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# Validity and Reliability of the Disaster Preparedness Knowledge Instrument for Health Cadres in Volcanic Disaster-Prone Areas



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## ABSTRACT

**Background:** Public health cadres can play an important role in improving disaster response and recovery. However, a multidimensional instrument is needed to assess the levels of disaster knowledge for community health cadres. This instrument is important to develop a complete and effective educational program for disaster preparation for health cadres. Therefore, this study aimed to test validity and reliability of the disaster preparedness knowledge instrument for health cadres in areas prone to volcanic disasters.

**Methods:** A cross-sectional study was conducted by involving 300 respondents. The instrument was developed by conducting literature review followed by completing a qualitative study. We reduced the original instrument from 50 items to a final instrument comprising 41 items, classified into 6 categories: 1) early warning [16 items]; 2) disaster triage [4 items]; 3) basic life support [7 items];

4) first aid [7 items]; 5) search and rescue [5 items]; and 6) logistic, communications and team organization [2 items]. Instrument validation was assessed by using Pearson Product moment and the reliability was estimated by using internal consistency reliability.

**Results:** 300 respondents were involved in this study with all respondents were women aged between 40-49 years old. All of them were either health cadre or high school students. In instrumental testing, all 41 items of the instrument were confirmed through content validity (Pearson Product Moment). Using internal consistency reliability, the study found reasonable inter-item reliability for all items (Cronbach's  $\alpha$ : 0.785-0.807).

**Conclusion:** Higher score on disaster triage aspect suggest that health cadres have pivotal role in emergency care during disaster. The finding revealed that disaster triage technique and skills for health cadres or lay man is very important.

**Keywords:** Validity, reliability, instrument, knowledge evaluation, disaster preparedness

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## INTRODUCTION

Indonesia is a country that prone to natural disasters, such as tsunami, volcano eruptions, and earthquakes, which are caused by its geological, geographical, demographic and sociological conditions.<sup>1</sup> Indonesia located in the Pacific Ring of Fire, which has many active volcanoes that could pose a danger to humans. Indonesia has more active volcanoes than other countries-around 129 volcanoes stretching 700 km from Aceh to North Sulawesi through Bukit Barisan, Java Island, Nusa Tenggara and Maluku.<sup>2</sup> According to Law No. 24 of 2007, disaster management is the responsibility of all individuals. The change is that the responsive paradigm has developed into prevention, sectorial has becomes multi-sectorial, decentralized and it is the responsibility for components of society. Thus, the concept of disaster management is a shared responsibility of all the components of government, society and other parties from the business sector and other fields. Community Based Disaster Risk Reduction (CBDRR) is one form of the actualization of shared responsibility in disaster management. Health

cadres are one of the important components in the community. Village health cadres are educated and trained volunteers in certain fields that grow in the community and feel obliged to implement, improve and foster the welfare of the community with selfless sincerity and work based on the call to carry out humanitarian tasks.<sup>3</sup>

At present, disaster preparedness and response is an important priority for everyone to be involved in. To prevent loss of life and limit the impact of disasters, emergency preparedness should be implemented by village health cadres because of their closeness with local community and able to perform several roles and tasks in assisting the community in the emergency phase.<sup>4</sup> However, previous studies reported that role of health volunteers during disaster events are tend to be limited due to lack of qualified staff<sup>5</sup> and, until recently, unavailability of instrument to evaluate health cadres knowledge related to disaster preparedness. In addition, village health cadres have the responsibility to effectively prepare themselves for services

before the disaster strikes and they must have the ability to think critically and respond to whatever possible needs may arise.<sup>6</sup>

Today, every village has health cadres as a part of the government's efforts to improve the quality of health services and community health status. Cadres are one of the parties who are relied upon and part of the social capital of the community and have an important role in the implementation of disaster preparedness and emergency at the village level. During this time, village health cadres have in depth and varied tasks such as implementation of toddlers integrated health post, elderly integrated health post, Adolescent Family Development cadre, Toddler Family Development cadre, Mosquito Nest Eradication cadres and so on. Village health cadres consist of people living in communities that contribute to primary health care to improve their health status. Their role potential depends on the level of training they have received.<sup>7</sup> Cadres play an important role in the crisis phase or emergency phase because many victims can be saved in the first hours after the crisis.<sup>8</sup>

Evidence showed that health cadres can play an important role and task in the development and achievement of emergency management.<sup>9</sup> Health cadres are classified into the category of trained lay persons who are the main focus because they are the first responders to act in the case of local disasters. Health cadres can play an important role in improving disaster response and recovery because of their potential and effectiveness in improving community health, increasing disaster preparedness, complementing the efforts of disaster responders, and building trusted relationships between all interested parties. These activities increase social capital and significantly increase community resilience in anticipating future disasters.<sup>10</sup> With the paradigm shift in disaster management, the task of community-based disaster risk reduction is automatically referred to health cadres. Based on the experience of women's health cadres in facing disasters, health cadres need special training in handling emergency response in the event of a disaster<sup>11</sup> and competence training in disaster management.

The main competencies in disaster management are being developed into a long-term educational program. Therefore, a measuring instrument or knowledge instrument in disaster preparedness for health cadres is need to be developed especially in the areas prone to volcanic disasters. Therefore, the purpose of this study was to assess the validity and reliability of the Preparedness Disaster Knowledge Instrument for Health Cadre in Volcanic Disaster Prone Area.

## METHODS

### Instrument Preparation

The preparation of the instrument was based on the literature review and qualitative studies that have been carried out. The framework of the instruments includes (1) early warning; (2) disaster triage; (3) Basic life support; (4) first aid; (5) search and rescue; (6) logistics, communication and team organizations. In the first stage of the preparation of the instrument, 70 candidate items of instrument statements were arranged. After the instrument items were arranged, the content validity was conducted using face validity and expert judgment. Face validity was carried out to 20 health cadres from various levels of education. Then, expert judgment was carried out by involving academic experts and clinical experts in the field of disaster. Face validity is the most basic and very minimum level of content validity. Content validity judgment made by experts, while face validity judgment was derived from test participants.<sup>12</sup> Gregory et al. defined that face validity is only the stage of general acceptance towards the function of measuring tests or acceptance of language and not related to statistical validity. Further analysis after the validity of the appearance is logical validity which is a procedure for evaluating the feasibility of item content through a qualitative assessment using the expert judgment.

Expert judgment was conducted by three experts in the field of disaster. The results of the expert judgment was used for the analysis of the validity by referring to coefficient of Aiken's V content, conducted scaling the validity of each item with a V-value of 0.92.<sup>13</sup> The results of the analysis for content showed that there were 50 items with a V-value > 0.92 (Figure 1) which consisted of 17 items related to early warning, 6 item statements related to disaster triage, 8 item statements related to basic life support, 8 item statements related to first aid, 6 item statements related to search and rescue, 5 statement items related to logistics, communications and team organization. After conducting quantitative and qualitative content validity, the validity and reliability of the instrument was then tested on 300 health cadre individuals.

### Study Design and Participants

To quantitatively validate the instrument, a cross sectional study was conducted by involving 300 health cadres. All respondents in this study were health cadres who lived in 9 villages in volcanic disaster-prone areas. There were approximately 10 integrated health posts in every village with the total of 450 health cadres. Out of a total of 450 questionnaires distributed, only 300 questionnaires were completed and returned.

### Data Collection

Data collection was carried out between November 2018 and February 2019. First, the research team appointed research assistants to assist in the process of collecting data. Then, we explained the research protocol to research assistants to equalize the understanding related to the data collection process. Then, permission from local authority was obtained and data collection was conducted by visiting health cadres in their houses.

### Data analysis

SPSS for Windows version 17.0 was used for data analysis. Before the analysis, the accuracy of all data was examined and missing values were identified. Descriptive analysis was used to describe the demographic data. The validity of the instrument was determined by using the Pearson Product Moment test. The internal consistency of the instrument was

determined by using Cronbach's  $\alpha$  coefficient. The composite reliability (CR) was examined.

## RESULTS

### Demographic Characteristics of the Responders

The demographic profile of the participants is presented in Table 1. The total number of respondents in this study was 300. All of the respondents were female (100%) and mostly aged between 30-39 years (26%) and 40-49 years (47%). The majority of them had more than ten years served as a health cadre (37.3%) but 39% were senior high school graduates.

### Validity test

Validity assessment was conducted using the Pearson Product Moment. The analysis was conducted by correlating each score of items with the total score. Total score is the sum of all the item scores. All items with  $r$  count  $\geq r$  table meant that the items were significantly correlated to the total scores.<sup>14</sup> The  $r$ -table value for validity testing was found at 0.113. After conducting the validity test, with comparing  $r$ -count and  $r$ -table value, 41 of 50 items were categorised as valid. The summary of validity test results is presented in Table 2.

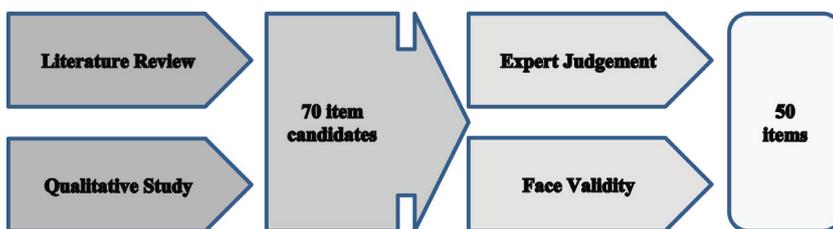
### Reliability test

General consensus shows that the instrument is considered to have good reliability if the value  $\geq 0.700$ . The reliability assessment was conducted using Cronbach alpha because the instrument was a questionnaire with a multilevel scale. The result of Cronbach  $\alpha$  coefficient was found at 0.798 (0.785 – 0.807), which means that the 41 items of questions were considered reliable.

In this instrument there were 41 valid and reliable statements out of a total of 50 statements. Of the 41 statements, 16 items were categorized into early warning, 4 items were categorized in disaster triage, 7 items were categorized into basic life support, 7 items were categorized into first aid, 5 items were categorized into search and rescue, and 2 items were categorized into logistics and organization management.

## DISCUSSION

There are some basic skills to help victims in the emergency phase during disaster such as giving an early warning, first aid, triage, search and rescue, and logistics, communications and team organization.<sup>15,16</sup> More importantly, a basic first aid technique is paramount to help most of the injured



**Figure 1** Steps in Instrument Preparation

**Table 1** The demographics profile of the participants (n=300)

Variable	n	(%)
<b>Gender</b>		
Male	0	0
Female	300	100
<b>Age</b>		
20 – 29 years	15	5
30 – 39 years	78	26
40 – 49 years	141	47
50 – 59 years	53	17.7
≥ 60 years	13	4.3
<b>Service time as a health cadre</b>		
≤ 3 years	19	6.3
4 – 6 years	101	33.7
7 – 9 years	57	19
≥ 10 years	123	41
<b>Educational level</b>		
Elementary School	79	26.3
Junior High School	93	31
Senior High School	117	39
Diploma/Bachelor	11	3.7

**Table 2** The results of the validity and reliability tests of the disaster knowledge instrument

No	Statements	r-count	r-table	Cronbach's Alpha if Item Deleted	Notes
<b>Early Warning</b>					
1	Disasters are only caused by natural factors such as tornados, floods and volcanic eruptions.	0.191	0.113	0.800	Valid
2	Disasters can affect victims psychologically.	0.319	0.113	0.794	Valid
3	Volcanic alert status is a condition that occurs when smoke comes out of the crater and an earthquake is felt in the area around the volcano.	0.337	0.113	0.794	Valid
4	Volcanic alert status is a condition that occurs when more frequent earthquakes occur and more smoke comes out and eruptions tend to occur.	0.543	0.113	0.787	Valid
5	Rivers and valleys are a vulnerable place for volcanic disasters.	0.124	0.113	0.802	Valid
6	Health cadres need to know the disaster gathering points in the area around their environment in preparation for disasters.	0.175	0.113	0.797	Valid
7	Health cadres need to know the disaster evacuation route in their environment.	0.165	0.113	0.797	Valid
8	Recognising the direction of the wind around the residence is not a form of disaster preparedness.	0.243	0.113	0.798	Valid
9	Kentongan is one of the traditional tools that can no longer be used as a disaster warning communication tool.	0.525	0.113	0.787	Valid
10	Radio is not a communication tool in disaster warning.	0.312	0.113	0.795	Valid
11	Clothes, medications, foods and drinks are equipment that must be prepared for disaster preparedness.	0.56	0.113	0.785	Valid
12	Lighters, flashlights and radios are some of the equipment that are not needed in disaster preparedness.	0.254	0.113	0.798	Valid
13	Important documents such as degree certificates are some of equipment that are needed to prepare when disasters occur.	0.459	0.113	0.789	Valid
14	People with mental disorders are not vulnerable groups as victims of disasters.	0.205	0.113	0.800	Valid
15	People with disabilities are one of the vulnerable groups as victims of disasters.	0.289	0.113	0.795	Valid
16	People who are chronically ill are one of the vulnerable groups as victims of disasters.	0.368	0.113	0.793	Valid
<b>Disaster Triage</b>					
1	First triage in disasters is given without selecting the priority of disaster victims.	0.303	0.113	0.794	Valid
2	Victims who can walk and can follow orders are labelled GREEN	0.443	0.113	0.789	Valid
3	The RED label is given to the victims who are seriously injured and cannot from the disaster location.	0.211	0.113	0.797	Valid
4	The GREEN label is given to victims who are unconscious and have many injuries.	0.444	0.113	0.788	Valid

Table 2 Continue

No	Statements	r-count	r-table	Cronbach's Alpha if Item Deleted	Notes
<b>Basic Life Support</b>					
1	Cardiopulmonary Resuscitation (CPR) is done by compressing the victim's chest as much as possible.	0.366	0.113	0.793	Valid
2	The victims who need CPR are those who still quiet and not breathing when woken up.	0.52	0.113	0.789	Valid
3	Make sure to positioning yourself in a safe environment before helping.	0.33	0.113	0.795	Valid
4	When asking for help, helpers must mention victim's location.	0.198	0.113	0.798	Valid
5	When asking for help, helpers must explain victim's condition.	0.218	0.113	0.797	Valid
6	Chest compression spot is on the chest centre when practising CPR.	0.204	0.113	0.798	Valid
7	The type of help required if finding a sinking victim is basic life support.	0.498	0.113	0.787	Valid
<b>First Aid</b>					
1	One of the signs of fracture are bone deformities.	0.288	0.113	0.796	Valid
2	One of the signs of fracture is pain.	0.193	0.113	0.797	Valid
3	One of fracture handling methods is applying bandages.	0.573	0.113	0.785	Valid
4	Checking pulses, skin sensation and movement are needed before applying bandages	0.437	0.113	0.790	Valid
5	Checking pulses, skin sensation and movement are needed after applying bandages.	0.416	0.113	0.790	Valid
6	Bright red blood emanating from the wound is a type of arterial bleeding.	0.397	0.113	0.791	Valid
7	Bright red blood emanating from the wound is a type of venous bleeding.	0.12	0.113	0.807	Valid
<b>Search and Rescue</b>					
1	Emergency removal is carried out in environmental conditions that endanger patients.	0.46	0.113	0.791	Valid
2	Non-emergency removal is carried out in environmental conditions that endanger patients.	0.318	0.113	0.796	Valid
3	Lifting of victims with pulling clothes is included in emergency transfers.	0.286	0.113	0.794	Valid
4	Blanket pulls are included in the emergency transfer type.	0.44	0.113	0.789	Valid
5	Open-air cars are one of transportation methods that can be used to carry disaster victims.	0.171	0.113	0.798	Valid
<b>Logistic and Management Organisation</b>					
1	When helping disaster victims, helpers follow instructions from BPBD.	0.176	0.113	0.798	Valid
2	Respecting team members or other parties who are helping the disaster victim is needed.	0.205	0.113	0.797	Valid

victims. These treatments can include bleeding control, shock treatment, and stabilization.<sup>17</sup>

In the category of early warning, in our instrument, there were 16 statements regarding the

early readiness of the health cadres in reducing the community-based disaster. These statements include disaster knowledge, volcanic status, volcanic disaster-prone area, knowledge regarding the

assembly point and evacuation route, communication models during disasters, disaster-prone groups, along with the necessary preparation and provisions that must be prepared by the community in the event of volcanic eruption. The early preparedness is important for community members especially those in disaster prone areas. Knowledge of early preparedness can improve understanding of disaster risks so appropriate action can be taken in the event of an emergency.<sup>18-20</sup>

Early warning is an integral part of the disaster risk mitigation system. Health cadres must be ready to understand the situation and characteristics of disasters and be aware of early warning, mobilization and evacuation. These are the first actions that must be taken during the emergency phase or response phase in the event of disaster.<sup>21</sup> In addition, cadres should identify available resources and equipment that can be used to support the early warning system and to send an alert to the community.<sup>22-24</sup>

In the event of a disaster, prioritizing and selecting which victims to help first is necessary to improve the quality and accuracy of the service for the disaster victims. When providing aid to a disaster victim, health cadres can perform a selection method based on their own capacity to help health workers in providing health services. In addition, providing basic life support is also necessary because in an emergency situation, disaster victims can be saved by effectively performing basic life-saving methods, such as clearing the airway, heart and lungs resuscitation, shock treatment, bleeding control, and application of a splint on musculoskeletal trauma.<sup>17</sup> In an emergency, bleeding, airway obstruction and shock can often cause death. Therefore, the main priorities of health cadres are manually clearing the airway, bleeding control, and shock treatment.<sup>25,26</sup>

The transportation techniques during disaster can be done by health cadres in collaboration with other volunteers such as fire-fighters, emergency medical services, police, and so on. The search and rescue team priorities are to find and evacuate victims from affected zones and transport them to the medical posts after conducting triage. Health cadres take the role in providing first aid to victims in affected zones and helping other volunteers by guiding them to other victims and the evacuation route.<sup>3</sup>

Victims with green symbol or minor injuries can be transferred by non-medical transportation after all red symbol or acute victims have been evacuated. As soon as they arrive in health services such as hospitals, every injured person must be re-examined, reassessed, stabilized and given definitive care. Health cadres must understand the

transportation plan and the location of transportation vehicles.<sup>27</sup> Immediately after evacuation or removal of victims, health cadres can conduct an assessment of the victims by performing simple actions, such as first aid, basic life support, or stopping bleeding according to their competencies in order to assist the medical team in providing first aid to disaster victims. The next action is to help prepare transportation for the victims to the nearest health centre or hospital using an ambulance that has been previously prepared.<sup>28</sup>

The development of disaster preparedness instruments for health cadres is still considered limited. Health cadres need to master not only the knowledge of disaster preparedness but also the skills needed to reduce disaster risks throughout the pre-disaster, in-disaster and post-disaster periods. Cadre volunteers are viewed as having a good ability to empower communities using societal and cultural approaches. The development of disaster preparedness instruments for health cadres needs greater attention from academics, government and other parties who are responsible for advocating and empowering communities.

## CONCLUSION

This study indicates that the disaster preparedness knowledge instrument for health cadres in volcanic prone area was reliable and valid for measuring the knowledge of community health cadres. The instrument contains six essential components related to disaster preparedness, which composed of early warning, disaster triage, basic life support, first aid, search and rescue and logistics, communication and team organisations. Higher score on disaster triage aspect suggest that health cadres have pivotal role in emergency care during disaster. This finding revealed that disaster triage technique dan skills for health cadres or lay man are very important. It needs to be further developed in order to validate psychometric properties with confirmatory factor analysis. This instrument may thus be used to evaluate the health cadres' knowledge of disaster preparedness in volcanic disaster prone areas.

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## CONFLICT OF INTEREST

All authors declared that there is no conflict of interest regarding the publication of this article.

## AUTHOR CONTRIBUTION

All author contributed equally in writing this articles.

## ETHIC APPROVAL

This study has been approved by ethic commission of Universitas Gadjah Mada with letter number KE/FK/0341/EC/2018.

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