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RESEARCH METHODOLOGY

The Disaster Preparedness Evaluation Tool©: psychometric testing of the Classical Arabic version

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Abstract

Title. The Disaster Preparedness Evaluation Tool©: psychometric testing of the Classical Arabic version.

Aim. This paper is a report of a study conducted to translate the Disaster Preparedness Evaluation Tool© into Arabic and to determine its psychometric properties, including reliability, validity and factorial structure.

Background. Worldwide numbers of natural and man-made disasters have greatly increased in recent years. Since disaster strikes without warning, all healthcare providers, especially nurses, must be prepared with appropriate skills and resources for disaster procedures and management during the three phases of disaster: pre disaster, during disaster and post disaster. Knowledge levels need to be evaluated to plan effective educational programmes.

Methods. The Disaster Preparedness Evaluation Tool© was translated into Classical Arabic using Beaton's guideline for translation and validated by experts and a pilot study with 20 Registered Nurses from the target population. Data were collected in 2008 using self-administered questionnaires from 474 (79% return rate) Jordanian Registered Nurses who worked in randomly selected Ministry of Health hospitals and two university hospitals.

Results. Principal component analysis (Promax rotation with Kaiser Normalization procedure, SPSS© version 15) was used to determined construct validity, and three factors explained 64% of the variance: *knowledge, skills* and *post disaster management*. Cronbach's alpha was 0·90, which demonstrated internal consistency.

Conclusion. These results support the reliability and validity of the Disaster Preparedness Evaluation Tool© as a measure of *knowledge, skills* and *post disaster management*. It can be used with confidence with an Arabic-speaking nursing population to measure their preparedness for disasters. Based on the results of such studies, effective disaster preparedness programmes could be developed to enhance nurses' disaster preparedness.

Keywords: Arabic, Disaster Preparedness Evaluation Tool©, instrument development, Jordan, psychometric testing

Introduction

Disasters are occurring more frequently around the world (Jennings-Sanders *et al.* 2005, Wise 2007), causing more than 75,000 deaths each year, with a direct impact on more than 200,000,000 other people (Deeny & McFetridge 2005). The Asian Disaster Reduction Center (2003) has defined disasters as 'a serious disruption of the functioning of society, causing widespread human, material, or environmental losses which exceed the ability of affected society to cope using, only its own resources'. Not only do such disasters cause serious disruption to society as a whole, but they can also rapidly exceed the capabilities of healthcare systems. Emergency departments worldwide are prepared to address individual casualty patients' needs. However, multiple casualties require massive initial efforts by numerous healthcare providers, not just emergency department providers. They also require long-term support, and this continues to overtax already burdened facilities.

WHO, nursing researchers and educators all strongly recommend disaster preparedness education (Slepski 2005, Stanley 2005, Weiner 2005, Veenema 2006, Romann *et al.* 2007; Tichy *et al.* 2009). Before embarking on educational programmes, nursing leaders need to assess nurses' current preparation levels. Although the DPET® is now available for evaluating disaster preparedness in English, there was no tool available for use with Arabic-speaking nurses.

Background

The World Health Organization (WHO) (2003) addressed the need for disaster preparation in their report on health disaster preparedness, mitigation and response in the Eastern Mediterranean Region. They recommended a multi-hazard strategy, with many key points. The significant points can be summarized as: (i) the need to use a disaster risk management approach; (ii) the requirement for dedicated resources; and (iii) the need for close coordination and collaboration within the healthcare sector for disaster mitigation and preparedness.

To enact the WHO strategy, and since disaster strikes without warning, all healthcare providers must have appropriate knowledge and skills for disaster management before disaster strikes. They must recognize when they cannot provide effective care for multiple victims, and when they must call on outside help to prevent additional mortality and morbidity. This requires appropriate disaster management plans and preparation. Effective general preparation will enable healthcare providers to respond more appropriately, regardless of the type of disaster. Such preparedness can only occur when healthcare providers are aware of the elements of disaster, and have the knowledge, skills, resources and communication abilities with which to address disasters.

Nurses have a significant role in disaster preparedness. However, they are a segment of healthcare providers which is typically underprepared for disaster management (Slepski 2005; Weeks, 2007). Although a few disaster preparedness and management courses have been established in Western nursing schools to prepare nurses for disaster and mass casualty situations management (Bond & Beaton 2005, Veenema 2006), no such courses have been reported in Arab countries. There is also little in the research literature about how nurses perceive their education and preparation. Fung *et al.* (2008) found that 97% of their 164 participants – Registered Nurse Masters' degree students – considered that they were not adequately prepared.

Disaster Preparedness Evaluation Tool (DPET)®

Bond and Tichy (2007) originally developed the Disaster Preparedness Evaluation Tool© to assess the preparedness of Nurse Practitioners for disasters (Tichy *et al.* 2009). The instrument was designed to measure Nurse Practitioner's knowledge and skills regarding disaster/post disaster response and management. Development of the original tool was based on suggested disaster preparedness competencies for nurse practitioners found in the current literature from the American Association of Colleges of Nursing's Essentials of Master's Education (1996), the Nurse Practitioners' competencies of the National Organization of Nurse Practitioner Faculties (NONPF) (2002), and recommendations of a Nurse Practitioner panel comprised of NPs who were experts in disaster.

The DPET® instrument has 68 items which measure nurse practitioners' perceptions of their preparedness for disaster management. Forty-seven items are Likert-type questions with six response options ranging from strongly disagree to strongly agree.

The first 25 items relate to *Pre Disaster Preparedness*. Response choices range from 1 to 6 (Strongly Disagree to Strongly Agree). Cronbach's alpha was 0·93 for all items in the preparedness section. The items were grouped into three categories: knowledge, disaster skills, and personal preparedness.

The next 16 items relate to *Response*. Response choices also range from 1 to 6 (Strongly Disagree to Strongly Agree), with a Cronbach's Alpha of 0·93. The items are grouped into two categories: knowledge and patient management.

The last six items relate to the *Recovery* stage of disaster. Response choices range from 1 to 6 (Strongly Disagree to Strongly Agree), with a Cronbach's alpha of 0·91. The items

are grouped in two categories: knowledge and management. In addition to the Likert-type items, there are 21 open-ended questions and demographic data questions.

Using the Disaster Preparedness Evaluation Tool (DPET®) Tichy *et al.* (2009) found that participants had received some disaster management preparation from undergraduate courses, Masters' degree courses and in-service training. However, similar to Fung *et al.* (2008), they found that 75% of their 166 participants felt unprepared for disaster management.

The study

Aim

The aim of the study was to translate the DEPT© into Arabic and to determine the psychometric properties of the Arabic version, including its reliability, validity, and factorial structure.

Methodology

After modification of the scale for use with Jordanian nurses, three items were omitted because they were applicable only to Nurse Practitioners; the participants of the current study were RNs.

Translation of the instrument

Beaton *et al.* (2000) Guidelines for the Process of Cross-Cultural Adaptation of Self-Report Measures was used as a guideline for translation of the DPET©. The first step was translation of the original questionnaire into classical Arabic by two independent translators. The two translators then met to discuss the translated versions and to agree on one synthesized Arabic version. The DPET© was translated into *classical* Arabic, rather than colloquial Arabic. Arabic-speaking countries may have numerous dialects, but classical Arabic is the written language in all of them. After agreement by the translators, the synthesized Arabic version was back-translated into English by two independent translators. Finally, the back-translated version was compared with the original tool by a committee of experts, who determined that the back-translated tool was identical to the original tool.

Face validity of the Arabic version of the tool was tested by an expert in the field, while the content validity was tested by a panel of experts. This group of experts suggested slight modifications (re-wording) for clarity in Arabic. After these modifications, the intermediate Arabic version was pretested in a pilot study with a group of 20 RNs from the target population. The purpose was to determine if the intermediate Arabic version was comprehensible. Again, slight modifications in wording were made based on feedback from the pilot group. In addition, Dr Bond, the principal author of the original tool, approved the back-translated tool.

The results of the pilot study revealed high Cronbach's alphas, measuring internal consistency for the tool's dimensions: 0·86 for *knowledge*, 0·88 for *during and post disaster management* and 0·90 for *skills*. The overall reliability of the questionnaire as measured by Cronbach's alpha was 0·93. All the above values indicated high internal consistency (Polit & Beck 2004, p. 420).

Participants

The target population for this study was Jordanian RNs working in hospitals in Jordan. The accessible nursing population was RNs working in Ministry of Health hospitals and university hospitals. Nurses working in these hospitals were considered representative of Jordanian nurses. They worked in the three geographical regions of the country (North, South and Middle). A random method was used to select a hospital from each region, except for the university hospitals, of which there are only two; RNs from both university hospitals were included in the study.

Convenience sampling was used to recruit the sample from each of the hospitals, with the following inclusion criteria: RNs who had at least a 3-year diploma in general nursing, had at least 1 year's experience, and were currently working as an RN in a hospital setting. Only RNs were chosen to participate in the study, since the aim was to explore the perceptions of this group of nurses regarding disaster preparedness and management. Hospital administrators distributed the questionnaires at staff meetings in their institutions.

Nunnally and Bernstein (1994) recommended five to ten respondents per item as the ideal sample size. The instrument used for data collection in this study had 65 items, which suggested that 325–650 respondents were needed. Field (2005) stated that a sample of more than 300 was adequate to ensure the reliability of factor analysis. Therefore, 600 RNs were recruited, with 120 questionnaires distributed in each of the five hospitals.

Data collection

The self-administered questionnaires were distributed to all potential participants, accompanied by a cover letter which clarified the purpose of the study, and the rights of participants to choose either to participate or not. The average time needed to complete the questionnaire was given as 20–30 minutes. Those who agreed to participate in the study

Table 1 Total variance explained by principal component analysis initial eigenvalues

	Initial eigenvalues		
Component	Total	% of Variance	Cumulative %
1. PDM	25·79	57·30	57·30
2. SK	1·84	4·08	61·39
3. KN	1·37	3·05	64·43

Extraction method: principal component analysis.
PDM, post disaster management; SK, skills; KN, knowledge.

were informed to complete the questionnaires independently. Submission of a completed questionnaire represented consent to participate. Completed questionnaire were returned to a box in the office of the Director of Nursing, sealed in the envelopes provided. This collection method was used for to increase the response rate; in Jordan mail delivery is not generally used, except for very important documents, which are delivered to the offices of high ranking officials. After 1 week, the researcher returned to the directors' offices and collected the completed questionnaires. Data collection occurred in 2008.

Ethical considerations

The study was approved by the appropriate ethics committees. Confidentiality was ensured by having the completed questionnaires returned in sealed envelopes. Data were secured by saving them in a personal password-protected computer, with hard copies in a cabinet in a locked office. Further, the questionnaires were coded by numbers to maintain confidentiality, and only the principal investigator had access to the raw data.

Data analysis

All statistical analyses for the data were carried out with SPSS version 15 (SPSS Inc., 2006, Chicago, IL, USA). Descriptive statistics were used to describe the sample characteristics. Cronbach's alpha and item-total correlations were used to assess reliability, and the criterion for acceptable correlations was ($r > 0{\cdot}30$). Factor analysis was used to test the construct validity of the tool. The appropriateness of factor analysis was tested using the Kaiser–Meyer–Ollin (KMO) test and the value was 0·96 (this should be more than 0·5), which means that the sample was adequate. Bartlett's test was used to test the sphericity and determinant of the correlation matrix. The results showed that the value of χ^2 was 12536·8 with $P < 0{\cdot}001$, which means that the correlation matrix was not an identity matrix.

Principal component analysis categorized the instrument into relevant factors. Pett *et al.* (2003) stated that to determine the number of initial factors only the factors with eigenvalues greater than one should be selected. Furthermore, the factor

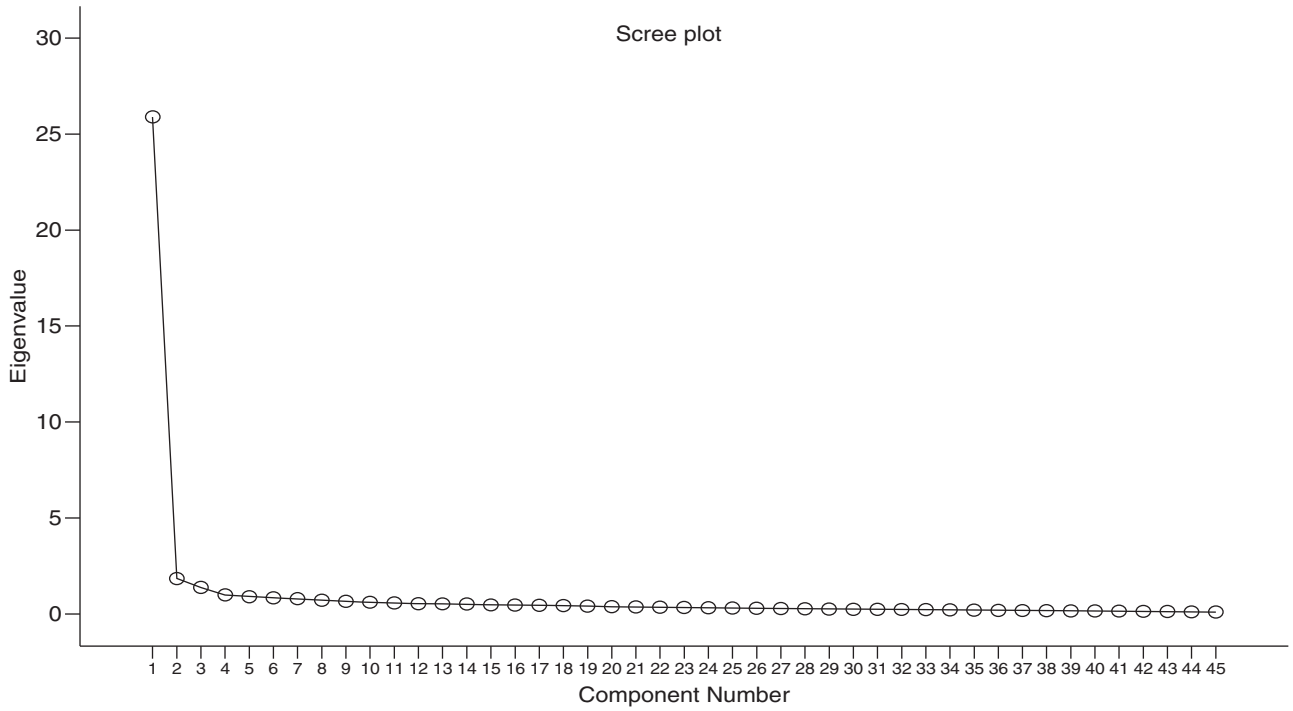

Figure 1 Scree Plot for eigenvalues plotted against principal components.

Table 2 Total variance explained by principal component analysis 'rotation sums of squared loadings'

	Rotation sums of squared loadings		
Component	Total	% of Variance	Cumulative %
1. PDM	11·09	24·64	24·64
2. SK	9·64	21·42	46·06
3. KN	8·27	18·37	64·43

Extraction method: principal component analysis.
Rotation method: Promax with Kaiser Normalization.
PDM, post disaster management; SK, skills; KN, knowledge.

with the largest eigenvalues has the most variance and is probably the main factor, while factors with small or negative eigenvalues are usually omitted from solutions (Tabachnick & Fidell 1996). In the current study, three factors had eigenvalues >1 (see Table 1). The scree plot (shown in Figure 1) supported the idea that three factors identified the characteristics of variables in the data set. These factors were rotated using the Promax Kaiser Normalization procedure.

The Promax rotation procedure was applied to minimize the number of variables with high loadings on a factor, thereby enhancing the interpretability of the factors (Pett *et al.* 2003). The rationale for using this procedure was that we assumed that the three factors that emerged were correlated: preparedness for disaster may include skills, knowledge, and specific knowledge to respond in the three phases of disaster. Table 2 shows the loading coefficients of the factors with the items after the rotation procedure. After rotation, the loadings on the second and third factors were greater than the values before rotation.

Results

Study limitations

It is a limitation of the study that data were obtained in only five hospitals, which was a relatively small number. Nevertheless, the hospitals from which the participants were recruited were randomly selected, which helps to eliminates systematic bias. Convenience sampling is not as effective as random sampling. However, it was used for the present study since there was not a large enough population of RNs to achieve randomization with adequate numbers for statistical analysis.

Participant demographics

Four hundred seventy-four (79%) complete and usable questionnaires were returned, out of the 600 that were distributed. A demographic profile of the 474 respondents is presented in Table 3. There were no statistically significant differences in preparedness for disaster management based on age, sex, or educational level ($P = 0{\cdot}80$, $P = 0{\cdot}31$ and $P = 0{\cdot}18$ respectively). There were statistically significant differences in perceptions of preparedness according to the type of hospital in which nurses worked [$P = 0{\cdot}001$ and their years of experience ($P = 0{\cdot}045$)].

Table 3 Participant demographics (original $n = 600$, with 512 returned, 474 usable, 38 ineligible = 79% usable response rate)

Characteristics			
Sex			
Male			183 (38·6%)
Female			291 (61·4%)
	M (median)	SD	Range
Age (years)	31·16 (30)	6·218	21–53
Years as Registered Nurse	8·60 (7)	6·018	1–35
Hours worked/week as Registered Nurse	46·72 (48)	5·275	30–60
Highest degree			
Three-year diploma		66	13·9%
Bachelor's degree		374	78·9%
Master's degree in nursing		27	5·7%
Master's degree in other discipline		7	1·5%
Facility type			
University hospital		183	38·6%
Governmental hospital		291	61·4%

Reliability and internal consistency

Cronbach's alpha for the complete instrument was 0·90, which supported the internal consistency reliability of the original tool. Internal consistency reliability was calculated for the three groups of items corresponding to the three factors extracted by factor analysis. Cronbach's alpha for the *knowledge* subscale was 0·91, for the *skills* subscale was 0·90 and 0·91 for the *post disaster management* subscale. Ferketich (1991) stated a Cronbach's alpha coefficient greater than 0·70 was considered acceptable support for the internal

Table 4 Component correlation matrix

Component	1	2	3
1. PDM	1·00	0·70	0·74
2. SK	0·70	1·00	0·72
3. KN	0·74	0·72	1·00

Extraction method: principal component analysis.
Rotation method: Promax with Kaiser Normalization.
PDM, post disaster management; SK, skills; KN, knowledge.

Table 5 Loading of 45 Disaster Preparedness Evaluation Tool Items on the rotated factors structure matrix

		Component		
		1. PDM	2. SK	3. KN
q42	I am familiar with what the scope of my role as a registered nurse in a postdisaster situation would be	0·84		
q32	As an RN, I would feel confident in my abilities as a direct care provider and first responder in disaster situations	0·82		
q33	As an RN, I would feel confident as a manager or coordinator of a shelter	0·82		
q39	I would feel confident providing patient education on stress and abnormal functioning related to trauma	0·82		
q40	I would feel confident providing education on coping skills and training for patients who experience traumatic situations so they are able to manage themselves	0·82		
q45	I feel confident managing (caring, evaluating) emotional outcomes for Acute Stress Disorder or PTSD following disaster or trauma in a multi-disciplinary way such as referrals, and follow-ups and I know what to expect in ensuing months	0·82		
q34	As an RN, I would feel reasonably confident in my abilities to be a member of a decontamination team	0·81		
q35	In case of a bioterrorism/biological or chemical attacks, I know how to perform focused health history and assessment, specific to the biological or chemical agents that are used	0·80		
q28	I am familiar with psychological interventions, behavioural therapy, cognitive strategies, support groups and incident debriefing for patients who experience emotional or physical trauma	0·80		
q29	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	0·81	.	
q41	I am able to differentiate the signs and symptoms of Acute Stress disorder and Post Traumatic Stress Disorders (PTSD)	0·81		
q43	I participate in peer evaluation of skills on disaster preparedness and response	0·80		
q44	I am familiar with how to perform focused health assessment for PTSD	0·79		
q38	I would feel confident implementing emergency plans, evacuation procedures, and similar functions	0·78		
q26	I can identify possible indicators of mass exposure evidenced by a clustering of patients with similar symptoms	0·78		
q27	I can manage the common symptoms and reactions of disaster survivors that are of affective, behavioural, cognitive, and physical nature	0·78		
q36	I feel reasonably confident I can care for patients independently without supervision of a physician in a disaster situation	0·77		
q31	I feel confident recognizing differences in health assessments indicating potential exposure to biological or chemical agents	0·75		
q30	I am familiar with the main Groups (A, B, C) of biological weapons (Anthrax, Plague, Botulism, Smallpox, etc.), their signs and symptoms, and effective treatments	0·74		
q37	I am familiar with the organizational logistics and roles among local and national agencies in disaster response situations	0·73		
q18	I know the limits of my knowledge, skills, and authority as an RN to act in disaster situations, and I would know when I exceed them	0·69		
q20	In case of a bioterrorism/biological or chemical attacks I know how to execute decontamination procedures		0·88	
q21	In a case of bioterrorism/biological or chemical attacks I know how to perform isolation procedures so that I minimize the risks of community exposure		0·88	
q19	In case of a bioterrorism/biological or chemical attacks, I know how to use personal protective equipment		0·84	
q22	I am familiar with the local emergency response system for disasters		0·83	
q23	I am familiar with accepted triage principles used in disaster situations		0·83	
q24	I have personal/family emergency plans in place for disaster situations		0·81	
q10	I consider myself prepared for the management of disasters		0·80	
q15	I participate/have participated in creating new guidelines, emergency plans, or lobbying for improvements on the local or national level		0·79	
q25	I have an agreement with loved ones and family members on how to execute our personal/family emergency plans		0·78	
q16	I would be considered a key leadership figure in my community in a disaster situation		0·71	
17	I am aware of what the potential risks in my community are (e.g. earthquake, floods, terror, etc.)		0·70	

Table 5 (*Continued*)

		Component		
		1. PDM	2. SK	3. KN
q6	I am aware of classes about disaster preparedness and management that are offered for example at either my workplace, the university, or community			0·84
q7	I would be interested in educational classes on disaster preparedness that relate specifically to my community situation			0·84
q3	I know who to contact (chain of command) in disaster situations in my community			0·80
q5	I read journal articles related to disaster preparedness			0·78
q4	I participate in one of the following educational activities on a regular basis: continuing education classes, seminars, or conferences dealing with disaster preparedness			0·76
q1	I participate in disaster drills or exercises at my workplace (clinic, hospital, etc.) on a regular basis			0·75
q8	I find that the research literature on disaster preparedness and management is easily accessible			0·73
q12	I know where to find relevant research or information related to disaster preparedness and management to fill in gaps in my knowledge			0·72
q9	I find that the research literature on disaster preparedness is understandable			0·71
q2	I have participated in emergency plan drafting and emergency planning for disaster situations in my community			0·70
q13	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 (health department, e.g.)			0·69
q11	Finding relevant information about disaster preparedness related to my community needs is an obstacle to my level of preparedness			0·67
q14	In case of a disaster situation I think that there is sufficient support from local officials on the county, region or governance level			0·63

Extraction method: principal component analysis.
Rotation method: Promax with Kaiser Normalization.
PDM, post disaster management; SK, skills; KN, knowledge; RN, Registered Nurse.

consistency of the tested scale. These values indicated *high* internal consistency (Polit & Beck 2004, p. 420).

Correlation matrix

On a 6-point scale, from 1, *strongly disagree,* to 6, *strongly agree,* the means ranged from 2·72 (item 15: participation in building guidelines or emergency plans) to 3·83 (item 18: knowing the limitation of knowledge and skills in disaster situations). Examination of the correlation matrix indicated that all items were correlated ($r > 0{\cdot}30$). Inter-item correlations ranged between 0·39 and 0·74. The correlations between factors were found satisfactory ($P = 0{\cdot}05$). The correlations between the three major factors were 0·70, 0·72 and 0·74 respectively (see Table 4). Such values were considered to be acceptable (Pett *et al.* 2003). The table is too large to be included in the manuscript, but is available from the authors.

Factor analysis is often used in data reduction to identify a small number of factors that explain most of the variance observed in a much larger number of visible variables (Field 2005). Items loading at less than 0·40 should be suppressed (Pett *et al.* 2003). In the current analysis, all factors were loaded on at least one factor at more than 0·60, which is considered excellent loading (Fain 2004). As shown in Tables 2 and 5, there 13 items loaded on Factor 3 (which explained 18·369% of the common variance), labelled as *Knowledge*; 11 items loaded on Factor 2 (which explained 21·423% of the common variance) labelled as *Skills;* while 21 items loaded on Factor 1 (which explained 24·641% of the common variance), labelled as *Post disaster Management*. The saturation level of each item upon the correlated factors is presented in Table 5. These results are relatively consistent with what Tichy *et al.* (2009) indicated regarding the main factors in the original tool.

Conclusion

According to a Google search (February 15, 2009), there are 25 Arabic-speaking countries. Nursing educators, researchers, and policy-makers in these countries could find Arabic versions of instruments such as this useful for improving nursing practice. This evaluation of the psychometric properties of the Classical Arabic version of The Disaster Preparedness Evaluation Tool® (DPET®) suggests that it is a valid and reliable instrument to measure nurses' preparation for disaster management. Using data from evaluations based on the DPET®, educators can identify the current level of

What is already known about this topic

- Disasters are increasing worldwide, with related healthcare concerns, and preparedness is a key factor in effective disaster management.
- Without knowledge of current preparation, it is difficult to develop appropriate educational models to improve Registered Nurses' disaster preparedness.
- The Disaster Preparedness Evaluation Tool provides a method to measure Registered Nurses' knowledge, skills and post disaster management preparation.

What this paper adds

- Translation of the Disaster Preparedness Evaluation Tool© into classical Arabic provides a means to evaluate Arabic-speaking Registered Nurses' preparation for disaster.
- Psychometric testing of the Disaster Preparedness Evaluation Tool© revealed acceptable reliability and validity of the instrument.

Implications for practice and/or policy

- The classical Arabic Disaster Preparedness Evaluation Tool© can be used with confidence in Arabic-speaking Registered Nurses populations.
- Further educational programmes can be developed based on results from studies using the Disaster Preparedness Evaluation Tool© to determine Registered Nurses' disaster preparedness.

nurses' disaster preparedness, and develop additional appropriate educational programmes to enhance this. Such preparation will enable nurses to participate in coordination and collaboration within the healthcare sector for disaster preparedness and mitigation.

Author contributions

MAAAK, AEB, RLB and AAT were responsible for the study conception and design. MAAAK performed the data collection. MAAAK, RLB and AAT performed the data analysis. MAAAK, AEB, RLB and AAT were responsible for the drafting of the manuscript. MAAAK, AEB, RLB and AAT made critical revisions to the paper for important intellectual content. MAAAK, RLB and AAT provided statistical expertise. MAAAK and RLB obtained funding. AEB and RLB provided administrative, technical or material support. RLB and AAT supervised the study.

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Conflict of interest

No conflict of interest has been declared by the authors.

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