed questionnaires were collected automatically and were exported to an Excel file manually.

Statistical Analysis

Data were analyzed using Excel®, SPSS® Software (version 23) (IBM SPSS Inc., Chicago, Illinois), AMOS® Software (version 23) (IBM SPSS Inc., Chicago, IL), and Vista® Software (version 64) (Microsoft Corporation, Redmond, WA).

First, descriptive statistics were drawn up to examine the data distributions. Second, EFA was used to establish the construct validity of the DPET tool by performing principal components analysis (PCA) with varimax rotation. The appropriateness of the factor analysis was evaluated using the Kaiser-Meyer-Olkin (KMO) measure, where a score is considered good if it is higher than 0.90 and excellent if it is greater than 0.95. Bartlett's test was used to test the sphericity and determinant of the correlation matrix ($P < 0.05$). The eigenvalues-greater-than-1 rule and the scree plot can determine the factor number.[28] Items were excluded when they met the following criteria: (1) item loading < 0.50 on 1 factor or (2) item

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Table 1. Demographic and clinical background information of the analyzed participants

Variables	Subsample 1[a] (n=30)	Subsample 2[b] (n=633)	Subsample 3[c] (n=205)
Age, median (range)	31 (20-65)	29 (18-55)	32 (21-49)
Gender, n (%)			
Men	1 (3.4)	118 (18.6)	34 (16.59)
Women	28 (96.6)	515 (81.4)	171 (83.41)
Education, n (%)			
Junior college	7 (24.1)	227 (35.86)	57 (27.8)
University	22 (75.9)	406 (64.14)	148 (72.2)
Years of work, n (%)			
0-5	17 (58.6)	261 (41.23)	49 (23.9)
6-10	3 (10.3)	196 (30.96)	68 (33.17)
11-15	2 (6.9)	90 (14.22)	36 (17.56)
Over 15	7 (24.1)	86 (13.59)	52 (25.37)
Hospital level, n (%)			
Third grade	29 (100)	563 (88.94)	114 (55.61)
Second grade	0	60 (9.48)	82 (40)
First grade	0	10 (1.58)	9 (4.39)
Previous experience, n (%)			
Had experienced	5 (17.2)	61 (9.64)	17 (8.29)
None	24 (82.8)	572 (90.36)	188 (91.71)

Note: [a]the pilot testing phase; [b]the EFA phase; [c]the CFA phase.

loading > 0.40 on 2 factors.[29] Parallel analysis (PA) verified the accuracy of the factors extracted.[30] The number of factors was equal to the number of sample eigenvalues exceeding the corresponding mean eigenvalues and the 95th eigenvalues obtained from the random data correlation matrices.[31]

Third, CFA was performed using Maximum Likelihood Estimate (MLE) after EFA to examine the structural model fit of the DPET-MC tool. The following criteria were used to evaluate the fit indexes: Chi square statistic/ degrees of freedom (x^2/ DF) < 3.0; root-mean-square error of approximation (RMSEA) < 0.08; the incremental fit index (IFI), the Tucker-Lewis index (TLI), and the comparative fit index (CFI) > 0.90.[32,33]

Fourth, internal consistency reliability was performed to assess the coordinated degree among dimensions and items in the scale. A Cronbach's alpha higher than 0.70 is considered acceptable and higher than 0.90 is considered good.[34,35] Split-half reliability was used to test the degree of consistency within items. Items were grouped using odd and even-half method. In general, a split-half reliability coefficient higher than 0.75 was acceptable and lower than 0.40 was poor.[36]

Results

Phase 1

After the translation and back-translation process, a pre-test version of the DPET was produced. All the translators made modifications and cultural adjustments during discussions. No difficulties were encountered during the translation and adaptation process because the translators were experienced and there was a Taiwanese version to act as a reference. Similarly, the remaining steps in the process proceeded without any challenges. The results of face validity indicated that the scale was acceptable and comprehensive.

Phase 2

The pre-test scale was completed by 30 emergency nurses (subsample 1, overall response rate = 96.7%) in a third-grade hospital in Guangdong, China. Participants were invited to complete the questionnaires 2 weeks later (overall response rate = 96.7%). The Cronbach's alpha coefficient was 0.99 and the ICC was 0.60.

Phase 3

Demographic and Clinical Background Information

In the first study, 633 emergency nurses were recruited (response rate = 100%). Participants' ages ranged from 18 to 55 years. Most of them were female (n = 515; 81.4%). Most had attended university (n = 406; 64.14%). Most features of the second study were similar to those of the first. The participants' demographic information was summarized in Table 1.

Exploratory Factor Analysis and Parallel Analysis

The KMO value (0.972) and Bartlett's test of sphericity ($x^2 = 24551.88$, $P < 0.001$) suggested that the data were appropriate for PCA. The PCA with varimax rotation and the scree plot extracted a 5-factor solution that explained 64.06% of the total variance. Finally, 5 factors with 34 items were extracted: pre-disaster management (10 items), post-disaster skills and knowledge (7 items), pre-disaster knowledge (8 items), knowledge and skills in the workplace (6 items), and pre-disaster awareness (3 items). Factor loadings, item communalities, and the variance explained by the factors are shown in Table 2. A total of 5 factors were extracted using PA, too.

Confirmatory Factor Analysis

CFA was performed to validate the 5-factor structure after determining the construct validity with sub-sample 3. A second-order

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Table 2. Exploratory factor analysis with factor loadings for the DPET scale

Item Description	1	2	3	4	5
I would be interested in educational classes on disaster preparedness that relate specifically to my community situation.	−0.154	0.106	0.211	0.097	**0.654**
I know the limits of my knowledge, skills, and authority as an NP to act in disaster situations.	−0.042	0.022	0.058	0.014	**0.797**
I am aware of potential vulnerabilities in my community (e.g. earthquake, floods, terror).	0.212	0.05	0.049	0.013	**0.666**
I find that the research literature on disaster preparedness is understandable.	0.219	0.103	**0.514**	0.106	0.446
I have a list of contacts in the medical or health community in which I practice. I know referral contacts in case of a disaster situation (eg, health department).	0.135	0.186	**0.648**	0.141	0.176
I read journal articles related to disaster preparedness.	0.188	0.212	**0.651**	0.176	0.214
I know where to find relevant research or information related to disaster preparedness and management to fill in gaps in my knowledge.	0.264	0.183	**0.717**	0.11	0.09
I find that the research literature on disaster preparedness and management is easily accessible.	0.345	0.116	**0.66**	0.107	0.118
In case of a disaster situation, I think that there is sufficient support from local officials on the county or state level.	0.045	0.127	**0.652**	0.152	0.153
I am familiar with the local emergency response system for disasters.	0.459	0.233	0.55	0.223	0.068
Finding relevant information about disaster preparedness related to my community needs is an obstacle to my level of preparedness.	0.117	−0.053	0.143	0.171	0.438
I know who to contact (chain of command) in disaster situations in my community.	0.413	0.17	**0.549**	0.199	0.005
I am aware of classes about disaster preparedness and management that are offered in my workplace, the university, or community.	0.272	0.301	**0.598**	0.207	0.008
I participate in one of the following educational activities on a regular basis: continuing education classes, seminars, or conferences dealing with disaster preparedness.	0.509	0.251	0.513	0.101	0.04
I have participated in emergency planning for disaster situations in my community.	**0.73**	0.275	0.271	0.052	0.087
I participate/have participated in creating new guidelines or emergency plans or in lobbying for improvements on the local or national level.	**0.749**	0.283	0.256	0.039	0.074
In case of a bioterrorism/biological attack, I know how to use personal protective equipment.	**0.51**	0.228	0.337	0.368	0.013
I am familiar with accepted triage principles used in disaster situations.	0.075	0.109	0.216	**0.685**	0.062
In a case of bioterrorism/biological attack, I know how to perform isolation procedures so that I minimize the risks for community exposure.	0.418	0.214	0.348	**0.534**	−0.04
I participate in disaster drills or exercises at my workplace (eg, clinic, hospital) on a regular basis.	0.327	0.221	0.469	0.324	−0.002
In case of a bioterrorism/biological attack, I know how to execute decontamination procedures.	**0.68**	0.281	0.341	0.234	0.055
I consider myself prepared for the management of disasters.	**0.598**	0.268	0.334	0.394	0.032
I would be considered a leadership figure in my community in a disaster situation.	**0.746**	0.313	0.165	0.189	0.09
I have personal/family emergency plans in place for disaster situations.	**0.641**	0.229	0.262	0.412	0.045
I have an agreement with loved ones and family members on how to execute our personal/family emergency plans.	0.557	0.182	0.207	0.534	0.07
I am familiar with psychological interventions, behavioral therapy, cognitive strategies, support groups and incident debriefing for patients who experience emotional or physical trauma.	**0.609**	0.364	0.267	0.346	0.097
I am able to describe my role in the response phase of a disaster in the context of my workplace, the general public, media, and personal contacts.	**0.53**	0.362	0.317	0.447	0.104
Some research has shown that NPs feel constrained by medical malpractice concerns or license restrictions in terms of responding to disasters. This constraint applies to me too.	0.3	0.159	0.049	**0.504**	0.213
I am familiar with the organizational logistics and roles among local, state, and federal agencies in disaster response situations.	**0.672**	0.388	0.303	0.199	0.059
I would feel reasonably confident providing patient education on stress and abnormal functioning related to trauma.	0.419	**0.5**	0.227	0.387	0.06
I can manage the common symptoms and reactions of disaster survivors that are of an affective, behavioral, cognitive, or physical nature.	0.503	0.474	0.243	0.401	0.078
I feel reasonably confident I can treat patients independently without supervision of a physician in a disaster situation.	0.36	0.352	0.126	**0.593**	0.111
I can identify possible indicators of mass exposure evidenced by a clustering of patients with similar symptoms.	0.322	0.429	0.228	**0.594**	0.119
I would feel confident working as a triage NP and setting up temporary clinics in disaster situations.	0.256	0.437	0.16	**0.618**	0.173
As an NP, I would feel confident as a manager or coordinator of a shelter.	0.211	0.549	0.172	0.571	0.071
As an NP, I would feel confident in my abilities as a direct care provider and first responder in disaster situations.	0.028	0.572	0.201	0.589	0.089

(*Continued*)

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Table 2. (*Continued*)

Item Description	1	2	3	4	5
I would feel confident implementing emergency plans, evacuation procedures, and similar functions.	0.022	0.58	0.211	0.624	0.071
As an NP, I would feel reasonably confident in my abilities to be a member of a decontamination team.	0.057	0.617	0.19	0.482	0.034
I feel reasonably confident discerning deviations in health assessments indicating potential exposure to biological agents.	0.253	**0.648**	0.201	0.353	0.067
I am familiar with the main groups (A, B, C) of biological weapons (eg, anthrax, plague, botulism, smallpox), their signs and symptoms, and effective treatment.	0.456	0.673	0.145	0.132	0.07
In a bioterrorism/biological attack, I would know how to perform a focused health history and assessment specific to bioagents that are used.	0.512	0.681	0.177	0.133	0.038
I am familiar with what the scope of my role would be in a postdisaster situation.	0.129	**0.717**	0.262	0.234	0.038
I am able to discern signs and symptoms of acute stress disorder and post-traumatic stress disorders (PTSD).	0.427	**0.723**	0.194	0.161	0.045
I am comfortable providing education on coping skills and training for patients who experience traumatic situations.	0.398	**0.717**	0.19	0.235	0.044
I am comfortable managing (treating, evaluating) emotional outcomes for acute stress disorder or PTSD.	0.36	**0.713**	0.189	0.255	0.02
I am familiar with how to perform focused health assessment for PTSD.	0.42	**0.72**	0.238	0.211	0.001
I participate in peer evaluation of skills in disaster preparedness and response.	0.463	0.63	0.296	0.106	−0.014

Note: Factor loadings exceeding 0.50 on one factor are in boldface (except for exceeding 0.40 on two factors).

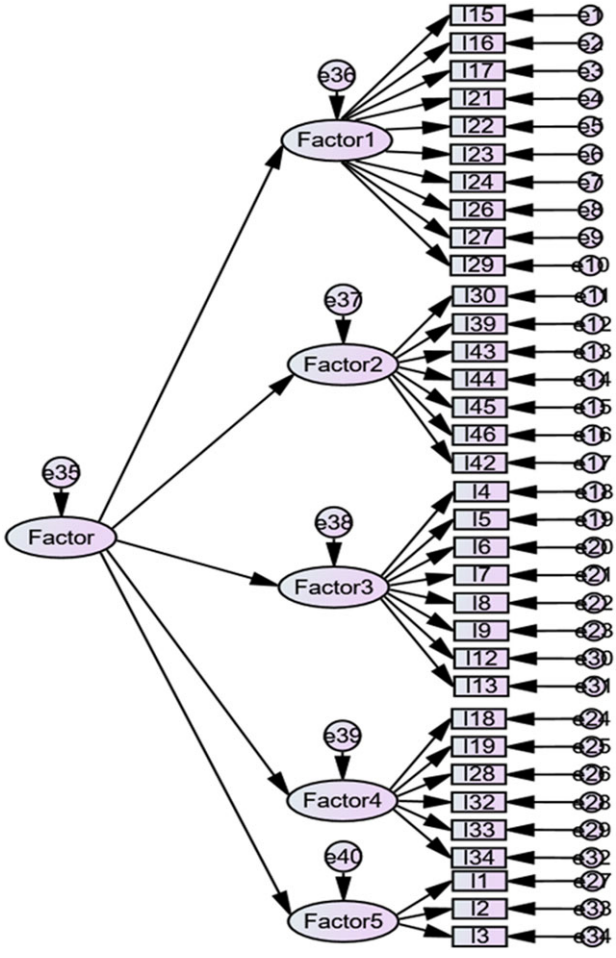

Figure 2. The factor structure of Disaster Preparedness Evaluation Tool – Mainland China version (DPET-MC).
Note: Factor: disaster preparedness; Factor 1: pre-disaster management; Factor 2: post-disaster skills and knowledge; Factor 3: pre-disaster knowledge; Factor 4: knowledge and skills in the workplace; Factor 5: pre-disaster awareness; I: item; e: residual error.

model including 5 factors was measured using 34 items (Figure 2). The goodness of fit of the model was good: x^2/ DF = 1.978, RMSEA = 0.071, IFI = 0.907, TLI = 0.90, CFI = 0.90. The standardised pathway loading variance and number of items for each factor are listed as follows: 0.44-0.86 for 10 items (factor 1), 0.75-0.88 for 7 items (factor 2), 0.58-0.83 for 8 items (factor 3), 0.51-0.88 for 6 items (factor 4), and 0.53-0.66 for 3 items (factor 5).

Reliability

The Cronbach's alpha for the total scale was 0.97, and the coefficients for the sub-scales ranged from 0.79 to 0.96. The split-half reliability for the total scale was 0.97, and the coefficients for the subscales ranged from 0.67 to 0.95 (Table 3).

Discussion

In this study, we obtained a DPET-MC scale with 5 dimensions and 34 items that indicated good psychometric properties. This scale may be a reliable and valid instrument to assess disaster preparedness among emergency nurses in mainland China and can provide guidelines for constructing training programs and assignments.

The translation process was conducted rigorously following the 'Process of Cross-Cultural Adaptation Guidelines' to maintain equivalence. The results of face validity and the pre-test promoted the comprehensibility and credibility of the scale. The EFA extracted a 5-factor solution with 34 items, which accounted for 64.06% of the total variance, including (1) pre-disaster management, (2) post-disaster skills and knowledge, (3) pre-disaster knowledge, (4) knowledge and skills in the workplace, and (5) pre-disaster awareness. The 5 dimensions of the DPET-C were: post-disaster management, skills, knowledge of self-preparation in a disaster, knowledge to respond in the community and knowledge to respond in the workplace. The 5-factor solution of the DPET-MC scale was consistent with the DPET-C scale for Taiwan and China.[15] Since both scales were applicable to Chinese nurses, they did have some common features. However,

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Table 3. Internal consistency reliability and split-half reliability of the DPET-CM scale

Dimension	Cronbach's alpha	95% confidence interval	Split-half reliability	95% confidence interval
Total scale	0.97	0.96, 0.97	0.97	0.96, 0.97
Pre-disaster awareness	0.79	0.74, 0.84	0.67	0.59, 0.74
Pre-disaster knowledge	0.88	0.85, 0.91	0.87	0.84, 0.89
Pre-disaster management	0.94	0.92, 0.95	0.94	0.92, 0.95
Knowledge and skills in the workplace	0.90	0.88, 0.92	0.89	0.87, 0.91
Post-disaster skills and knowledge	0.96	0.95, 0.96	0.95	0.93, 0.96

there were also some differences such as the number of items, item splitting, and the contents of the dimensions. The reasons for this may be the differences in the economic and medical environments, political policies, language habits (Taiwan uses traditional characters, while mainland China uses simplified characters), and applicable groups (the study on Taiwan targeted public health nurses, while this study on mainland China was tailored towards emergency nurses).[38] The DPET-C scale indicated that nurses should be able to participate in emergency planning and prevent the threat of biological and chemical weapons and nuclear radiation. However, according to the DPET-MC scale, nurses were more likely to be equipped with disaster knowledge, skills, management and coordination. The reasons for the differences might be: (1) there were few biological and chemical threats in mainland China, so relevant training and education were insufficient; (2) emergency departments of Chinese hospitals attached more importance to comprehensive first-aid skills, such as wound classification, cardiopulmonary resuscitation (CPR) and fracture fixation; (3) the rescue of biological and chemical weapons mainly relied on professional medical institutions, such as the Chinese Centre for Disease Control and Prevention; (4) the prevention of nuclear radiation was mainly in the charge of specialized military hospitals, which were not involved in this investigation. Meanwhile, the 5-factor solution in the DPET-MC scale was different from the Arabic version of the DPET, which extracted 3 factors, namely knowledge, skills, and post-disaster management.[16] The reasons for this might be the differences in culture and perceptions between the 2 different countries. Furthermore, the DPET-MC scale did not fit the factor structure proposed by Heather C King in the US version[20] which included 3 factors, namely disaster knowledge, disaster skills, and personal preparedness. The discrepancy might be the result of the different characteristics of the participants in both studies, as our study focused on emergency nurses and their study focused on health care personnel.

The reliability of the scale was good, as indicated by the excellent results of internal consistency reliability and split-half reliability. The Cronbach's alpha was 0.97 and the split-half reliability coefficient was 0.97, which were higher than the acceptable coefficients of 0.70 and 0.75. The results of reliability indicated the items in the scale and subscales that measured the same trait.[40]

This study had some practical advantages. The DPET-MC scale had fewer items when compared to the original scale, which can save time and energy for emergency nurses in a fast-paced work environment. The EFA, PA, and CFA were used to identify the validity of the scale and draw up a reliable solution that could provide guidelines for educators and managers to construct pre-disaster training and post-disaster assignment.[41]

This study had a few limitations as well. First, the scale was translated and validated within Guangdong province in China. Thus, it is unclear whether the statistical results can be replicated in other regions in China. Second, the self-reporting method has the potential to lead to subjective results when nurses assess their capabilities, rather than objective observations and evaluations by a third person's unbiased perspective. Third, emergency nurses in this study were mainly from third-grade hospitals and could not represent other grade hospitals. Therefore, the promotion of this tool is limited. Future studies should ensure appropriate proportions in the collection of research subjects. Fourth, most of the emergency nurses included in this study were female, which could not represent male nurses as well. Future research should take into account the representativeness of the sample. Fifth, in this study, the convenience sampling was used to obtain an un-representative sample. Future studies should consider more objective sampling methods, such as stratified sampling. Sixth, professional titles of emergency nurses should be included in the description of demographic data, because different professional titles might lead to different levels of disaster preparedness.

Conclusion

The DPET-MC scale was translated and validated using various methods with the involvement of teachers, experts, and emergency nurses in mainland China. The results indicated that the DPET-MC scale was a reliable and valid instrument to assess disaster preparedness of emergency nurses. Educators can identify the prevailing level of disaster preparedness among emergency nurses and were able to develop appropriate educational programs to enhance it. Managers in hospitals can measure emergency nurses' disaster preparedness to provide evidence for pre-disaster targeted training and post-disaster assignments.

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Ethical Standardss. The School and all the hospitals approved the study. Participants provided their informed consent, and the information received from them was treated as confidential.[37] Professors Bond and Tichy authorized the researchers via email to use and translate the DPET into mainland China version.

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