

# Flood Disaster Management for Older People in Flood-Prone Areas

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## Abstract

Older people should have good knowledge and ability to practice flood disaster management. A cross-sectional study towards 140 respondents participated in the study. In this study, the majority of older people were able to specify the types of disaster; definition of flooding; factors that cause flooding; impact of floods; and signs that a flood would occur. Most of older people had a flood knowledge score of 38.5. The mean score for disaster management practices was highest during a disaster (26.5 points) followed by a score before a disaster (24.8 points) and after a disaster (18.8 points) as the lowest score. Flood knowledge was significantly different among different marital status, gender, age, family income, education, and the number of respondents' children who were still alive. The older people with good flood knowledge were 3.63 times better in implementing flood management than the older people with low flood knowledge (Odd Ratio 3.63). It can be concluded that most older people have good knowledge of flooding, but it is necessary to increase older people's knowledge before the flood so that mitigation practices and flood preparedness can be better in this group.

**Keywords:** Older people; Disaster-prone groups; Knowledge and practice; Flood disaster management

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## 1. Introduction

Natural disasters link to human behaviors in which humans determine whether a natural threat will turn into a disaster, or will only stay a threat. During early 2021 until early September 2021; 1,829 natural disasters in Indonesia have occurred, which are dominated by floods (750 cases) and landslides (346 cases) (National Board for Disaster Management, 2021). During disaster, children and other vulnerable groups, such as women and the older people, contribute the highest number of victims (National Board for Disaster Management, 2007). The majority of older people are in the category of high hazard and moderate hazard during a disaster due to their physical limitations, sensory disturbances, and the presence of degenerative diseases (Cornell, *et al.*, 2012). Problems in hearing, physical mobility, vision, and memory affect

the survival rate when a disaster or emergency occurs. Although in normal circumstances the limitations experienced can be tolerated, they become very influential when a disaster occurs. These limitations make it difficult for the older people to move faster or leave their homes during disasters, especially during natural disasters. This situation is even worse for the older people who live alone in the community, whose situation is different from the older people who live in care facilities such as hospitals and nursing homes who can easily get help.

Disaster preparedness is any activity prior to a disaster that aims to develop the operational capacity and facilitate an effective response when a disaster occurs (National Board for Disaster Management, 2017). With increased knowledge on disaster

preparedness, the older people will know what actions to take when facing a disaster. Knowledge is the main key that can influence the attitude and concern of the community to be ready and alert in dealing with disasters. The older people who have a good attitude are the older people who are ready to face disasters based on their good knowledge of the signs of a disaster so that they are always ready to evacuate at any time. Preparedness in dealing with disasters has the aim of ensuring appropriate and rapid efforts in dealing with disaster events. Disaster management is all efforts or activities carried out in the context of prevention, mitigation, preparedness, emergency response, and recovery efforts related to disasters. This is divided into several stages of before, during, and after a disaster (Minister for Public Works and Human Settlements, 2017). Disaster mitigation is a series of efforts to reduce disaster risks through physical development, increasing awareness, and the ability to face disaster threats. Mitigation and preparedness are performed before a disaster occurs (pre-disaster). The community, especially the older people group, needs to understand the importance of mitigation or efforts to reduce disaster risks, so that they are more skilled, agile, and trained in helping themselves when a disaster occurs.

West Java Province has a high disaster risk due to the complex geographical conditions of the region, in addition to the fact that it is the province with the densest population in Indonesia. Based on the 2020 Indonesian Disaster Risk Index (IRBI), West Java Province has a risk index of 145.81 (high). Depok City, as one of the cities in West Java Province, has a moderate risk index value of 82.56 in 2021 (National Board for Disaster Management, 2021). The most frequent disaster threat in Depok City is flooding. The Mayor of Depok once set a response status for floods, landslides, and strong winds in Depok City for a period of 14 days (1-14 January 2020). The profile of Depok City's natural disasters in 2007-2015 describes 12 floods and 6 landslides that occur every year, despite no fatalities (Ministry of Agrarian and Spatial Planning, 2016). Depok is often hit by floods, landslides, and tornadoes.

There are 23 flood and landslide prone points in Depok City with Sukmajaya, Pancoran Mas, Cipayung, and Sawangan Sub-districts as the areas with the highest number of flood and landslide prone points. Several flood events that occurred during the last 5 years in Depok City have claimed lives and the safety of the older people. Some of them are the older people who died during the flood due to being trapped in a flood in their house because they lived alone; the older people who were ill and could not help themselves while they were locked in the house so they could not save themselves; the older people who died from hypothermia (exposure to cold temperatures for a long time causes the body to lose control to control body temperature). During the flood, the older people were evacuated by members of the Fire and Disaster Management Service and Disaster Management Youth Volunteers (*Taruna Siaga Bencana*, Tagana) of Depok City using rubber boats.

By referring to the data above, it is apparent that the risk of flood disasters can be reduced by disaster mitigation. The aim is to improve community preparedness and disaster risk reduction in the long term to reduce the number of victims and to minimize the impact of disasters as much as possible. However, non-structural disaster mitigation behavior in the older people group that includes reducing the possibility or consequences of risk through modification of human behavior processes is still low. This is due to the lack of knowledge about the preparedness against natural disasters among the older people while the threat of natural disasters is very real. The paradigm of natural disaster risk management with the aim of achieving sustainable and environmentally friendly development needs to be communicated to the people of Indonesia through education on flood preparedness and disaster mitigation. For this, it is necessary to conduct a preliminary study to assess the level of knowledge and preparedness behavior of the older people living in flood-prone areas in flood management (pre, during, and post-flood) so that interventions are well-targeted, effective, and efficient.

## **2. Materials and Methods**

### *2.1 Study design*

This was a cross-sectional study using the Simple Random Sampling approach (Sastroasmoro and Ismael, 2014). The ethical clearance was obtained from the Health Research Ethics Commission for Research and Development Agency of the Ministry of Health. The informed consent form was signed by all respondents in August 2021.

### *2.2 Population and sample*

The population was all older people who live in 8 flood-prone urban villages of Depok City (Pancoran Mas, Mampang, Rangkapan Jaya, Rangkapan Jaya Baru, Depok, Kedaung, Sawangan Baru, and Cinangka). Study sites were selected using the purposive sampling technique. The inclusion criteria used for the respondents were 60 years old and above; male or female; living in one of the selected urban villages; living in the community (not in nursing homes, hospitals, etc.); had experienced flooding in the living area in the last two years, healthy and not currently undergoing certain medical treatment; and did not have dementia/senile. The determination of the study sites of 8 selected sub-districts of Depok City was made based on the frequency of floods in the last three years and that the areas were included as flood-prone areas (Depok City Fire and Disaster Management Service, 2020).

### *2.3 Data collection*

Primary data were collected through a survey in the form of structured interviews of selected 140 respondents by trained enumerator in house visits. The structured questionnaire used in data collection included items on socio-demographic characteristics (marital status, age, latest education, occupation, number of people living together in the house, number of biological children, and total monthly family income); knowledge of natural disasters and floods (definition of disasters, causal factors, types of disasters, examples of natural disasters, impact of

natural disasters, disaster-prone groups and what makes them vulnerable, and whether or not the older people need to prepare for natural disasters); knowledge and practice of the older people in flood management (always ready to evacuate themselves when there is a flood; always prepare for an unexpected flood; know the signs of an imminent flood; actions taken before, during, and after a flood; sources of flood news information; actions taken during a flood; whether the older people is a priority to be evacuated by the family during a flood; place to evacuate during a flood; emergency response plans during a flood; source for information on early warning; participation in flood preparedness training; and expectation regarding flood management by Depok City Government. The scoring of the older people practice in flood management before, during, and after the flood was done to assess the level of preparedness, emergency response, and post-flood recovery behavior in the range of 0-100 values.

### *2.4 Data analysis*

Data analysis was carried out univariately to obtain the distribution of the frequency; minimum and maximum values; and the average of all the variables studied. Bivariate analysis was used to assess the difference in the mean knowledge of natural disasters with flood management behavior/actions; differences in the mean scores of flood knowledge; and practices carried out before, during, and after the flood based on socio-demographic characteristics using the independent t test at a significance level of  $p < 0.05$ . Multivariate analysis with the Multiple Logistic Regression was conducted to obtain the main determinant variables related to flood disaster management practices in the older people group. Data analysis was performed using the SPSS version 21 for Windows program.

## **3. Results and Discussion**

Table 1 describes the socio-demography characteristic of respondents. The proportion of respondents aged 65 years and above was twice as high as those aged 60 years with

a mean age of 63.5 years. The youngest respondent was 60 years while the oldest was 80 years. The composition of male and female respondents was almost the same (1:1) with most were married. Most of the respondents had a low level of education and unemployed. Majority of respondents live with her/his husband/wife and children in the house owned by the respondents. Most respondents had 3-4 biological children with a family income ranging from USD 66.7 to USD 200 which was mostly obtained by the respondents' family. When asked about the cause of flood, the majority of respondents stated that high rainfall was the cause. A small number of respondents said that the habit of littering can cause flooding. Most respondents considered natural, non-natural, and human factors as the causes of flooding with natural disaster as the type of disaster most mentioned. Only a small number of respondents stated that social disaster was also a type of disaster. Flood was the type of natural disaster most widely known by almost all respondents. The impact of natural disasters and floods that most respondents mentioned was damages to infrastructure. The most widely known vulnerable groups in natural disaster were children and the older people. Rain for more than 2 hours was mentioned as a common sign of impending flood by most respondents. Most older people have a flood knowledge score of 38.5 with a mean score of 33.8, a minimum score of 3.85, and the maximum score of 77.

One of the groups prone to natural disasters and public health emergencies is the older people. Natural disasters can disrupt and threaten the lives of the older people. The older people are vulnerable to disasters due to illness, cognitive decline, decreased physical condition, decreased health status, decreased sensory awareness, reduced ability to move/mobility, and increased risk of morbidity pre, during, and post-disaster (Kar, 2016; PAHO, 2012). The older people need priority care during a disaster, but their care is often not the focus during disaster response. In some cases, although the older people are considered a vulnerable group in post-disaster situations, their special needs are rarely met by the emergency service providers. The mental health needs of the older people during the

post-disaster period are often neglected for various reasons, such as concerns about stigma, lack of information about available services, and being unable or choosing not to seek help (Guddo and Ramesh, 2020). The vulnerability of the older people that is present before the disaster period arrives includes the presence of infectious diseases and or chronic diseases (hypertension, diabetes, heart disease, etc.). This condition is accompanied by impaired physiological functions of the body, as well as cognitive and sensory declines due to aging that contribute to the fragility/vulnerability that requires special attentions when evacuating to a safer place (Lesley, 2017). Often the older people choose to remain at home when natural disasters occur for certain reasons, including depression, which affects the motivation to seek self-help. Several things that also affect the impact of natural disasters for the older people, especially those who live alone, are the problem of mass communication for the disaster early warning system; the lack of close family and community support for the older people; and the lack of trained personnel during disasters (Cherniack, 2008; Rafiey, *et al.*, 2016). Priorities focused on the needs and abilities of the older people in disaster management are often neglected. Thus, the government and local communities should pay full attention to minimize the impact of disasters on the older people (PTSD, 2018). Therefore, special protection and measures need to be given to the older people group in order to be able to survive in the midst of disaster and post-disaster situations.

Practices/actions taken by the older people in flood disaster management are divided into actions before, during, and after the flood. The majority of respondents prepared important documents and valuable documents in an easy-to-carry bag during flood evacuation. During the flood, the majority of respondents had a behavioral score of 23.1 with a mean score of 24.8, the highest score of 61.5, and the lowest score of 1. When there was a flood, most of the respondents evacuated their electronic goods and equipment to a higher place in the house and fled to a safer relative's house. For the older people who remained in their home

**Table 1** Socio-demography characteristic of respondents

<b>Variable</b>	<b>Number (n)</b>	<b>Proportion (%)</b>
Age (years old):		
Less than 60	45	32.1
More than or equal to 60	95	67.9
Gender:		
Male	65	46.4
Female	75	53.6
Marital status:		
Married	84	60.0
Single (widow / widower)	56	40.0
Last education:		
Less than 12 years	72	51.4
More than or equal to 12 years	68	48.6
Live with:		
Alone	6	4.3
Husband / wife	8	5.7
Husband / wife and children	126	90.0
Number of biology children:		
Less than 4 person	115	82.1
More than or equal to 4 person	25	17.9
Total family income		
Less than USD 66.7	19	13.6
USD 66.7 – USD 200	44	31.4
USD 200 - USD 333.3	31	22.1
More than USD 333.3	35	25.0

during the flood, they claimed that they did so to keep their belongings from being washed away or lost or stolen by others. Evacuating to the second floor of a residential house was the self-evacuation option that most respondents had. Preparing medicines as first aid for floods and preparing sufficient food stocks during floods were common actions taken by respondents during floods. The mean practice score during the flood was 26.5 with the lowest score of 10 and the highest being 55. Cleaning the house from mud, dirt, and flood garbage was performed by most of the respondents after the flood. The remaining respondents checked the electrical panels to ensure their safety from the flood effect. The mean practice score of the older people after the flood was 18.3 and the minimum and maximum scores of 0 and 66.7, respectively (Table 2).

The differences in the mean scores of flood knowledge and flood management before, during, and after flooding are

listed in Table 3. Flood knowledge was significantly different among different marital status, gender, age, family income, education, and the number of respondents' children who were still alive. There were also significant differences in the practices performed by respondent before the flood based on gender, marital status, age, education, family income, and the number of respondents' children who were still alive. Meanwhile, the actions taken post-flood by the respondents differed significantly by gender, age, education, and family income. Based on the results of multiple logistic regression multivariate analysis of 9 independent variables, the most dominant variable on older people practice in flood disaster management was good flood knowledge with an OR of 3.63 (Table 4). The older people who had good flood knowledge had 3.63 times better flood management practices compared to the older people with low flood knowledge.

**Table 2.** Practice at pre, during, and post-flood disaster (Multiple answer/response)

Practice of older people	Number (n)	Proportion (%)
<i>At pre flood disaster</i>		
Put valuables things in a safer place	69	49.3
Home renovation by raising the house floor	65	46.4
Prepare a disaster preparedness bag	16	11.4
Score of pre-flood disaster preparedness practice		
Mean $\pm$ SD		24.8 $\pm$ 12.2
Minimum – maximum		0 – 61.5
<i>During flood disaster</i>		
Evacuating electronic goods and household equipment to higher ground	50	35.7
Evacuating to a relative/other person's house outside	29	20.7
Staying at home to guard their things	51	36.4
Preparing medicines for first aids	25	17.9
Evacuating to the second floor at home	38	27.1
Preparing sufficient food stocks	18	12.9
Score of during flood disaster practice		
Mean $\pm$ SD		26.5 $\pm$ 9.5
Minimum – maximum		10 – 55
<i>At post flood disaster</i>		
Cleaning the house from mud, dirt, and flood garbage	116	82.9
Making sure the electrical panels in the house were safe	12	8.6
Score of post flood disaster practice		
Mean $\pm$ SD		18.3 $\pm$ 10.4
Minimum – maximum		0 – 66.7

**Table 3.** Mean scores difference of flood knowledge and practices at pre, during, and post disaster based on socio-demography characteristics

Variable	n	Flood knowledge			Practice During disaster			Post-disaster					
		Mean	± DS	P	Mean	± DS	P	Mean	± DS	P			
#Gender													
Male	65	37.0	± 13.1	*0.002	27.0	± 14.1	*0.047	28.5	± 10.8	*0.024	20.5	± 12.1	*0.025
Female	75	31.0	± 8.5		22.8	± 10.0		24.7	± 7.9		16.4	± 8.4	
#Marital status													
Marriage	84	36.1	± 12.1	*0.002	27.1	± 13.1	*0.005	28.2	± 10.6	*0.004	19.0	± 11.3	*0.323
Widow/widower	56	30.3	± 8.9		21.3	± 10.0		23.8	± 7.0		17.3	± 9.0	
#Age (years old)													
< 60	45	37.9	± 13.5	*0.009	29.7	± 13.8	*0.003	28.0	± 11.5	0.241	21.5	± 12.1	*0.026
>= 60	95	31.9	± 9.5		22.5	± 10.8		25.7	± 8.4		16.8	± 9.3	
**Last education (years of schooling)													
Less than 12	65	29.6	± 9.0	*0.001	19.1	± 9.5	*0.001	22.1	± 6.7	*0.001	15.4	± 8.5	*0.001
More than 12	75	33.8	± 9.2		28.4	± 10.5		30.3	± 9.4		17.7	± 7.1	
**Number of biology children													
1-2	52	34.2	± 11.8	*0.026	26.4	± 12.4	*0.04	26.8	± 9.6	*0.358	19.9	± 11.0	0.121
3-4	63	35.5	± 10.7		25.6	± 12.5		27.1	± 10.2		18.5	± 11.2	
> 4	25	28.5	± 10.1		19.2	± 9.9		24.0	± 7.2		14.7	± 5.5	
**Total family income													
Less than US 66.7	19	30.4	± 8.0	*0.002	17.8	± 8.2	*0.001	22.1	± 7.1	*0.001	20.2	± 7.0	*0.001
US 66.7 – US 200	44	32.2	± 10.1		20.2	± 9.9		24.8	± 7.7		14.4	± 9.2	
US 200 – US 333.3	31	33.4	± 9.8		27.3	± 10.8		27.3	± 8.0		17.2	± 8.0	
More than US 333.3	35	40.4	± 13.6		33.4	± 13.9		32.9	± 11.2		23.8	± 14.2	

# t-test independent

\*\*One way ANOVA

\*p < 0.05

DS : Deviation Standard

E

**Table 4.** Multivariate analysis of determinant factors for disaster management practice

	B	S.E.	Wald	df	Sig.	Exp(B) / OR	95% CI for EXP(B)	
							Lower	Upper
Gender - Male	-,073	,447	,027	1	,870	,929	,387	2,230
Marital status - Married	,413	,525	,621	1	,431	1,512	,541	4,229
Age <= 60 years old	-,373	,488	,584	1	,445	,689	,265	1,792
Education – at least Junior High School	1,245	,458	7,396	1	,007	3,473	1,416	8,520
Number of children - 1-2 person	,196	,448	,191	1	,662	1,216	,505	2,925
Flood knowledge - Good	1,290	,429	9,069	1	,003	3,634	1,569	8,417
Total income family - > IDR 3,000,000	1,198	,407	8,655	1	,003	3,313	1,492	7,359
Constant	-2,105	,493	18,241	1	,000	,122		

One of the special efforts that need to be prepared to reduce disaster risk is preparedness and mitigation. Preparedness is the organization of real and effect steps to anticipate natural disasters in the pre-disaster cycle ([https://www.preventionweb.net/files/2743\\_Introdp.pdf](https://www.preventionweb.net/files/2743_Introdp.pdf), 2021). The necessary forms or efforts to survive in the face of disasters include increasing public knowledge and awareness about disasters ([https://www.gdrc.org/uem/disasters/1-dm\\_cycle.html](https://www.gdrc.org/uem/disasters/1-dm_cycle.html), 2020). The knowledge capacity on how to deal with situations before, during, and post-disaster for the older people needs to be improved. The knowledge of the older people about the causes of flooding, which is the high rainfall, is in line with studies conducted on people in Bekasi City. This knowledge is obtained from the experience of floods almost every year. The flood experience of the community can provide knowledge about the flood disaster and will affect the attitude and concern of the community to be ready to anticipate flood (Erlia, *et al.*, 2017; Ridha and Cut, 2017). Both these studies showed that the older people have good flood knowledge. This underlies the practice of pre-flood preparedness in the form of preparing important documents and valuable documents in a bag that is easy to carry during flood evacuation. Preparing medicines as first aid for floods and preparing sufficient food stocks during floods also reflect this good level of knowledge. Cleaning the house from mud, dirt, and flood garbage was performed by most of the respondents after the flood. The remaining respondents checks

the electrical panels to ensure their safety, as well as providing clean water and ensuring the health of the family from the effects of flooding. Knowledge and practice/behavior are inseparable because they are interrelated. Knowledge of disaster preparedness can affect a person's behavior when a disaster occurs (Awaliyah, *et al.*, 2014; Notoatmojo, 2003).

The main finding of the present study are the knowledge and actions of the older people in dealing with flood are significantly different based on the respondent's marital status, gender, age, family income, education, and the number of respondents' children who are still alive. Age and education contribute to the flood knowledge of the older people. This finding is supported by a study of the older people in Surabaya on increasing earthquake preparedness (Agung and Ainur, 2019). The longer a person stays in formal and informal education, the higher the level of disaster knowledge they have (Hoffman and Muttarak, 2017). Significant differences are also seen in the knowledge of flood based on marital status and gender among older people. Spouse, both husband and wife, plays an important role in influencing the improvement of flood disaster preparedness actions and decision-making behavior. Husband and wife have strong mutual responsibilities and agreement in determining an action/behavior (Bronfenbrenner, 1979; Hammer, *et al.*, 2003). The stronger the agreement/consensus between husband and wife is, the greater the commitment and responsibility in determining disaster preparedness actions (Hung, 2019).

Gender plays a role in determining disaster preparedness actions. A previous study describes that men are more active and confident in determining flood preparedness behavior in Serbia. Gender is positively correlated with flood preparedness (Cvetkovic, *et al.*, 2018). Family income is one of the important factors for decision making in carrying out disaster preparedness actions. Individuals with lower incomes are less likely to take any action in disaster preparedness, as shown in a previous study that income level has a significant relationship with disaster preparedness behavior (Cvetkovic, 2016). Disaster preparedness is also determined by family characteristics, such as the number of children. The higher the number of children in a family is, the lower the level of disaster preparedness. The number of family members negatively correlates to the level of disaster preparedness. Families with three children are less prepared to face disasters than families with one child (Basolo, *et al.*, 2009; Annis, *et al.*, 2016).

The older people with good knowledge on flood will have 3.63 times better practice of flood management compared to the older people with low flood knowledge. This finding supported by the two studies pointed out that the knowledge of disaster mitigation has a significant relationship with community preparedness in dealing with disasters (Jahirin and Sunsun, 2021; Suryadi, *et al.*, 2021; Songlar, *et al.*, 2019). Flood knowledge is the key to flood preparedness behavior and knowledge is an important domain in shaping one's behavior. To reduce the risk of a disaster, increasing understanding through knowledge is urgently important. One way to increase awareness is to improve the people's knowledge of an issue. Knowledge affects perceptions and responses to floods (Priyanti, *et al.*, 2019). If the community's knowledge of disasters is classified as good, a generation that is resilient to disasters and has good preparedness for disasters can be formed (Handayani, *et al.*, 2019).

## 4. Conclusion

The older people practice in flood disaster management is quite good, as reflected in the main findings of this study. This is apparent from the efforts made by the older people and their families before, during, and after the flood. However, the priority of evacuation of the older people during flooding by the family is still low because they still prioritize saving electronic goods to higher places. The best knowledge of flood management for the older people is identified for during a disaster stage while the lowest knowledge is seen in post-disaster stage. The older people with good flood knowledge have 3.63 times better flood management practices compared to the older people with low flood knowledge. It is concluded that the practice of pre-flood management for older people families need to be improved so that they prioritize saving the older people over the belongings in the house. Knowledge of pre- and post-flood management of the older people also needs to be improved so that they make better flood disaster mitigation and recovery efforts. The older people can play an active role in preparing themselves to face possible disasters by identifying their needs, including medicines, physical limitations, difficulties in doing activities, etc. It is necessary to provide training to increase flood preparedness and mitigation for the older people because the older people are a resource that can be mobilized during emergency response and flood disaster recovery.

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