Original Article

Cross-cultural adaptation, validity, and reliability of the Chinese version of the Nurses' Perceptions of Disaster Core Competencies Scale (NPDCC)

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Background: In recent years, disasters occurred frequently all over the world, and the role of nurses in public health emergencies and disaster emergencies was highlighted under the background of the covid19 epidemic. However, there was a lack of education and evaluation. Our study aims to cross-cultural adapt the Nurses' Perceptions of Disaster Core Competencies Scale (NPDCC) and evaluate the reliability and validity of the Chinese version.

Methods: We translated the scale following the translation-integration-back translation-expert review procedure, adapted according to Chinese culture. We evaluated the reliability and validity of the scale, and a total sample of 911 nurse data from the Yangtze River Delta Regional Nursing Alliance Hospital was gathered.

Results: The Chinese version of NPDCC included 45 items, 5 factors (critical thinking skills, special diagnostic skills, general diagnostic skills, technical skills, and communication skills) were extracted from the analysis, which could explain the 68.289% of the total variance. The content validity index was 0.925. The Cronbach's α of the total NPDCC score was 0.978, and 0.884–0.945 for every factor. The split-half for the scale was 0.930, and every factor was 0.861–0.894.

Conclusions: The Chinese version of NPDCC has excellent reliability and validity, and it is suitable to measure nurses' perceptions of disaster core competencies in China. The next step is to promote the application in a large scale.

Keywords: Disaster nursing; disaster preparedness; nurses; public emergency; core competencies; reliability; validity

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Introduction

Public emergencies refer to natural disasters, accident disasters, public health events, and social security events that occur suddenly and cause or may cause serious social hazards and require emergency response measures. The government of China refers to all disasters as "public emergencies" and divides them into four categories: natural disasters, accident disasters, public health events, and social security events (1). Public emergencies have frequently occurred, including severe acute respiratory syndrome (SARS) in 2003, human avian influenza in 2005, influenza A (H1N1) in 2010, avian influenza A (H7N9) in 2013, Ebola hemorrhagic fever in 2014, the Middle East respiratory syndrome (MERS) in 2015, and COVID19 in 2019 have emerged in the recent years. With COVID19, according to the global data released on the official website of the World Health Organization on July 15, 13,150,645 people have been confirmed, and 574,464 people have died (2). These emergencies have seriously threatened the health and economic development of people all over the world. Nurses are the leading force in the rescue of public emergencies, and the core emergency response ability directly affects the quality of the entire medical rescue, of considerable significance to the protection of public health, social stability and economic development (3). WHO claimed that nurses provide care in emergency settings and will be key to the achievement of universal health coverage (4). But global disaster nursing education and research is lacking now (5,6). The survey results by Jolyon May indicate that nurses' participation is obviously less than doctors' in the course of disaster management and training, and the degree of attention to disaster response ability is not enough (7). Recently, Chinese scholars have studied the strategies of nurses to cope with public emergencies, but there are insufficient specific measurement tools for nurses' core capacity of disaster preparedness. Applicable to the evaluation of nurses, Turkish scholar Celik (8) developed and validated the Nurses' Perceptions of Disaster Core Competencies Scale (NPDCC) according to International Nursing Coalition for Mass Casualty Education (INCMCE) Disaster preparedness framework in 2010. The scale has 45 items and five subscales: Critical Thinking Skills, Special Diagnostic Skills, General Diagnostic Skills, Technical Skills and Communication Skills. This is a Likert-type scale where each item is scored from 1 point for 'This needs to be taught' to 5 points for 'I can do and teach it'. Minimum and maximum scores vary between 45 and 225. High scores signify higher perceptions of disaster core competencies. However, its adaption into the Chinese language has not been done yet. This study aims to translate the English version of NPDCC into Chinese combining with Chinese nurses' status and cultural background and to test its reliability and validity among nursing staff, and to provide a reliable and practical measurement tool for assessing the core competence of nurses' public emergency in China. At the same time, it is hoped that the promotion and application of assessment tools can arouse the attention of the global health system on the education and training of emergency response ability of nurses. We present the following article in accordance with the SURGE reporting checklist (available at http://dx.doi.org/10.21037/apm-20-1454).

Methods

The required permission has been obtained from the original author of the English version scale via e-mail. The translation and cultural adaptation were conducted according to the procedure established by Sousa et al. (9). According to the factor analysis sample scale estimation method: the sample size is 5–10 times of the number of items (10). EFA and CFA samples were separated. So at least 900 samples need to be included. A total of 911 nurses were recruited and completed the questionnaire in the Yangtze River Delta Regional Lung Disease Nursing Alliance Hospital (35 hospitals, covering 5 provinces) from February to March 2020. These hospitals are all tertiary hospitals, which require nurses to master the ability of disaster care. This study was conducted according to the Declaration of Helsinki (as revised in 2013) principles and the ethics was approved by the institutional review board of Shanghai Pulmonary Hospital (ethical ID number: K19-146). Informed consent was obtained from all individual participants included in the study.

Subjects

The inclusion criteria are as follows:

(I) Obtained a nurse qualification certificate;
(II) A nurse working in a clinical department for at least one year;
(III) Informed and agreed to take part in this research.

The exclusion criteria are as follows:

(I) Practitioner nurses;
(II) Training nurses;
(III) Those who were out-of-post during the

investigation;
(IV) Logistics or auxiliary department nurses.

Instrument

Celik *et al.* (8) developed and confirmed the NPDCC for these disaster competencies and literature of INCMCE. The scale has 45 items and five factors: critical thinking skills, special diagnostic skills, general diagnostic skills, technical skills, and communication skills (*Table S1*). The scale is Likert-type, where each item is scored from 1 point for 'this needs to be taught' to 5 points for 'I can do it and teach it.' Minimum and maximum scores vary between 45 and 225. High scores signify higher perceptions of disaster core competencies. Celik *et al.* (8) reported that the alpha coefficients of the subscales to vary between 0.81 and 0.92 and is 0.96 for the total scale.

Translation and cultural adaptation

We obtained permission to translate the English version of the scale into Chinese from the authors using forward and back-translation with reconciliation by a panel of experts. Two English-speaking nursing professionals translated the original questionnaires into Chinese versions, and then the research team discussed and merged the two translations to form a Chinese NPDCC. Two postgraduate English majors who are unfamiliar with the original scale and have bilingual abilities translated the Chinese translation of NPDCC back to English NPDCC. Finally, the expert group compared the back-translated version of NPDCC with the original English scale. The sentences that do not conform to the Chinese cultural background and customs were discussed and changed by members of the research group. The scale is less influenced by cross culture, and the definitions involved are basically the same

Forty-five nurses from Shanghai Pulmonary Hospital were selected to conduct a pilot study to understand the respondents' understanding of the content of the scale and the problems and suggestions during the filling. With the feedback from the survey respondents and the recommendations of the expert group, the Chinese version of NPDCC was appropriately formed in the definitive version. According to the pre-survey results, the scale was adjusted as follows: The item 23 of Original scale" *I can explain the psychological effects of the disaster* ……" is adjusted as "*I can assess and diagnose the psychological effects of the disaster* ……"; The item 45 of Original scale" *I can explain the appropriate coping strategies to provide support for myself and others against negative effects of disasters*" is adjusted as "*I can explain how to adopt appropriate coping strategies to help myself and others to resist the negative effects of public health emergencies*".

Statistical analysis

SPSS software (version 21.0) and Amos software (24.0) were used for the statistical analysis. Descriptive statistics are used to summarize the nurses' demographic characteristics. The analyses were expressed as mean ± standard deviation and percentages. For the Chinese version NPDCC, assessments of reliability and validity, as well as explanatory factor analysis (EFA), were conducted. Item analysis includes critical ratio and correlation analysis: critical ratio test should reach the significance level, indicating the item has sufficient discrimination, and items should be deleted for the Pearson correlation coefficient below 0.60 (11). The internal consistency and half-split reliability analysis were used for reliability analysis: Cronbach's alpha coefficient measuring the average correlation among the items in the scale was considered excellent for above 0.70. The split-half reliability coefficients were considered excellent for above 0.60 (12,13). Validity analysis includes content validity and constructs validity analysis. EFA and confirmatory factor analysis (CFA) are utilized for constructing the validity analysis. The significance level was set at 5% ($P<0.05$).

Results

The NPDCC was designed as an electronic version through a software named "questionnaire star". After obtaining the consent of the nurses, the questionnaire survey was conducted by scanning the QR (Quick Response) code of the web questionnaire. Nurses can draw a lottery of gifts to thank them for their cooperation in completing the study. Each questionnaire needs to be completed completely, and any missing items will be eliminated. A questionnaire was conducted among 911 nurses, and the response rate (number of valid questionnaires/total number of respondents) was 100%.

Demographic characteristics

Nurses' mean age was 34.26 and meant the professional experience was 15.54, most of them were women (97.1%), married (78.27%), and worked as service nurses (92.35%). Other demographic information of the research objects was

Table 1 Demographic characteristics of nursing staff (N=911)

Characteristics	n	%
Gender		
Female	885	97.1
Male	26	2.6
Age		
20–30	381	41.82
31–40	319	35.02
41–50	158	17.34
>50	53	5.82
Professional experience		
1–5 years	199	21.84
6–10 years	267	29.31
11–15 years	143	15.70
16–20 years	100	10.98
>20 years	202	22.17
Educational degree		
Associate degree	367	40.3
Bachelor's degree	530	58.2
Master's degree	13	1.4
Doctorate degree	1	0.1
Nursing title		
Nurse	229	25.1
Nurse supervisor	340	37.3
Nurse in charge	236	25.9
Associate professor of nursing	87	9.5
Professor of nursing	19	2.1
Infectious disease experience		
Yes	337	37
No	574	63
Other public emergencies experience		
Yes	189	20.7
No	722	79.3
Public emergency training experience		
Yes	569	62.5
No	342	37.5
Hospital level		
Tertiary hospital	649	71.2
Secondary hospital	250	27.4
Primary hospital	12	1.3

Table 2 NPDCC scores for total and subscales (N=911)

Characteristics	Mean	SD
The total score of NPDCC	133.82	32.96
Critical thinking skills (CTS)	11.47	3.44
Special diagnostic skills (SDS)	15.18	4.87
General diagnostic skills (GDS)	37.41	10.10
Technical skills (TS)	46.64	15.51
Communication skills (CS)	23.14	8.83

NPDCC, the Nurses' Perceptions of Disaster Core Competencies Scale.

shown in *Table 1*.

NPDCC scores of nurses

The NPDCC total score was 133.82 [standard deviation (SD): 32.96], and the critical thinking skills, special diagnostic skills, general diagnostic skills, technical skills, and communication skills scores are presented in *Table 2*.

Item analysis

Critical ratio (CR value) was used to evaluate the differentiation of Chinese NPDCC entries. The total NPDCC scores of 911 sample data were ranked in descending order. The first 27% with the highest score was in the high group, and the last 27% with the lowest score was in the low group. The results showed that the CR values of all items were greater than 3 and reached the significance level (all $P<0.01$), and the correlation coefficient between the items and the total score of the scale was 0.600–0.800 (all $P<0.01$), indicating that the items in the scale had high discrimination, so all items in the scale were retained (*Table 3*).

Reliability

The Cronbach's alpha of the total NPDCC score was 0.978, and 0.884–0.945 for the subscales. The split-half for the scale was 0.930, and for the subscales were 0.861–0.894 (*Table 3*).

Validity

Content validity

There are no clear recommendations on the number of

Table 3 Validity and reliability evidence

Construct and items	Total variance explained	Factor loading	Item discrimination indices (z)	Corrected item-total correlation coefficients	Cronbach's alpha	Split-half reliability coefficients
CTS	17.135%				0.884	0.861
T1		0.647	−19.712[a]	0.631		
T2		0.644	−19.840[a]	0.719		
T3		0.583	−19.555[a]	0.698		
T4		0.676	−19.800[a]	0.738		
SDS	32.975%				0.916	0.894
T5		0.686	−19.829[a]	0.727		
T6		0.690	−19.933[a]	0.726		
T7		0.739	−20.133[a]	0.632		
T8		0.726	−20.464[a]	0.658		
T9		0.756	−20.322[a]	0.670		
T10		0.684	−19.732[a]	0.737		
GDS	47.176%				0.942	0.877
T11		0.708	−20.111[a]	0.667		
T12		0.620	−19.975[a]	0.660		
T13		0.594	−19.806[a]	0.754		
T14		0.453	−19.807[a]	0.776		
T15		0.462	−19.885[a]	0.710		
T16		0.554	−19.972[a]	0.759		
T17		0.522	−19.871[a]	0.737		
T18		0.721	−19.677[a]	0.718		
T19		0.720	−19.824[a]	0.703		
T20		0.629	−19.788[a]	0.732		
T21		0.571	−19.716[a]	0.744		
T22		0.419	−19.733[a]	0.719		
T23		0.457	−19.719[a]	0.705		
TS	58.562%				0.945	0.888
T24		0.403	−20.037[a]	0.698		
T25		0.452	−19.955[a]	0.662		
T26		0.426	−19.652[a]	0.778		
T27		0.631	−20.420[a]	0.713		
T28		0.662	−20.947[a]	0.664		
T29		0.754	−21.222[a]	0.604		
T30		0.756	−20.744[a]	0.600		

Table 3 (*continued*)

Table 3 (*continued*)

Construct and items	Total variance explained	Factor loading	Item discrimination indices (z)	Corrected item-total correlation coefficients	Cronbach's alpha	Split-half reliability coefficients
T31		0.640	−19.834[a]	0.680		
T32		0.753	−20.424[a]	0.689		
T33		0.403	−19.692[a]	0.708		
T34		0.646	−19.924[a]	0.733		
T35		0.651	−19.937[a]	0.745		
T36		0.576	−20.127[a]	0.750		
T37		0.580	−19.883[a]	0.789		
CS	68.289%				0.941	0.914
T38		0.633	−19.730[a]	0.785		
T39		0.654	−19.695[a]	0.732		
T40		0.642	−19.805[a]	0.739		
T41		0.621	−20.038[a]	0.800		
T42		0.667	−19.633[a]	0.714		
T43		0.707	−19.676[a]	0.766		
T44		0.671	−19.516[a]	0.779		
T45		0.607	−19.824[a]	0.778		

[a], P<0.001. CTS, critical thinking skills; SDS, special diagnostic skills; GDS, general diagnostic skills; TS, technical skills; CS, communication skills.

experts to include. Lynn suggested including a minimum of 3 experts, but more than 10 was not considered helpful (14). Therefore, nursing experts from general or specialist hospitals in Shanghai, Zhejiang, Jiangsu, and Anhui provinces are five members of this research group. They are professors in respiratory medicine, infectious diseases, intensive care unit (ICU), and nursing management. They rated the unambiguity, familiarity, and appropriateness of the items of the CBS-G on a 4-point Likert scale (very unambiguous/familiar/appropriate =4; not at all ambiguous/unfamiliar/inappropriate =1) (15). And the results showed that the content validity index (S-CVI) of the scale was 0.925, and the content validity index (I-CVI) of each item was 0.800–1.000.

Construct validity

EFA for the original five-factor model

Bartlett's sphericity test x^2 value was 4,135.385 (P<0.001), and the Kaiser-Meyer-Olkin (KMO) test value was 0.976, indicating that the scale was suitable for factor analysis (16). Using principal component analysis and maximum variance orthogonal study. This method was performed to extract the characteristic value of one or more common factors. The results showed that the characteristic value of one or more common factors with five, the cumulative variance contribution rate was 68.289%, and the scale of various objective factors loading >0.40. Further, all entries were in the scope of their respective factors, and these results were the same as the original scale. The exploratory factor analysis results are shown in *Table 3*.

CFA for the original five-factor model

We used SPSS AMOS (Version 24.0) to evaluate the research model with the data collected from nursing staff in China. The model produced acceptable fit indices, as shown in *Table 4*. The results of CFA demonstrated that all scales used in this study formed adequate measurement models, and thus, provided evidence for the construct validity of the measures (17).

Table 4 Model fit indices

Variable	Model	Acceptable values (13)
χ^2	4,006.928	
P value	<0.001	0.05≤P≤1.00
χ^2/df	4.403	<3
Root mean square error of approximation (RMSEA)	0.061	<0.08
Standardized root mean square residual (SRMR)	0.0583	<0.10
The goodness of fit index (GFI)	0.796	≥0.90
Tuckere Lewis index (TLI)	0.907	≥0.90
Incremental fit index (IFI)	0.915	≥0.90
Comparative fit index (CFI)	0.914	≥0.90

Discussion

Project analysis is to explore the differences between high- and low-scoring research objects on each item or to evaluate for homogeneity between items. The results can be used as the basis for item selection or modification (18). In this study, the extreme group comparison method and the total score correlation method were used to evaluate each item to screen the Chinese version of the NPDCC scale. The top 27% of the scale items with the highest score are high grouping, and the bottom 27% of the scale items are low grouping. The t-test results show that there is statistical significance between the high and low groupings of each item of the scale (P<0.01). The correlation coefficients between the items and the total scores are all above 0.04, indicating that all items in the Chinese version of the NPDCC scale have high discrimination, that is, all items have a strong discriminative ability to nurses' core competence in disasters and are retained.

In terms of content validity, if the content validity index of the scale entry is ≥0.78, and the content validity index of the scale is ≥0.90, it can be considered the evaluation tool has good content validity (19). This study evaluated the content validity of the Chinese version of the NPDCC scale by five nursing experts in related fields. After two rounds of expert consultation, the content validity index of the scale was 0.925, and the content validity index of each item (I-CVI) was over 0.800. The results of this study show that the NPDCC scale indicates that the Chinese version of NPDCC content is valid.

In terms of structural validity, the Chinese version of the NPDCC scale was verified through exploratory factor analysis and CFA, and the common factors were extracted using principal component analysis. A screen diagram of the factor structure was generated, with factor load values and commonness ≥0.40. It can be considered the entry that is in this factor (20). The results of this study show that the cumulative contribution rate of the five common factors of critical thinking skills, special diagnostic skills, general diagnostic skills, technical skills, and communication skills is 68.289%, and the load value of each item on the corresponding factor is 0.403–0.756. The test results of the original scale are similar and have sufficient structural validity.

Reliability is an effective evaluation of tool stability. The higher the reliability, the greater the credibility (21). The Cronbach's alpha coefficient of each dimension of the scale is >0.70, and the Cronbach's alpha coefficient of the total scale is >0.80, indicating that the reliability of the scale is excellent (12,13). The results of this study show that the Cronbach's alpha coefficient of the Chinese version of the NPDCC scale is 0.978, and the Cronbach's alpha coefficients of the subscales are 0.884 to 0.945; the half-coefficient of the scale is 0.930, and the half-reliability of each dimension is 0.861–0.894. The Chinese version of the NPDCC scale has high reliability and stability.

G Taskiran used NPDCC to investigate 406 nurses in Turkey. The results show 'Technical Skills' scored highest across the subscales of the scale, and 'Critical Thinking Skills' scored lowest (5). And Park used NPDCC to explore Factors influencing disaster nursing core competencies of emergency nurses working in 12 hospitals in South Korea (22). In this study, we complete Cross-cultural adaptation and test of NPDCC. However, the further application of the

scale needs further research.

Study limitation: The sample source for reliability and validity verification is relatively single, and it needs to be applied in other areas of China in the follow-up study.

Conclusions

The NPDCC scale covers five aspects of nurses' core competencies in disasters, which can comprehensively measure the core competencies of nurses in response to disasters. The Chinese version of NPDCC has excellent reliability and validity and meets the requirements of measurement. It shows it is suitable for measuring the cognitive level of the nurse's core public emergency.

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Footnote

Reporting Checklist: The authors have completed the SURGE reporting checklist. Available at http://dx.doi.org/10.21037/apm-20-1454

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Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/apm-20-1454). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. This study was conducted according to the Declaration of Helsinki (as revised in 2013) principles and the ethics was approved by the institutional review board of Shanghai Pulmonary Hospital (ethical ID number: K19-146). Informed consent was obtained from all individual participants included in the study.

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Supplementary

Table S1 factors and items of NPDCC

Factors	Items
Critical thinking skills	1. I can use the ethical principles and the nationally approved information in order to decide the actions to be taken and prioritize them in case of a disaster
	2. During and after the mass casualty, I can make decisions to assess the nursing care needs of the victims
	3. I can explain the basic nursing care for the individuals, families, society and special groups (children, elders, disabled people and pregnants etc.) in accordance with the needs of pre-disaster, disaster and post-disaster period
	4. I can explain the principles of triage applied and accepted in the mass casualties (i.e., START-Simple Triage and Rapid Treatment)
Special diagnostic skills	5. In the case of a disaster, I can assess the risk situations that can affect the health of mine, my team and the victims, together with the disaster response team
	6. I can recognize the possible indications of the situation the group of people, with the same symptoms, is exposed to
	7. I can explain the general symptoms and findings of the exposure to the chemical, biological, radioactive, nuclear and explosive substances that threaten human health
	8. I can update my knowledge on the chemical, biological, radiological, nuclear and explosive substances in accordance with the up-to-date information
	9. I can explain the essential elements (nature, size, limits, duration etc. of the event) required for the assessment of a mass casualty
	10. I can determine the groups that may highly likely be affected and require special care (children, elders, people with a suppressed immune system etc.) during the mass casualty
General diagnostic skills	11. I can get a history of health to assess exposure to chemical, biological, radiological, nuclear and explosive substances
	12. I can assess the airway patency and respiration
	13. I can perform a cardiovascular assessment including the monitoring of the vital signs and the shock signs
	14. I can assess the dermatological conditions, especially like injury, burn and eruption
	15. I can do pain assess men
	16. I can assess the condition of injury from head to foot
	17. I can do a general gastrointestinal system assessment including stool sampling
	18. I can do basic neurological assessment
	19. I can do a basic musculoskeletal system assessment
	20. I can do a basic mental, spiritual and emotional state assessment
	21. I can assess the immediate and late psychological reactions/responses of the individual, family and community following mass casualty
	22. I can refer the victims to the appropriate sources (psychiatrists, psychologists, consultants, and psychiatric nurses etc.) in order to provide psychological support in the disasters
	23. I can assess and diagnose the psychological effects of the disaster on the professional disaster response teams (healthcare professionals, firefighters, ambulance personnel, police etc.)
Technical skills	24. I can ensure safe drug management (especially vasoactive and analgesic drugs, oral, subcutaneous, intramuscular and intravenous drug administrations, etc.)
	25. I can provide safe vaccinations for the protection of the community health in disasters
	26. I know and apply the appropriate nursing interventions against the side effects of the drugs administered
	27. I can apply basic first aid practices
	28. I can administer oxygen and apply breathing techniques
	29. I can insert a urinary catheter
	30. I can insert a nasogastric tube
	31. I can apply lavage (e.g., eye and wound lavage)
	32. I can perform the basic wound care
	33. In case of exposure to the chemical, biological, radiological, nuclear and explosive substances, I can start the appropriate isolation and decontamination processes by assessing the needs of the victims, mine and the disaster response team
	34. I know and can apply the safety concerns and the use of the personal protective equipment
	35. I can choose and use the personal protective equipment as required
	36. Taking into account the nature of the exposure factors and/or injuries, I can apply fluid/nutritional therapy in accordance with the medical treatment and follow up the fluid that the patients take in and out
	37. I can assess the transfer status of the injured individual and perform preparation, care, and follow-up in such a way to ensure the safety of the patient during the transfer
Communication skills	38. I know the disaster management system of the institution I work for and I can explain my professional role in the emergency plans
	39. I can explain the emergency plans at my workplace and the functions of these plans at community, regional (Xiang, Zhen, Xian) and provincial (Sheng and Shi) levels
	40. I know and can apply the importance of the security and privacy issues during the intervention of mass casualties
	41. I can ensure the appropriate recording of nursing assessments, interventions and care results during and after the mass casualty
	42. I can refer applications from patients, the media and other sources to appropriate sources for information about mass casualties
	43. I can explain the basic principles of risk communication to be applied for the individuals and groups affected by disaster during a mass casualty
	44. I can recognize the fear, panic and stress reactions that the victims, families and disaster response teams can display during a disaster
	45. I can explain how to adopt appropriate coping strategies to help myself and others to resist the negative effects of public health emergencies