

Short Communication

Validity and Reliability of the Knowledge and Attitude Assessment Tool for Cadres in Tsunami-Prone Areas

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ABSTRACT

Background: Padang city is a high-risk area for tsunamis, making the presence of disaster preparedness cadres crucial as the frontline in response. However, many cadres have never received formal training and have limited knowledge and attitudes regarding tsunami emergencies. Cadre competency evaluation has been hampered by the lack of specific, psychometrically tested instruments. **Objective:** This study aimed to test the validity and reliability of tsunami preparedness knowledge and attitudes instruments for cadres in tsunami-prone areas. **Methods:** This cross-sectional study included 90 respondents. The instrument was developed through a literature review and a qualitative study. Content validity was tested through expert assessment via three expert judgments. The construct validity and reliability were tested on 90 cadres. Instrument validity was assessed via biserial correlation (knowledge) and Pearson's product-moment correlation (attitude). Reliability was tested via the Kuder Richardson formula (KR-20) and Cronbach's alpha. **Results:** The results of the expert judgments on the knowledge and attitude questionnaires were 0.81–1 and 0.75–1, respectively. The construct validity test resulted in 12 knowledge statement items and 12 attitude items that were declared valid, with R values > R values. The reliability test results for the knowledge and attitude questionnaires were 0.630 and 0.737, respectively, indicating that the questionnaire is reliable. **Conclusion:** This instrument can be used by health workers, community nurses, and policymakers to map cadre capacity accurately and as an evaluation tool before and after providing future disaster training

KEYWORDS

Attitude, cadres, disaster preparedness, knowledge, reliability, validity, methodology

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INTRODUCTION

According to the United Nations Office for Disaster Risk Reduction (UNDRR), a disaster is a serious disruption to the functioning of a community or society at any scale due to hazardous events interacting with conditions of capacity, exposure, and vulnerability, which can result in losses and impacts on humans, the economy, the environment, and materials [1]. The incidence of natural disasters is increasing annually worldwide. In 2021, natural disasters caused 10,492 deaths, impacted 101.8 million people, and resulted in economic losses of 252.1 billion USD. The Asian continent is the region that has the worst impact on disasters, where 40% of disasters are in Asia, which affects 49% of deaths and 66% of people who are affected [2]. One of the most destructive and deadly natural disasters in the world is the tsunami [3].

Tsunamis are among the most devastating natural disasters that can devastate coastal areas and reach further islands. A tsunami is a series of enormous ocean waves caused by severe disturbances on the seafloor, such as shallow earthquakes, volcanic eruptions, or ocean avalanches [4]. A tsunami is a series of waves with long time intervals. The heights of tsunami waves can reach tens of meters and roll inland at very high speeds, causing considerable damage [5]. In recent years, researchers have observed the threat of a magnitude earthquake that could trigger a tsunami of up to 10 m, lasting approximately 30 min, which would impact the people of Padang city. Padang city is a city in West Sumatra Province with high tsunami potential because of its location on the coast facing the Megathrust earthquake plate [6,7].

Various methods have been implemented to minimize the impact of disasters, especially tsunamis. One of them is the framework adopted from the Sendai Framework Disaster Risk Reduction (SFDRR) 2015-2030 by the National Disaster Management Agency (BNPB) in the form of Disaster Risk Reduction (PRB). One DRR effort is the implementation of Community-Based Disaster Risk Reduction (PRBBK) programs. PRBBK is an approach to the community in managing disaster risk in their own environment [8]. One of the indicators of PRBBK is the existence of a team of disaster management community volunteers who are actively involved in capacity-building, knowledge, and disaster education activities such as cadre/disaster preparedness groups [8]. Disaster preparedness cadres are communities whose function is to prevent emergencies and disasters, including preparedness, prevention, and mitigation, as well as the existence of quick response handling in the health sector [9]. Disaster preparedness cadres are individuals who are appointed and volunteer to become disaster preparedness cadres who have confidence and are able to train and direct the community in disaster preparedness [10].

On the basis of initial observations of disaster preparedness in Padang city, a worrying phenomenon was discovered: most cadres had never received formal training in disaster management, and none had received tsunami emergency training. The lack of this training directly impacts the low cognitive and attitudinal levels of disaster preparedness cadres face in facing the tsunami threat, thus creating a paradox where disaster preparedness cadres have the same level of unpreparedness as the general public. However, currently available preparedness instruments measure preparedness only for earthquakes and volcanic eruptions [11,12], without addressing the technical specifications of tsunamis and the strategic role of cadres as information bridges. The absence of a specific, valid, and reliable instrument makes it impossible to accurately measure the effectiveness of cadres' roles, ultimately increasing the risk of fatalities during a disaster. Therefore, the validity and reliability of a tsunami-specific instrument for disaster preparedness cadres must be tested.

Validity and reliability are the main concepts used to assess the quality of research instruments [13]. Validity refers to the extent to which an instrument measures the concept it is supposed to measure, such that the results obtained truly reflect the reality being studied. Reliability, on the other hand, refers to the consistency of the instrument's results when it is used for different measurements under similar conditions. Thus, validity and reliability tests can minimize the risk of errors in data collection and provide a strong basis for drawing conclusions and generalizing research findings [14]. Therefore, this study aimed to assess the validity and reliability of disaster preparedness knowledge and attitudes instruments for disaster preparedness cadres in tsunami-prone areas.

MATERIALS AND METHODS

Study design, setting, and population

This research was conducted with a quantitative analysis design via a cross-sectional study involving 90 disaster preparedness cadres. The questionnaire was designed to measure the level of knowledge and attitudes toward disaster preparedness among cadres. The study was conducted in Ulak Karang Selatan, Air Tawar Timur, Air Tawar Barat, and Lolong Belanti subdistricts, Padang city, Indonesia, because the area is in the red zone, which is prone to tsunami disasters. Primary data were collected through questionnaire distribution.

Variables and operational definitions

The research instrument on the knowledge and attitudes of disaster preparedness cadres was prepared on the basis of literature studies, followed by a qualitative study. The knowledge questionnaire consisted of 12 multiple-choice questions. The scores for this questionnaire were 1 (true) and 0 (false). The total score for this instrument ranges from 0–12, with the interpretation that the higher the knowledge score is, the lower the knowledge level. The outline of the knowledge questionnaire is presented in [Table 1](#).

Table 1. Knowledge questionnaire grid

No	Items	Question number
1	Community-based disaster concepts and preparedness	1-2
2	Emergency first aid for tsunami disasters	3-4
3	Emergency first aid for drowning victims	5-7
4	Cardiopulmonary resuscitation (CPR)	8-9
5	Postdisaster body evacuation	10-12

The attitude questionnaire consisted of 12 questions with Likert-style answer options. The scoring of this questionnaire was as follows: strongly agree = 5, agree = 4, partially agree = 3, disagree = 2, and strongly disagree = 1. The total score on this instrument ranges from 12–60, with the interpretation that the higher the total attitude score is, the better the attitude, and the lower the attitude score is, the worse the attitude. The grid on the attitude questionnaire is presented in [Table 2](#).

After the instrument items were compiled, content validity was assessed via expert judgment. The expert judgment in this study was provided by three people. Expert judgment was carried out by an academic in the field of disaster and emergency management, who is a lecturer in disaster and emergency management and has experience in providing education related to disaster and emergency management to the community. One disaster practitioner was an expert in the field of disasters, especially tsunamis, and one emergency practitioner was a health practitioner, a member of disaster volunteers, and had been in the field during disasters.

Table 2. Attitude questionnaire grid

No	Items	Question number
1	Community-based disaster concepts and preparedness	1-3
2	Emergency first aid for tsunami disasters	4-5
3	Emergency first aid for drowning victims	6-7
4	Cardiopulmonary resuscitation (CPR)	8-9
5	Postdisaster body evacuation	10-12

Sample technique and sample selection

The sample in this study comprised 90 disaster preparedness cadres living in four tsunami-prone subdistricts in Padang city, namely, Ulak Karang Selatan, Air Tawar Timur, Air Tawar Barat, and Lolong Belanti. Cluster random sampling was used as the sampling technique. The inclusion criteria were as follows: disaster preparedness cadres in tsunami-prone areas, aged 20–

59 years, never participated in training, and willing to be respondents. The exclusion criterion was not completing the questionnaire.

Statistical analysis

In assessing the content validity of the knowledge and attitude questionnaire, the experts assessed four indicators for each question: relevance, clarity, simplicity, and ambiguity. The assessment process used a polytomous rating scale with a rating range of 1-4. Aiken's V was used for the content validity test assessment. If there are differences between experts, researchers use the Nominal Group Technique (NGT), wherein researchers ask experts with differing opinions to explain their perspectives. After the discussion, a revote was held. Decisions are made on the basis of a majority vote or by reaching a predetermined percentage of agreement.

After conducting content validity tests, the researchers conducted validity and reliability tests on the instruments given to disaster preparedness cadres. The validity test of the researcher's knowledge questionnaire used a biserial correlation test [15]. Moreover, in the attitude questionnaire, the researcher used the Pearson product-moment test to compare the calculated *r* value and the table *r* value. Both tests use the Pearson product moment '*r*' value table with degrees of freedom (*df*) = *n*-2 in the biserial correlation test and *df* = *n*-*k* in the Pearson product moment test [16]. The statement is valid if the calculated *r* value is greater than the table *r* value.

Reliability testing on the researcher's knowledge questionnaire used the Kuder Richardson Formula (KR-20) test, and the reliability testing on the attitude questionnaire used the Cronbach's alpha test [9,17–25]. The assessment of the KR-20 reliability test reveals that if the test results are in the range of 0.6–0.8, then the level of reliability is high, whereas if the Cronbach's alpha reliability test is >0.60, then it is considered reliable [26].

Ethical considerations

This study underwent an ethical review process by the Research Ethics Committee of the Faculty of Medicine, Public Health, and Nursing, Gadjah Mada University (FK-KMK UGM), with publication number KE/FK/1571/EC/2023. Throughout the study, the researcher strictly adhered to research ethics principles.

RESULTS

Patient characteristics

The results of the study presented in Table 3 show that the majority (56.7%) of the respondents were male, the majority (67.8%) of the respondents had a final education level of high school, the average age was 28.17±9.986 years, and the average length of time as a disaster preparedness cadre was 1.74±1.796 years.

Table 3. Respondent characteristics (n=90)

Variable	Frequency (n)	Percentage (%)	Mean±SD
Age			28,17±9,986
Gender			
Male	51	56,7	
Female	39	43,3	
Education level			
Senior High School	61	67,8	
Diploma	11	12,2	
Collage	18	20	
Long time as a disaster preparedness cadre			1,74±1,796

Knowledge and attitudes toward validity and reliability tests

The assessment of the content validity test of the knowledge and attitude questionnaire via Aiken's V is presented in Table 4. The range of V values for the knowledge questionnaire is 0.81–1, which is very high, and that of the attitude questionnaire is 0.75–1, which is high to very high.

Table 4. Results of the content validity test (expert judgment) of the questionnaire

No	Variable	Indicator	V	Interpretation
1	Knowledge	1-12	0,81 – 1	Very high
2	Attitude	1-12	0,75 – 1	High to very high

The validity test measurement of the researcher's knowledge questionnaire used a biserial correlation test. Moreover, in the attitude questionnaire, the researcher used the Pearson product-moment test to compare the calculated r value and the table r value. Both tests used the Pearson product moment 'r' table value with degrees of freedom (df) = n-2 in the biserial correlation test and df = n-k in the Pearson product moment test. A statement is said to be valid if the calculated r value is greater than the table r value. The results of the validity test for the knowledge questionnaire are presented in Table 5, and the results of the validity test for the attitude questionnaire are presented in Table 6. Table 5 shows that all the items of the knowledge questionnaire are declared valid, where r results > the r table. As shown in Table 5, the lowest number of questions is question No. 11, and the highest number of questions are question items No. 4 and No. 6.

Table 5. Results of the validity test of the knowledge questionnaire (n=90)

No	Question	R table	R result	Description
1	Question No 1	0,207	0,360	Valid
2	Question No 2	0,207	0,360	Valid
3	Question No 3	0,207	0,375	Valid
4	Question No 4	0,207	0,693	Valid
5	Question No 5	0,207	0,339	Valid
6	Question No 6	0,207	0,693	Valid
7	Question No 7	0,207	0,433	Valid
8	Question No 8	0,207	0,273	Valid
9	Question No 9	0,207	0,492	Valid
10	Question No 10	0,207	0,484	Valid
11	Question No 11	0,207	0,269	Valid
12	Question No 12	0,207	0,333	Valid

Table 6 shows that all the items of the attitude questionnaire are declared valid, where r is calculated > r table. As shown in Table 6, the item with the lowest score is question No. 5, and the item with the highest score is question No. 9.

Table 6. Results of the validity test of the attitude questionnaire (n=90)

No	Question	R table	R result	Description
1	Question No 1	0,220	0,520	Valid
2	Question No 2	0,220	0,631	Valid
3	Question No 3	0,220	0,569	Valid
4	Question No 4	0,220	0,491	Valid
5	Question No 5	0,220	0,395	Valid
6	Question No 6	0,220	0,493	Valid
7	Question No 7	0,220	0,554	Valid
8	Question No 8	0,220	0,618	Valid
9	Question No 9	0,220	0,722	Valid
10	Question No 10	0,220	0,526	Valid
11	Question No 11	0,220	0,471	Valid
12	Question No 12	0,220	0,609	Valid

Reliability testing of the researcher's knowledge questionnaire was performed via the Kuder Richardson Formula (KR-20) test, and the attitude questionnaire was performed via the Cronbach's alpha test. The KR-20 reliability test assessment reveals that if the test results are in the range of 0.6–0.8, then the level of reliability is high, whereas if the Cronbach's alpha reliability test results are >0.60, then the results are reliable. The results of the reliability test for the knowledge and attitudes questionnaire are presented in Table 7. As shown in Table 7, the questionnaire on knowledge and attitudes was found to be reliable. In practical application, these results show that the items in the instrument are consistent with each other in measuring the dimensions of knowledge and attitudes.

Table 7. Results of the reliability test of the knowledge and attitude questionnaire (n=90)

No	Question	Indicator	Reliability test results	Interpretation
1	Knowledge	1-12	0,630 ^a	High reliability
2	Attitude	1-12	0,737 ^b	Reliabel

Remarks: ^aRichardson formula 20 (KR-20) and ^bcronbach's alpha tests

DISCUSSIONS

The research instrument on the knowledge and attitudes of disaster preparedness cadres prepared on the basis of literature studies, followed by a qualitative study on disaster preparedness cadres, emergency practitioners, and disaster practitioners, where five domains were obtained in the preparation of this instrument: 1) community-based disaster concepts and preparedness, (2) emergency first aid for tsunami disasters, (3) emergency first aid for drowning victims, (4) cardiopulmonary resuscitation (CPR), and (5) evacuation of bodies after a disaster [9,17–20,22–25].

Content validity shows the extent to which questions, tasks, or items in a question or instrument are able to represent the whole and proportionally [27]. The content validation process in this study involved one academic in the field of disaster and emergency management, one disaster, and one emergency practitioner to ensure that each question item represented real needs in the field and that the language used could be understood by laypeople. The validity and reliability tests for the knowledge and attitude instruments demonstrated excellent internal consistency. This means that the questionnaire is stable and reliable for repeatedly measuring the knowledge and attitudes of disaster preparedness cadres without being affected by wording ambiguity. This provides a strong foundation for future researchers to use this measurement tool as a standard for evaluating the competency of disaster preparedness cadres in tsunami-prone areas. Practically, this valid and reliable instrument can be used by future researchers, disaster nurses, or community nurses as an initial screening tool before training programs can be designed. By identifying the weakest areas of knowledge among disaster preparedness cadres, emergency education interventions can be implemented in a more targeted manner. Although this instrument met psychometric requirements, this study has limitations, as it covered only the city of Padang, requiring the generalization of the results to areas with different topographies.

Clinical implications

The instrument has been shown to provide an objective basis for health workers and community nurses to accurately map the capacity of cadres prior to the design of training programs. The identification of areas of weakness in knowledge facilitates the implementation of targeted emergency educational interventions. The data thus generated can be used as an argument for the Padang City Disaster Management Agency (BPBD) to standardise the training of all disaster preparedness cadres, so that their role as the front line is not only administrative but also functional in reducing mortality during tsunami disasters.

Limitations

It should be noted that the present study was conducted exclusively in Padang City, which is characterised by low-lying coastal topography. Consequently, the results of the study may not be

generalisable to areas with different topographies. Further testing is therefore required. The instrument has not yet been tested on cadres who have undergone formal training; therefore, its sensitivity to changes in competence after intervention is as yet unknown. The utilisation of cluster random sampling has the potential to engender selection bias, given that not all cadres in tsunami-prone areas are represented. It is recommended that further research be conducted in a multicentre setting, incorporating a range of topographies, with the objective of assessing the responsiveness of the instrument to structured training programmes.

CONCLUSIONS

This study shows that the instrument measuring knowledge and attitudes toward tsunami disaster preparedness among disaster preparedness cadres is valid and reliable. Practically, this valid and reliable instrument can be used by future researchers, disaster nurses, or community nurses as an initial screening tool before training programs can be designed. For public policy, the data generated from this instrument can be the basis of arguments for the Padang city BPBD to standardize training for all KSB so that their role as the front line is not only administrative but also functional.

CONFLICT OF INTEREST

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

AUTHOR CONTRIBUTIONS

Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Resources, Data Curation, Writing - Original Draft, Writing - Review & Editing, Visualization, Supervision: KRE, NF, FTA, RO, ZM, RAN and PIS.

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DECLARATION OF ARTIFICIAL INTELLIGENCE USE

We hereby confirm that no artificial intelligence (AI) tools or methodologies were utilized at any stage of this study, including during data collection, analysis, visualization, or manuscript preparation. All work presented in this study was conducted manually by the authors without the assistance of AI-based tools or systems.

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