

COMMUNITY PREPAREDNESS LEVEL ON TSUNAMI DISASTER IN SIDOASRI VILLAGE, SUMBERMANJING WETAN DISTRICT, MALANG REGENCY, INDONESIA

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Most of earthquakes and tsunamis in Indonesia cause high casualties. The high casualties showed that the level of community preparedness for tsunami disasters is still low. Sidoasri Beach is one of v-shape beach and the dangerous beach for tsunami in Malang. This research aims to determine the level of community preparedness on tsunami and describing the relationship between level of education and age with the level of community preparedness on tsunami. Sample of respondents was determined by proportional sampling method which then respondents were selected by systematic random sampling method. Datas were collected through observation, questionnaires, and documentation. The results showed that the index of community preparedness for tsunami in zone I and II which respectively 44,08% and 55,79% with moderate preparedness category, while the index of community preparedness for tsunami in zone III is 66,04% with a high preparedness category. Test showed that the high education impacts on high level of preparedness index on tsunami, whereas the high age impacts on low preparedness index on tsunami. The highest preparedness level is owned by educated College/Academy students and aged between 35–39 years-old. The worse preparedness level is owned by elementary school-educated and aged ≥ 55 years-old. Tsunami socialization is required to increase the tsunami disaster preparedness level of Sidoasri community, especially communities of zone I who is only elementary-school educated and aged ≥ 55 years-old. The College/Academy community or aged between 35–39 years should have played an active role in giving an understanding to the public about the importance of high preparedness of the tsunami disaster.

Keywords: Community Preparedness, Disaster, Tsunami

INTRODUCTION

Tsunami is known as a natural disaster which can cause both great casualties and impact for human being. Japan was hit by earthquake and tsunami in 2011. The Government of Japan noted that the confirmed death victims reached 15 413 people, while 8069 people were reported still missing (Tempointeraktif.com, 2011). The tsunami also has hit Aceh and North Sumatra in 2004. National Coordination Agency (Bakornas, 2005) stated that 173 981 victims died from this very tsunami disaster which occurred in Aceh and North Sumatra. Recorded earthquake disaster also has hit Bantul area, DIY with the victims reached 6,050 inhabitants (ITB Geodesy, 2007).

The high number of victims shows that the level of community preparedness in facing disaster is still quite weak. Spittal in Rinaldi (2009: 47) stated that Indonesia still has a weak preparedness in facing disasters. Indonesia, as a country, is hazard to natural disasters, it turns out that people still can not respond properly to the disaster. Sartohadi (2010: 9) added that natural disaster can not be eliminated by humans because it is part of the process of evolution of landforms that continues time by time.

Tsunami has hit the southern Malang district in 1958 and 1967 with the intensity scale reached MMI VII-VIII. There were 1539 houses were damaged in Dampit area alone, 14 people were killed, and 72 people were injured, while in Gondanglegi, there were nine people who were killed, 49 injured, 119 buildings have collapsed, 402 have cracked, and five mosques have damaged (Volcanology Department of Energy in the Vivanews .com).

A good understanding and knowledge about the dangers and tsunami disaster, especially for people who are threatened by tsunamis is needed. Small and Nicholls in *the United States -Indian Ocean Tsunami Warning System Program (US-IOTW) (2007: 2-7)* stated that there is currently estimated at 23% of the world population (1.2 billion people) live no more than 100 km from the coastline and 100 meters above the sea level. Latif (2006) added that the Estimated Time of Arrival all over the coast of Indonesia is only less than 30 minutes. Therefore, the evacuation time is very short.

Sidoasri village is situated in the southern coastal area of Malang district which is directly adjacent to the Indian Ocean and very close to the subduction zones. Thus, it is hazard to earthquakes and tsunamis. The tsunami has hit Tamban and Sendangbiru beach region which is located in west Sidoasri in 2006. The disaster caused damage to fishing boats and the nearby settlements (Primary Data, 2012).

Sidoasri has a population of 5070 inhabitants (Sidoasri Statistics Data). Besides, the non-productive age population (0-14 and 64 years and

above) is 35.44%. Large population also bring affect of the disaster as well as gives great possibilities as well. Habibi and Buchori (2013: 5) stated that more and more people aged under five and the elderly, the vulnerability of a disaster area will be greater. Sidoasri village population composition by educational level shows that 48.57% of the citizen only elementary school graduates. According Setyaningrum (2012: 263), senior high school graduate of the population has a low susceptibility to disasters compared with residents who are elementary school graduates.

This article aims to analyze the relationship between level of education and age on the level of community preparedness in facing the tsunami disaster as well as to analyze the level of community preparedness in facing tsunami disaster. It is expected that this research can be a reference for the government in providing public education in facing tsunami disaster.

Method

This type of research is a survey research with a quantitative approach. The level of preparedness on tsunamis is determined by weighting several indicators according to Table 1.

Table 1. Indicators of Community Preparedness in Facing Tsunami

No	Indicators	Value
1	Awareness and vigilance on tsunami threat	
	a.Community knowledge related to the danger of tsunami	5
	b.Understanding on the natural phenomena of tsunami	5
	c. Response to early warnings	5
	d. Early reaction to tsunami	5
2	Evacuation planning	
	a. Understanding about the evacuation sites	4
	b. Understanding about the evacuation route	4
3	Community Participation	
	a.The participation of the tsunami dissemination	3
	b.Willingness to join socialization	3

Source: Anwar, 2011

The preparedness in facing tsunami disaster is based on a person's awareness and alertness to the dangers that threaten the region. Awareness and vigilance on tsunami's threat can be obtained through the understanding of natural phenomena of tsunami, the response and reaction to the tsunami warning. Knowledge of the tsunami disaster is the basis for early evacuation and prevention of tsunami. If knowledge is

weak, then the danger of a tsunami warning will be difficult to be responded well. If there is a less respond, then the community will be less able to react to save themselves. Therefore, the first indicator has the highest value.

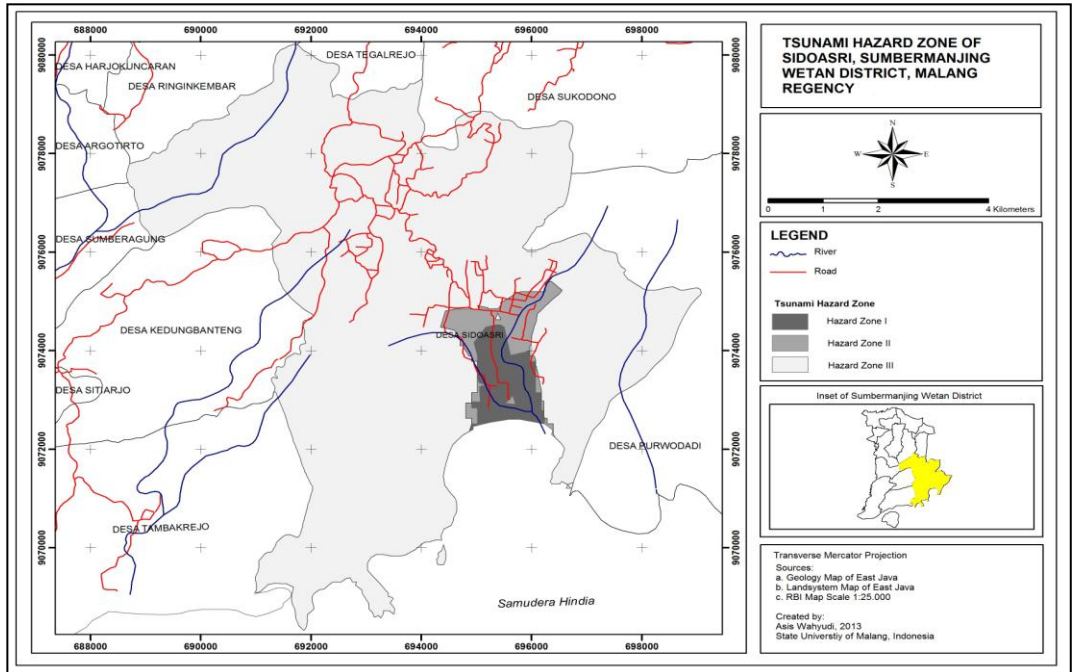


Figure 1. Tsunami Hazard Zone of Sidoasri Village, Malang Regency

Area sample is determined by determining the tsunami-hazard zones as shown in Figure 1. The sample of respondents was taken from a population of 1393 heads of household then determined by the proportional method and systematic random sampling. Based on the calculation method of sampling by Dixon and B. Leach (Tika, 2005), obtained a number of samples as shown in Table 2.

Table 2. Total Sample of the Respondents

No.	Hazard Zone	Head of Family Number	Number of Respondents
1.	Hazard Zone I	796	72
2.	Hazard Zone II	353	32
3.	Hazard Zone III	244	22
Total		1393	126

Source: Adopted from Desa Sidoasri's Profile, 2010

Data were collected through observation, questionnaire, and documentation methods which then are analyzed with a single tabulation, cross tabulation (crosstab), and Pearson Product Moment Correlation test. Questionnaire contains questions with answers that are categorized in right and wrong. Each correct answer is multiplied by value, so we get the community's preparedness on tsunami index and categorized in level of preparedness in Table 3.

Table 3. Categories Community Preparedness in Facing Tsunami

No.	Preparedness Index	Preparedness Level
1.	0–34%	Low
2.	34–66%	Moderate
3.	66–100%	High

Source: Anwar, 2011

RESULT AND DISCUSSION

Physical Condition of Sidoasri

Sidoasri village is geologically composed by the youngest sediment, the alluvium and coastal sediment (Qal) as well as swamps and river sediment (Qas). Alluvium and coastal sediment (Qal) located in the southern coastal of Sidoasri, while the swamp and river sediment (Qas) located in the northern part of Qal. Qal and Qas source material are from the sediment surface. Qal is composed of gravel, sand, and mud, while Qas is composed of gravel, less clogged sand, mud, and a thin layer of crop residues. The geological structure in the form of Qal and Qas have rock structure that is always under water, so that when the tsunami hit this rock, it can not be the wave absorbers. Such conditions make Sidoasri into tsunami-hazard area.

Sidoasri village is occupied by the landform and hazard plains (Figure 2). Landform is located in the northern plains, while the morphology swamp located to the south and overgrown by mangroves. In the southern part of the swamp area behind the ups and downs (M.2.3). Form of swamp land is young alluvium derived from a mixture of marine sediment deposition in the estuary and the Indian Ocean. The middle of a residential area of the plains between the hills (A.2.3). In litology, plateau landform between hills is fan alluvium sediment from the river, the River Kemudinan and Djokromo. Both rivers form the beach Sidoari shaped bay (V-shape) that can lead to high concentrations of tsunami waves (Intergovernmental Oceanographic Commission, 2008). Section flanking the village of Sidoasri be back old volcanic hills (V.3.2.1). Landform

backs of old volcanic hills of the Mount Balang land system and consists of andesite, basalt and breccia (Bappeda Malang, 2006).

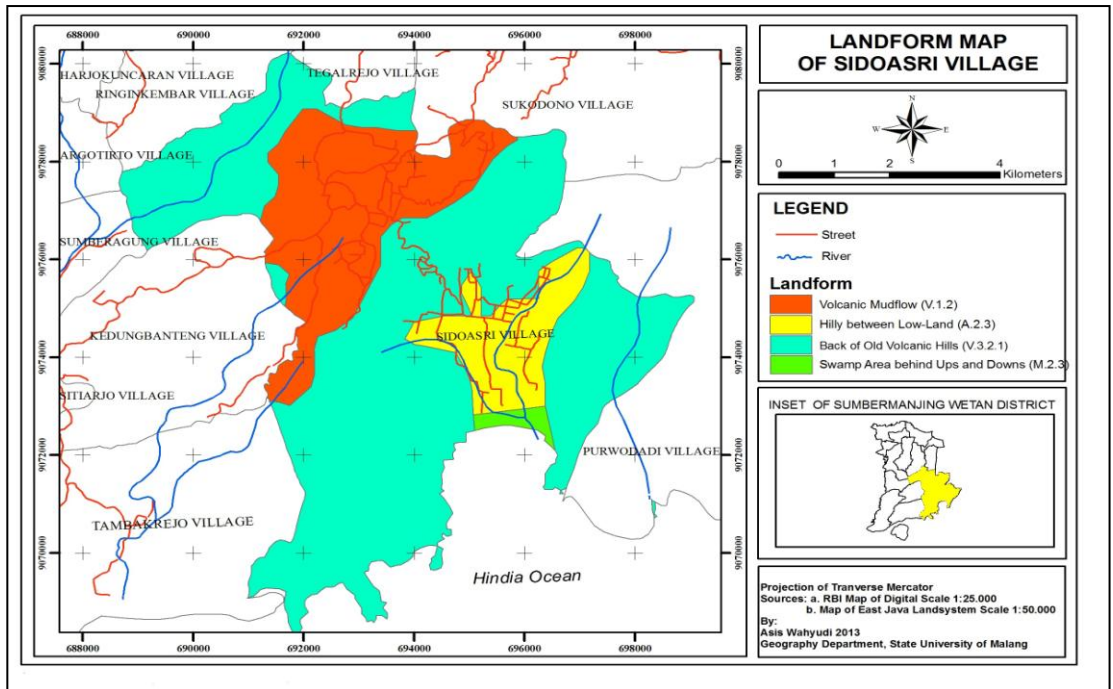


Figure 2. The Landform Map of Sidoasri Village

Table 4. Landuse of Sidoasri

No	Landuse	Large (Ha)	(%)
1.	Settlement	213	11,06
2.	Rice Field, consist of:		
	a. Technical Irrigation	100	5,19
	b. A half Technical Irrigation	161,660	8,40
	c. Rainfed	7	0,36
3.	Dry Field	236,460	12,28
4.	Forest	1.165,227	60,52
5.	Public Facilities	42	2,18
	Total	1.921,181	100

Source: Statistic Data of Sidoasri Village, 2010

Seeing from its topography, Sidoasri village is at an altitude of ≤ 25 meters above sea level. Tsunami inundation can be affected by altitude of place. The lower a settlement on the sea surface, the greater the possibility of a tsunami could inundate the area. Sidoari settlement areas in less than 30 meters above sea level.

Most area in the lowlands of Sidoasri have vulnerability to tsunamis based on the land use. Statistical data of Sidoasri village (Table 4) shows that most of its area is settlements, forests, and fields. The use of land for settlement is 11.06% of the entire area.

Correlation between Level of Education and Community Preparedness Level on Tsunami Disaster

The correlation between level of education and the level of community preparedness in facing the tsunami disaster (Table 5) shows that in the elementary school graduates respondents mostly have low and medium level of preparedness as much as 17.46% and 18.25%. Statistical test was done by using Pearson Correlations showed there is a significant relationship between the level of education and the level of community preparedness in facing the tsunami disaster. The higher a person's education level, the higher of preparedness index will be.

Level of education can affect someone's mindset in responding to natural phenomena. Kaunang in Dissastra (2011:7) stated that the knowledge gained through experience, which is in direct contact with the natural environment with the help of sensory organs. The experience gained from the results of both formal and non-formal learning.

Vulnerable respondents in zone I and II hazard largely from elementary school graduate. Difficulty in accessing the area outside of Sidoasri village because the road conditions are rocky and steep to be one of the causes. Respondents are admitted to not want to continue higher education because of the condition of the road to school is difficult. It is different with people in vulnerable zone III, who are largely educated at the level of universities/academies, because access to other areas that have high schools or universities (Turen/Malang) is closer and easier.

Table 5. Correlation between Level of Education and Community Preparedness Level on Tsunami Disaster

Level of Education	Preparedness Level						Total	%
	Low	%	Moderate	%	High	%		
Elementary	22	17,46	23	18,25	0	0	45	35,71
Junior High School	1	0,79	32	25,39	1	0,79	34	26,98
Senior High School	0	0	11	8,73	5	3,96	16	12,69
Diploma/College	0	0	6	4,76	25	19,84	31	24,60
Total	23	18,25	72	57,14	31	24,60	126	100

Source: Analysis of researcher by using SPSS 16.0

Elementary School educated people have the highest preparedness in the medium category, as well as educated respondents

who graduate from junior high and senior high school. Meanwhile, College/Academy graduates mostly have relatively high preparedness. These data suggest that education can affect a person's knowledge. According to research done by Setyaningrum and Giyarsih (2012: 263) that people without school/did not finish elementary school are in the category of highest vulnerability to disaster compared with the population at the level of higher education. The results showed that College/Academy educated people have the best disaster preparedness.

There is a tendency of the longer formal education, the level of preparedness in facing tsunami is higher. Higher educated people have the better knowledge and experience to answer the questionnaire about the tsunami disaster preparedness. As for the dissemination of disaster education contributes high enough in determining the preparedness of the community on the tsunami. This is consistent with the results of research and Marfai Sunarto (2012: 19), he stated that the program and the dissemination of disaster preparedness rehearsal field can improve local communities to natural disasters, including tsunamis.

Correlation between Age and Community Preparedness Level on Tsunami Disaster

The relationship between age and the level of community preparedness in facing tsunami disaster (Table 6) shows that the respondents with age range 35–39 years most have a level of preparedness that is classified in moderate, that as many as 18 of the 24 people in the same age range. Most high-level of preparedness is on the respondent with a lifespan of 30–34 years. Respondents who have low preparedness at most in the range of ≥ 55 years old, as many as ten people. Statistical test by using Pearson Correlations showed there is a significant relationship between age and the level of community preparedness in the facing the tsunami disaster. The lower of person's age, the preparedness index is higher.

Table 6. Correlation between Age and Community Preparedness Level on Tsunami Disaster

Age	Preparedness Level						Total	%
	Low	%	Moderate	%	High	%		
25–29	0	0	2	1,58	3	2,38	5	3,96
30–34	0	0	7	5,56	8	6,34	15	11,90
35–39	1	0,79	18	14,28	5	3,96	24	19,04
40–44	2	1,58	14	11,11	7	5,56	23	18,25
45–49	6	4,76	14	11,11	7	5,56	27	21,42
50–54	4	3,17	7	5,56	1	0,79	12	9,52

≥55	10	7,93	10	7,93	0	0	20	15,87
Total	23	18,25	72	57,14	31	24,60	126	100

Source: Analysis of researcher by using SPSS

The level of community preparedness in facing of the tsunami for the population aged between 35–39 years mostly in the medium category. The population aged between of 30–34 years mostly have a high degree of preparedness of the tsunami disaster. These results can be interpreted that the age of a person affects the power and the ability to obtain information. Young aged communities which are between 25–29, 30–34, and 35–39 years have a better ability to access information to disaster. Habibi and Buchori (2013: 5) had stated that the high percentage of aged population besides productive (0–14 and > 64 years) is one of indicators of higher vulnerability to disaster. The higher percentage of elderly and children, the chance of casualties is higher.

The less population in the productive age, the preparedness index tends to be higher. The ability to access and obtain information including information about the tsunami at a young age population (> 25 years) is better when compared to respondents in the older age. It can be concluded that the population aged between 35–39 years have the best level of preparedness in facing the tsunami compared to the population in other age range or older.

Community Preparedness Levels in Facing Tsunami

Community preparedness in facing the tsunami disaster can be viewed from three tsunami-hazard zones, hazard zone I, II, and III. Danger zone is based on the possibility of a tsunami flooded areas by overlaying maps of topography, geology, and geomorphology of Sidoasri village. Sidoasri is included tsunami-hazard areas because it occupies the coastal plains. This was confirmed by Sartohadi (2010: 14) that the tsunami-hazard region occupies undulating terrain in the coastal region. Sidoasri traversed by the river Djokromo and Kemudinan, so that residential areas are located in the watershed into areas hazard to tsunami. According to Bappeda Malang (2006:32) tsunami hazard areas in Malang are in the form of sediment swamp and the area around the river (Qas) then in the alluvium and coastal sediment (Qal), including Sidoasri.

Community preparedness index in hazard zone I (Table 7) is 14.99 or 44.08% with moderate preparedness category. Hazard zone I has the lowest preparedness index on other zones in the Sidoasri village. The highest hazard zone requires a high degree of preparedness. High preparedness can determine the ability of communities to save

themselves in case of a disaster. People in vulnerable zone I will have the greatest threat and loss if tsunami happened. Bappeda Malang (2006: 33) stated that the zone I is an area hazard to tsunami directly, so the impact of the damage is expected to be most severe.

The public preparedness index for hazard zone II is 18.97 or 55.79%, with moderate preparedness category. Hazard zone II is an area that is exposed to the possibility of a tsunami if a very large tsunami happened (Bappeda Malang, 2006). Community in this zone has a better chance to save themselves in case of a tsunami. People in vulnerable zones III have a relatively high degree of preparedness index by 66.04%. Hazard zone III is a safe zone. In the vulnerable zone III tsunami disaster preparedness is high, because the majority of the respondents can to answer questions posed by researchers correctly. The average level of community preparedness in facing the tsunami disaster in the village of Sidoasri is classified as moderate (55.30%).

Table 7. Community Preparedness Levels in Facing Tsunami Disaster

No	Indicators	Value	True Answer (%)			Preparedness Index		
			Zone I	Zone II	Zone III	Zone I	Zone II	Zone III
1	Awareness and vigilance on tsunami threat							
	a. Community knowledge associated with Tsunami hazard	5	90,30	100	95,45	4,51	5,00	4,77
	b. Understanding on natural phenomena of tsunami	5	6,94	6,25	13,64	0,35	0,31	0,68
	c. Response to early warnings	5	22,20	43,75	86,36	1,11	2,19	4,32
	d. Early reaction to the tsunami	5	20,82	31,25	59,09	1,04	1,56	2,95
2	Evacuation planning							
	a. Understanding the evacuation sites	4	80,6	93,75	95,45	3,22	3,75	3,82
	b. Understanding the evacuation route	4	45,8	71,88	72,73	1,83	2,88	2,91
3	Public Participation							
	a. The participation of the dissemination of tsunami	3	15,3	18,75	9,09	0,46	0,56	0,27
	b. Willingness to follow socialization	3	81,9	90,63	90,91	2,46	2,72	2,73
	Total	34	-	-	-	14,99	18,97	22,45
	%	100	-	-	-	44,08	55,79	66,04
	Preparedness Level					M*	M*	H**

Source: Primary Data, 2013

** High * Moderate

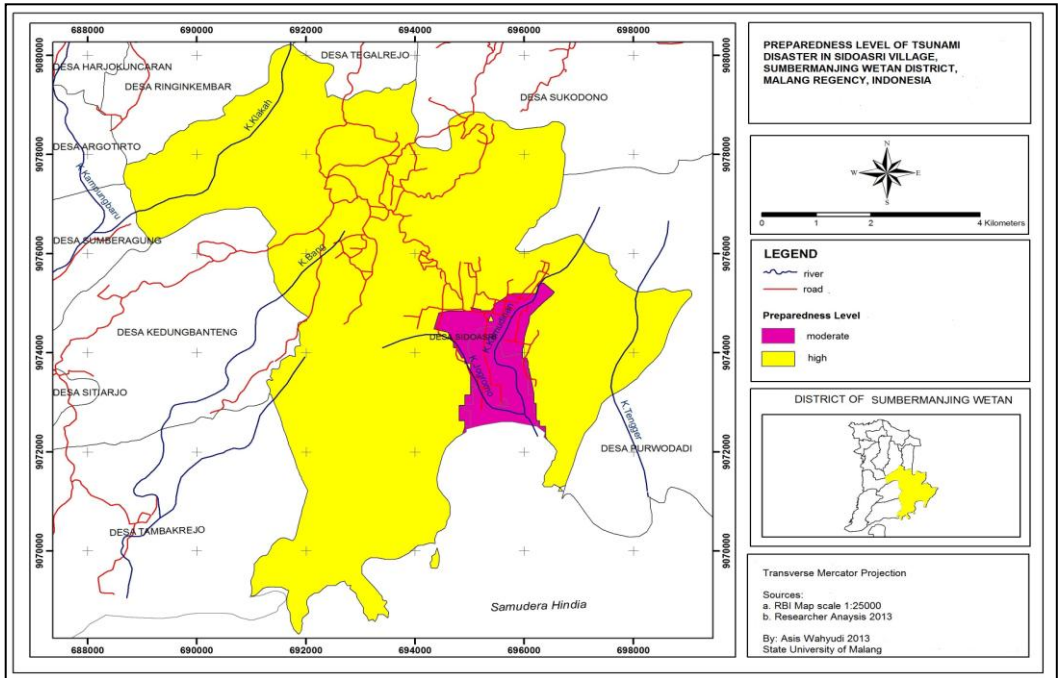


Figure 3. Community Preparedness Level on Tsunami Disaster in Sidoasri Village, Malang Regency

Table 8. Community Preparedness Index in Facing Tsunami (%) by Level of Education and Age

Age	Level of Education			
	Elementary	Junior High	Senior High	Diploma/College
25–29	-	54,18	-	75,08
30–34	39,45	46,95	66,74	79,24
35–39	38,09	48,07	63,50	80,41
40–44	33,22	47,69	-	76,98
45–49	32,26	43,71	63,07	77,10
50–54	32,77	39,90	55,55	70,73
≥55	29,72	41,49	-	69,06

Source: Primary Data Analysis, 2013

Relatively low level of community preparedness at age ≥ 55 years of elementary education and preparedness index is 29.72% (Table 8). Population aged ≥ 55 years and elementary school education had the lowest preparedness, while the population aged 35–39 years and College/Academy educated has the highest preparedness. There is a tendency that the higher of education level, the preparedness index is higher. The higher the person's age, then preparedness index tends to decrease.

CONCLUSIONS

Level of education and age are significantly associated with the level of community preparedness in facing the tsunami disaster in Sidoasri village. The higher of person's education, the index and the level of preparedness in facing tsunami is higher. Educated population who graduated from College/Academy has the most excellent level of preparedness. The younger the age of a person of ≥ 25 years, the index and the level of preparedness in facing tsunami is higher. People who have a good level of preparedness most are in the age group of 35–39 years old. Lowest preparedness is owned by Elementary school graduated population and aged ≥ 55 years.

Sidoasri residents need to follow the tsunami disaster socialization if it is being held, either by governmental or private. The knowledge and experience gained from this socialization can be a determinant in the level of their preparedness and family members in facing tsunami disaster. BPBDs (Regional Disaster Management Agency) of Malang need to provide socialization and disaster mitigation, especially to people aged ≥ 55 years old and elementary school graduates. Those who are university graduates educated and 35–39 year-old are expected to play an active role in providing socialization activities of tsunami to the public, particularly to community groups who have moderate and low levels of preparedness.

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APENDIX



Estuary at Sidoasri



Sidoasri Beach



One of Evacuation Route



One of Infrastructure of Sidoasri