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Environmental Changed, Capacity of Adaptation, and The Levels of Community Resilience Post-Earthquake in Lombok, Indonesia: A Cross-Sectional study

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Abstract

BACKGROUND: Natural disasters led to environmental destruction, casualties, and fatality. Disasters have been associated with post-traumatic disorders among affected community, thus, it is important to understand capability and resilience level post-disasters.

AIM: This study aims to determine the degree of environmental change and the capacity of adaptation associate to the levels of community resilience among earthquake victims in Lombok, Indonesia.

METHODS: A number of 129 respondents were recruited using clustered random sampling design. Data were collected using the adaptation capacity framework and the resilience brief scale questionnaire by face-to-face interviews. Significant level was set as p = 0.05 with 95% confidence interval. A Chi-square statistical test and logistic regression were used to test hypothesis.

RESULTS: A number of 129 respondents included in the study. Bivariate analysis indicated a significant correlation between environmental changed, adaptation capacity, and community resilience. Environmental changed was predictor that statistically significant predicted community resilience (ß = 2.425, p < 0.001).

CONCLUSION: The level of environmental destruction was significantly predicted the level of community resilience.

Introduction

Earthquakes are traumatic events. It is a natural disaster that causes a wide range of consequences including mental and physical health problems [1]. Disasters are events that occur suddenly or unplanned either caused by nature, non-natural, and social communities in which the impacts are on normal life patterns, damage to ecosystems [2]. In some countries such as Indonesia, natural disasters almost occur every year where the number of disaster events in 2014 reached 972 incidents with 374 fatalities, 1,764,227 suffered and displaced, and 39,823 residential damages [3]. In 2018, there were 1227 disasters where the incidents caused 124 deaths and house damages of 20,658 units [3]. Disasters cause a lot of damage and sufferings among victims, thus, taking necessary efforts to build or increase the potential for resilience in the community are imperative [4], [5].

Resilience is required to overcome all the impacts of changes. Community resilience is defined as an effort to overcome, deal with, and mitigate stress caused by traumatic events [6], [7]. It also refers to the ability of a community to rise from stressful or traumatic situations by utilizing available resources and adaptability to optimize the function and sustainability of a community [8]. One of the importance of building resilience is because resilience is a way to prevent or a preventive measure for reducing the worsening effects

of disasters [9]. However, this depends on the capacity or adaptation strategy of individuals, communities, regions, governments, organizations, or institutions to adapt to a disturbance and the occurrence or suppress the damage [10]. Hence, a community needs to develop an adaptive behavior where an adaptive capacity enables parties to anticipate, plan, react, and learn from disturbances [11]. Community sensitivity and adaptability to a disaster are determined by a number of assets and resources in the form of human, technological, physical, funding, environmental, political, and resources that can be used to deal with disturbances. Understanding of these factors is crucial to take necessary efforts for mitigation of the impacts of disaster.

Earthquake in Lombok, West Nusa Tenggara Province, occurred with a magnitude of 6.4 on the Richter scale and 1005 aftershocks caused many casualties and physical damage to house buildings and educational and health facilities [3]. The earthquake caused fatalities, injuries, damage to houses and public facilities, and refugees. It has been understood that human preparedness, responses, and adjustment to natural disasters, technological disasters, or violent conflicts are closely related to the ability of the community to bounce back after experiencing a disaster [12]. This makes resilience or the community's independent ability to face and recover one of the concerns and policy priorities. However, study on factors related to the independent ability of the Lombok community to build resilience in response to the earthquake is limited. This study aims to determine determinant factors related to community resilience of post-earthquake in Lombok.

Methods

Study setting, design, and participants

This was a cross-sectional study that included 129 participants of Tanjung North Lombok subdistrict that was affected by a 6.4 Richter scale earthquake. Sample was recruited using proportional cluster random sampling based on village levels. Methods for data collection were done with face-to-face interviews, where participants were explained the purpose of study and completed informed consents. Ethical approval was gained from the Committee of Ethics of Faculty of Medicine, Public Health and Nursing, Gadjah Mada University, with ID number KE/FK/0289/EC/2019.

Demographic characteristics

Respondents were asked to complete demographic data encompassing age, gender, education levels, occupations, and incomes. Age was a dichotomous data which were coded 1 as the age between 15 and 64 years and 2 if respondents aged 65 years and older. The code 1 (1) was defined as productive age and 2 (2) as non-productive. Those who finished elementary school were coded as 1, high school as 2, and graduate school as 3. Occupation was a categorical data for 1= worked and 2= not worked, while income was categorized based on minimal wages.

Environmental changed

Environmental change was defined as the damage of the environment characterized by the destruction of participant's houses due to earthquakes. The change was categorized as "light medium" (1) if houses had minimal destruction, while total destruction of the house was categorized as "heavy." Environmental change was assessed using an observation house destruction chart that was developed by the Research Institute for Human Settlements of the Ministry of Public Works [13].

Capacity adaptation

The Indonesian version of the Adaptation Capacity Framework was used to measure respondents capacity to adapt during disaster [14], [15]. This was 12-item questionnaire using Guttman scale, where the responses for yes were scored as 1 and no for 0. The questionnaire measured subdomains of sensitivity responses, disaster exposures, and coping strategies. The tool was valid and reliable with Cronbach of 0.907.

Levels of community resilience

Community resilience was measured with the Indonesian version the Resilience Brief Scale Questionnaire (RBSQ) [16]. The questionnaire was a Likert scale developed by Smith *et al*. (2008) scoring with one "strongly disagree" to 5 "strongly agree." The responses were categorized as good resilience (2) and bad resilience (1). Cronbach alpha for the RBSQ was 0.758.

Statistical analysis

Univariate data were presented in frequencies and percentages, while bivariate data that measured the association between respondent characteristics, predictors, and outcome variables were analyzed using Chi-square tests. Significance was determined using $p < 0.05$, 95% confidence interval (CI). A multivariate logistic regression model was applied to determine the most influential factor to the level of community resilience. Data were analyzed using IBM SPSS statistic 20.0 version [17].

Ethics clearance

This research has ethical clearance by the Committee of Ethics of Faculty of Medicine, Public Health and Nursing, Gadjah Mada University, with ID number KE/FK/0289/EC/2019. Respondents were affected the whole community earthquake and living in Tanjung North Lombok Regency.

Results

A total of 129 respondents from Tanjung North subdistrict of Lombok participated in the study, including 107 (82.9%) were male and of 103 (79.8%) respondents were aged between 15 and 64 years. Table 1 presents the association between demographic characteristics, predictors, and community resilience. Environmental factors which were dominantly heavy destruction or heavy changes were statistically significant associated with community resilience (p = <.001). Adaptation capacity including disaster exposure, sensitivity responses, and coping strategy was significantly correlated with community resilience (p = 0.025; 0.029; and 0.009), respectively.

Table 1: Summary of demographic characteristics, environmental changed, and capacity adaptation associated with community resilience (n = 129)

Variables	All participants	Community resilience levels		p value*
		Bad	Good	
Age, n (%)				
1 = 15–64	103 (82.9%)	7 (17.9%)	19 (21.9%)	0.681
2 = ≥ 65	26 (20.2%)	32 (82.1%)	71 (78.9%)	
Gender, n (%)				0.859
1 = Female	22 (17.1%)	7 (17.9%)	15 (16.7%)	
2 = Male	107 (82.9%)	32 (82.1%)	75 (83.3%)	
Education, n (%)				0.302
1 = Elementary	22 (17.1%)	9 (23.1%)	13 (14.4%)	
2 = High school	72 (55.8%)	18 (30.8%)	54 (60.0%)	
3 = Graduate	35 (27.1%)	12 (30.8%)	23 (25.6%)	
Occupation, n (%)				0.778
1 = Worked	98 (76.0%)	29 (74.4%)	69 (76.7%)	
2 = Not worked	31 (24.0%)	10 (46.2%)	21 (23.8%)	
Income, n (%)				0.288
1 = <1.800.000	77 (59.7%)	26 (66.7%)	51 (56.7%)	
2 = ≥1.800.000	52 (40.2%)	13 (33.3%)	39 (43.3%)	
Environmental changed, n (%)				0.000
1 = Light-medium	53 (41.1%)	4 (10.3%)	49 (54.4%)	
2 = Heavy	76 (58.9%)	35 (89.7%)	41 (45.6%)	
Disaster Exposure, N (%)				0.025
1 = High	59 (45.7%)	12 (30.8%)	47 (52.2%)	
2 = Low	70 (54.3%)	27 (69.2%)	43 (47.8%)	
Sensitivity Responses, N (%)				0.029
1 = High	29 (22.5%)	4 (10.3%)	25 (27.8%)	
2 = Low	100 (77.5%)	35 (89.7%)	65 (72.2%)	
Coping strategy, n (%)				0.009
1 = High	59 (45.7%)	11 (28.2%)	48 (53.3%)	
2 = Low	70 (54.3%)	28 (71.8%)	42 (46.7%)	

*The data presented were tested using Chi-square

The results of logistic regression analysis of all predictors on community resilience are shown in Table 2. After adjusting with all predictors, the logistic regression model yielded that environmental change significantly predicted the high community resilience.

Table 2: The results of logistic regression analysis of all predictors on community resilience (n = 129)

Model	Variables	B	SE	Wald	Sig.	Exp (B)	95% CI	
							Lower	Upper
I	Disaster exposure	0.549	0.47	1.35	0.24	1.732	0.686	4.371
	Sensitivity responses	0.974	0.66	2.19	0.14	2.649	0.729	9.619
	Coping strategy	0.803	0.48	2.81	0.09	2.232	0.873	5.704
	Environmental changed	2.352	0.58	16.23	< 0.001	10.509	3.346	33.009
II	Sensitivity responses	1.170	0.64	3.35	0.06	3.221	0.921	11.264
	Coping strategy	0.789	0.48	2.74	0.09	2.202	0.865	5.600
	Environmental changed	2.425	0.58	17.36	< 0.001	11.301	3.612	35.362

The modeling data presented were tested using logistic regression.

Discussion

This study is to determine factors related to community resilience among earthquake victims in Lombok, Indonesia, after adjusting with predictors. Our study identified that the earthquake resulted in heavy environmental destructions. In addition, there was low capacity for adaptation exposure to disaster and coping strategies among the earthquake victims. However, our study revealed that sensitivity responses of respondents were in high level. We found that respondents who had substantial environmental destruction predicted of 11 times having low resilience.

In our analysis, the low level of community resilience was significantly predicted by heavy environmental destructions including losing personal assets, housing, and displacements. Lombok's earthquake caused a huge damage of housings, public facilities, and massive displacements of 431,416 people. According to Ariviyanti (2014), the loss of personal assets such as homes, treasures, jobs, and life uncertainty was a major stressor for community that requires the ability to survive and adapt well [18]. In addition, a study by Ikizer (2016) showed the association between the loss of properties and the level of post-disaster resilience on those who experienced with property loss which caused barriers to do everyday life and social life, lacking of human resources, and ruining of family history [19]. It is understandable situations where survivors of natural disaster have to rely on their coping mechanisms and resources availability as well as depends on family supports, social networks, and wider community to manage and deal with their loss and emotional distress [20]. Sudden traumatic events and the loss of assets seem a prominent factor for grieving after disaster. In relation to the concept of community resilience, capacity to overcome difficulty and stressful situations using any available resources must be acknowledged as a complex process involving the dynamic interactions between individuals, communities, and the environment [10], [21].

The finding also showed that respondents in the low category of response sensitivity mostly had a level of resilience in the good category, while those who had high category of response sensitivity mostly showed a good level of resilience. The sensitivity response, community readiness and governmental actions, and

involvement of private sectors to the natural disasters are closely related to the ability of the community to bounce back after experiencing a disaster [2], [16]. Our study supported by Reams *et al*. (2017) who showed that there was a relationship between community resilience and response sensitivity on categorizing the impacts of disaster through provision of training and delivering useful information to stakeholders, thereby, communities could improve ability to respond and recover [10]. Similar study conducted by Ariviyanti (2014) who presented that the factors related to the level of community resilience were the existence of disaster-responsive social organizations in terms of response sensitivity [18]. The existence of social organizations leads people to care about the environment and the threat of future disasters [22]. It can be seen that synergy from local government, the private sector, and the community is an important aspect to increase resilience. This is a result of coordination system establishment and multi-stakeholder information management to ensure appropriateness of fund allocations on the risk reduction and community resilience improvement.

This study highlighted the majority of respondents who were in high and low levels of coping strategies indicated a good level of resilience. Coping strategy has an association on the psychological function of individuals after a disaster both in the short and long term [11], [23]. Our study is in line with a research conducted by Shing which showed the association between positive coping strategies and the level of community resilience after a disaster [11]. Other studies also indicated that the factors related to the level of resilience were coping strategy [19]. Individual's coping abilities are specifically related to the individual's ability to release the mind from trauma and to adapt to a disorder, take advantage of, and to the consequences of the changes caused [24], [25]. Furthermore, the Global Network of Civil Society Organizations for Disaster Reduction (GNDR) found that if the community is involved and able to participate, supported by local capacity supports, and available of risk guidelines, then the implementation of disaster risk reduction at the local level will show a positive impact [26].

Conclusion

There is a good resilience level in Tanjung Lombok Regency north after the earthquake because of previous exposure to disasters, a good coping adaptation, and response sensitivity provided by local authorities. We suggest improving collaboration across governmental, private, and community sectors in tackling both at the before and after the disaster.

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