The community capacity to respond to earthquakes and tsunami threat in Air Tawar Barat Sub-District, Padang City, West Sumatra, Indonesia

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Abstract. Air Tawar Barat Village, North Padang District, including the one of most vulnerable areas to the threat of earthquake and tsunami in Padang, West Sumatra Province, Indonesia. Earthquake disasters can result tsunami risk and unpredictable when it will occur. One of the efforts to reduce the risk of tsunami disasters is to increase the capacity and attitude of community preparedness against disasters. This study aims to identify the capacity of residents to face the tsunami disaster in Air Tawar Barat Village, Padang City, West Sumatra. The method is a quantitative-qualitative research through questionnaires assessing the capacity of communities and deep interviews related disaster knowledge to the subdistrict office, Kelompok Siaga Bencana (KSB) and local residents. Secondary data obtained from the documentation in Subdistrict office and KSB, as well as literature review. The results of the study, could be concluded that the residents had good knowledge of disaster mitigation with the percentage of 64%, preparedness plans and actions had a good value with the percentage of 68.88%, perceptions and traditions of residents in preparedness attitudes (local culture and wisdom) well enough with the percentage of 50.67%, leadership and programs of the government and KSB was poor enough with the percentage of 45.33% and the role of information in the attitude of preparedness is very important with the percentage of 70%, then the average capacity level was still at low-level with the percentage of 56.87%. Based on this, the communities, KSB, local agency and the government need to have well integrated communication and coordination. It could be seen that residents likely lack of understanding about the duties and function of the KSB in taking efforts to minimize disaster risk besides this far the programs in Air Tawar Barat sub-district did not run smoothly and postponed due to limitations.

1. Introduction
In the last four hundred years, Indonesia has experienced thousands of earthquakes and tsunami, because of its location which is mostly surrounded by oceans [1]. It is noted that the islands of Sumatra and Java are the areas most frequently hit by the two disasters [2]. In Sumatra, for example, the area in Padang City, West Sumatra, is one of the areas most susceptible to disasters [3][4], including the threat of earthquake-tsunami because of its location which is directly affected by the Eurasian and Indo-Australian plates that continue to moving to form a subduction zone [5]. This subduction zone has been the source of major earthquakes in West Sumatra, as shown in Figure 1 [6].
The earthquakes in subduction zone might result in tsunami in Sumatera Barat Province [7].

The disaster risk reduction efforts is more incentive to do until the government issued a law on disaster namely UU No 24 Tahun 2007 on Disaster Management. After this law is issued, all disaster management and disaster risk reduction efforts have been intensively implemented. The law states that disaster management efforts aim to protect the community from the threat of disaster. It is also stated that everything that causes the disruption of human life including the tsunami disaster is called a disaster [8]. Disaster risk reduction must have been implemented before it’s occurred. This way is conducted so that all preparations can be made as well as possible.

According to Anam (2018), there are three disaster management philosophies that must be understood by the community. Firstly, keep disasters away from residents. Secondly, residents are kept away from the threat of disasters, and thirdly to live side by side in harmony with disasters [9]. The first and second methods are very difficult to separate from the residents, so the choice is made in the third way, which is to live side by side with disasters but continuing to develop knowledge, disaster preparedness, capacity or ability to handle disasters. To build capacity through this third one is very possible in the context of disaster management. Community involvement in supporting and carrying out disaster mitigation procedures itself has a very significant impact on disaster risk reduction, both in the situation before disaster, during an emergency even after disaster occurs [10]. Community capacity is the ability of the community to take measures and to reduce threats and the potential losses due to disasters. Community capacity can be viewed from two aspects, namely individual and institutional capacities. Individual capacity is influenced by knowledge, culture (local wisdom) and action plans. Institutional capacity is influenced by the existence of programs, information, leadership, local wisdom and facilities [11].

In order to attempt the reduction of the risk of tsunami, The Government of Padang institutions and parties togetherly have made a tsunami hazard zone map from the analysis result of the earthquake and tsunami, that can be shown in Figure 2.
Figure 2. Tsunami disaster zone map in Padang [12].

Based on this map, the Padang area is divided into 3 zones i.e: 1) High Risk Zone (areas with a high level of vulnerability to tsunamis), which are areas with very red colors. 2) Medium Risk Zone (areas with a medium level of vulnerability to tsunamis), namely areas in pink color (3) Low Risk Zone: Lubuk Kilangan District, Pauh District, Koto Tangah District. Population data by district in the city of Padang in 2016, District of West Padang is a district that the number of inhabitants are at the level of the high vulnerability of the tsunami zone (100%) and followed by the District of North Padang (88.39%) . District of North Padang and Padang District West is sub-districts with the largest people number focused on several villages that have the highest risk of casualties and had to be isolated when it was occurred [12].

Air Tawar Barat is in the red zone from the existing mapping in the BPBD. Temporary Evacuation Site (TES) in Air Tawar Barat are UNP buildings and the Masjid of Al-Azhar, but the buildings are not enough to accommodate the residents while also accommodating the students, faculty staffs. Seeing this condition, the residents of Air Tawar Barat need horizontal evacuation or vertical evacuation ways. In order to minimize the possibility of a large number of casualties by relying on existing evacuation routes, the government should pay attention to the conditions of the routes, as the requirements for an adequate evacuation route which are lane safety, route distance and route feasibility. The evacuation route used for evacuation must be completely safe from dangerous objects that can fall on them, and the distance of the evacuation route used for evacuation from the living place of residence to a safer place must be a distance that allows quickly to arrive at a safe place and routes selected are also suitable for usage during the evacuation so as not to hinder the evacuation process. Air Tawar Barat itself, if seen from the condition of the evacuation route for the tsunami disaster can be categorized as inadequate, this can be seen from the inadequate width of road and to be compared to the population density in Air Tawar Barat, for example Jalan Belibis and Jalan Cendrawasih as well as Jalan Tunggul Hitam are evacuation routes having a width of road less than 4-6 meters, causing severe congestion. Therefore, in this area it is deemed necessary to add more evacuation routes and several shelter buildings considering the dense population living in this area. In fact, it should be necessary to undertake the Tabing Airport and only be opened in case of an earthquake occurs. Another issue that need to consider is the possibility of congestion (barrier) on the existing evacuation routes. So far, no alternative route scenario has been provided [13].

Currently, the community in Air Tawar Barat has formed a disaster care community, which is called Kelompok Siaga Bencana (KSB). KSB carries out its role during the pre-disaster supported by the
geographical condition of North Padang Subdistrict especially the red zone, the existence of programs from both the government and regional levels, have programs to increase preparedness. The important aspect is the existence of community’s willingness itself with the social spirit they have to togetherly build the community [14].

2. Methods
The study method is the combination of quantitative-qualitative analysis conducted in Air Tawar Barat Village, North Padang, Padang City, West Sumatra. The location of this research was chosen because it is directly opposite the Padang beach. Primary data obtained by survey directly to the field to see the facilities and infrastructure as disaster mitigation facilities and spread questionnaires to the residents in the Air Tawar Barat. The purpose of the deployment of questionnaires is to gather relevant information needed to identify the knowledge of disaster mitigation, attitudes and preparedness in facing Tsunami threatening case the heavy earthquake occurs, so that people have the good ability and readiness in the future against the risk of tsunami disaster. Meanwhile, other data needed in the form of secondary data obtained from related literatures. After collecting questionnaires with 30 respondents then calculating index value from respectively variable of capacity with using MS Excel to gain the average index value of the capacity.

3. Discussion

3.1. The characteristic of respondents
Air Tawar Barat subdistrict has a very high risk of tsunami disaster vulnerability and a fairly high population density is Air Tawar Barat village. Air Tawar Barat has geographically conditions and the potential for its enchanting natural beauty coupled with its topography directly adjacent to the Indian Ocean, the waves are quite high. Based on the information from the Head of Air Tawar Barat Subdistrict, it has the population registered at the agency around 5,870 people including students who are temporarily domiciled who are studying at UNP, more than 5 thousand, including outsiders who sell products and food, elementary school, high school, junior high school, and kindergarten were not domiciled but active in the area, if we count the population of Air Tawar Barat is about 25 thousand people who are active from 7 am to 8 pm.

Questionnaires were distributed to 30 respondents taking into account gender, age, and education level (shown in Figure 3, Figure 4, Figure 5, Figure 6 and Figure 7). The consideration of this category is determined with the aim of knowing the extent of respondents' knowledge and understanding of tsunami disaster information.

![Figure 3. Sex gender.](image1)

![Figure 4. Age rate.](image2)
3.2. Data
Data analysis has been carried out using quantitative methods by setting weighting scale, with several questions to respondents through filling form, which aims to obtain the desired evaluation results. Questionnaire variables include knowledge of disaster mitigation, plans and actions of residents against disasters, culture and local wisdom, leadership and ongoing programs as well as the importance of information on community preparedness and disaster mitigation. The variables of community capacity in facing tsunami threat could be shown in Table 1.

Furthermore, visiting the relevant agencies then interviewing with residents who will be given filling form, which has been determined based on predetermined categories. The interview was conducted with the KSB of Air Tawar Barat. The KSB was established in 2012, but its activities have so far been vacuumed, and have not held meetings with the community to conduct socialization or counseling to reduce the risk of tsunami disaster. Although the Government has developed preparedness programs for anticipating disaster risk, it’s constrained by several factors based on the results of interviews, i.e;

a) Lack of supporting facilities and infrastructure for instance a building that function as the center for KSB activities, tsunami warning signs, the directions of evacuation routes, communication equipment such as handy talkies and radios to convey warning information about KSB
activities because at the beginning the establishment of the KSB activity site was carried out at the Air Tawar Barat Sub-District office, because there is no special place for KSB activities.  
b) Unavailability of operational costs for social activities  
c) Lack of participation and members’s role in carrying out their duties

Table 1. Variables of community capacity in facing tsunami threat in study area.

| Main Variables | Sub Variables | Description |
|----------------|---------------|-------------|
| Knowledge of tsunami disaster mitigation | X1.1 | The community has knowledge of tsunami disaster |
| | X1.2 | How to rescue own self from tsunami disaster |
| | X1.3 | Participating in any training/seminar/simulation on disaster preparedness provided by any institution/agencies in the last five years |
| | X1.4 | Understanding living place as susceptible area against risk of tsunami disaster |
| | X1.5 | Providing education or knowledge to family members about the tsunami threat and the importance of preparedness in dealing with tsunami disaster |
| Action Plan | X2.1 | Preparing for securing valuable items as preparedness attitude in facing earthquake and tsunami disasters |
| | X2.2 | Preparing food stock, clothes, and daily needs as preparedness attitude in facing earthquake and tsunami disasters |
| | X2.3 | Preparing rescue plan in case the earthquake and tsunami occur |
| Culture and Local Wisdom | X3.1 | Need motivation to have knowledge of tsunami disaster mitigation and preparedness |
| | X3.2 | Having local wisdom by calling neighbours after earthquake occurs and getting ready to stay away from the beach. |
| Leadership and Programs | X4.1 | The Government establish KCB in some of subdistricts as a program to increase awareness of tsunami disaster |
| | X4.2 | All parties (local government, agencies, institution, community groups, and individuals) have responsibilities in order for reducing the loss and fatalities as result in tsunami disaster. |
| | X4.3 | The programs are carried out well and continuously |
| | X4.4 | Socialization, Education, and Simulation are effective efforts as mitigation and community preparedness |
| | X4.5 | Tsunami Early Warning System/GITEWS program goes well and continuously |
| | X4.6 | Availability of the evacuation routes in Air Tawar Barat |
| | X4.7 | Availability of the early warning facilities in Air Tawar Barat |
| Information | X5.1 | Social media needs to provide information in order to increase the community capacity of facing tsunami disaster. |
| | X5.2 | Presuming media as an accurate source in order for increasing community capacity |

The authors also identify the readiness of schools in the study area, where the school is very near to the beach. During the interview, the KSB explained that all the schools had been given tsunami disaster simulation by inviting residents around the school and teachers at the time of the establishment of the KSB. It was begun from what would be done when the earthquakes occur, what was done when the earthquake shaking for long time and risking of potential tsunami, as well as simulations of finding evacuation routes and so on. 

Basically, the concerns of local government is actually quite good in providing knowledge and information on disasters, but constrained by the lack of facilities and infrastructure, operational funds and the inactivity of KSB members and the difficulty of changing the community's paradigm of the consequence of tsunamis. the Kelurahan Cerdas Bencana (KCB) program in Air Tawar Barat not to carried out well. Some residents also responded that the presence of this KSB group seemed to frighten
them of the possible tsunami hazard, so that not all residents could properly accept every counseling and socialization provided by the KSB. Meanwhile, several admissions from the residents who were interviewed, they had given contrary answers. The residents admitted that the agency had never provided any counseling or socialization about tsunami disaster. This thing, certainly be concluded that both the residents and government do not have good communication and coordination in the success of the Kelurahan Cerdas Bencana (KCB) program. Thus, what is expected together is not achieved. However, it is not fully the government's fault if the residents think so, it's just a misunderstanding of residents against the socialization had been given by the KSB previously. Here, it could be said that the residents have not understood of every activity carrying out by the KSB.

Table 2. Weight value of variables.

| Respondents | Knowledge of tsunami disaster mitigation | Plan action | Local Wisdom and Culture | Program and Leadership | Information | Total |
|-------------|----------------------------------------|-------------|--------------------------|------------------------|-------------|-------|
| 1           | 21                                     | 9           | 9                        | 16                     | 8           | 63    |
| 2           | 16                                     | 10          | 8                        | 15                     | 8           | 57    |
| 3           | 18                                     | 12          | 8                        | 17                     | 6           | 61    |
| 4           | 15                                     | 10          | 7                        | 16                     | 6           | 54    |
| 5           | 19                                     | 12          | 7                        | 19                     | 8           | 65    |
| 6           | 19                                     | 12          | 7                        | 20                     | 6           | 64    |
| 7           | 16                                     | 11          | 6                        | 18                     | 8           | 59    |
| 8           | 14                                     | 10          | 6                        | 18                     | 6           | 54    |
| 9           | 13                                     | 10          | 8                        | 12                     | 6           | 49    |
| 10          | 15                                     | 10          | 9                        | 12                     | 6           | 52    |
| 11          | 13                                     | 9           | 8                        | 12                     | 6           | 48    |
| 12          | 17                                     | 12          | 6                        | 18                     | 8           | 61    |
| 13          | 15                                     | 10          | 7                        | 19                     | 6           | 57    |
| 14          | 15                                     | 11          | 6                        | 18                     | 8           | 58    |
| 15          | 14                                     | 10          | 9                        | 12                     | 6           | 51    |
| 16          | 17                                     | 10          | 8                        | 15                     | 8           | 58    |
| 17          | 13                                     | 10          | 9                        | 12                     | 6           | 50    |
| 18          | 19                                     | 9           | 9                        | 16                     | 6           | 59    |
| 19          | 21                                     | 9           | 9                        | 16                     | 8           | 63    |
| 20          | 15                                     | 11          | 6                        | 18                     | 8           | 58    |
| 21          | 13                                     | 10          | 9                        | 12                     | 6           | 50    |
| 22          | 16                                     | 11          | 6                        | 18                     | 8           | 59    |
| 23          | 15                                     | 11          | 6                        | 18                     | 8           | 58    |
| 24          | 15                                     | 10          | 7                        | 16                     | 8           | 56    |
| 25          | 16                                     | 10          | 8                        | 15                     | 8           | 57    |
| 26          | 19                                     | 12          | 7                        | 19                     | 8           | 65    |
| 27          | 13                                     | 10          | 9                        | 12                     | 6           | 50    |
| 28          | 15                                     | 10          | 8                        | 12                     | 6           | 51    |
| 29          | 15                                     | 10          | 7                        | 19                     | 6           | 57    |
| 30          | 20                                     | 9           | 9                        | 16                     | 8           | 62    |

| Total       | 482                                     | 310          | 228                      | 476                    | 210         | 1706   |

The questionnaires were distributed by visiting the houses of residents who had been previously determined as main respondents based on age rate, sex gender, education level and income level as well as selecting the residents who live near the beach line. It was distributed to 36 respondents with 20 questions about knowledge and preparedness for facing the tsunami disaster. However, in evaluating the sampling data, the writer validated only 30 respondents that fulfilled the criteria for answering all
questions. The data that had been collected from the questionnaire would be counted by weighting factor analysis using a Likert Scale with rates of 5, 4, 3, 2 and 1. Based on the results, it could be seen that residents in the study area commonly have preventive acts for facing tsunami but their knowledge are still not sufficient, need to coordinate with agency or local government so that communication would be delivered to the community. The recapitulation of weight value with the 20 questions given to respondents can be displayed in Table 2.

The criteria of capacity level could be defined as the following: very good 80-100%, good 60-80%, less good 40 -60% and 20-40% poor. The results obtained could be seen that in general the community's understanding of the earthquake and tsunami disasters is good from several aspects, but poor especially for program support and the completeness of supporting infrastructure for disaster preparedness, thus the total of community capacity is not good enough with the percentage of 56.87%.

| Knowledge of tsunami disaster mitigation | Plan action | Local Wisdom and Culture | Program and Leadership | Information | Total Percentage |
|-----------------------------------------|-------------|---------------------------|------------------------|-------------|------------------|
| 482/750 x 100 %                         | 310/450 x 100 % | 228/450 x 100 % | 476/1050 x 100 % | 210/300 x 100 | 1706/ 3000 x |
| = 64%                                   | = 68.88%      | =50.67%                   | =45.33%                | % =70 %     | =56.87%          |

4. Conclusions

Based on the answers of respondents (residents) and local agency in Air Tawar Barat Subdistrict, North Padang District was concluded that commonly the residents good for knowledge of disaster mitigation with a capacity level of = 64%, plans and preparedness actions were also good with capacity level = 68.88%, perceptions and traditions of residents in preparedness attitudes (culture and local wisdom) are good with a capacity level = 50.67%, leadership and programs from the government and KSB are poor with a capacity level of 45.33% and the role of information in preparedness attitude was very important with capacity level of 70%. Based on this, the community members, KSB and Agency have poor coordination and communication. It could be seen that residents might not understand the duties and function of the KSB in Air Tawar Barat. The authors reviewed that the actual information and socialization given by the KSB still considered insufficient, therefore information about disaster preparedness is very significant for the community.

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