

## *Health Adaptation Behavior of Farmers and Fishermen in Areas Exposed to Climate Change*

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### **ABSTRACT**

*Climate change is a definite, indisputable, clear, firm, and imminent reality, and has the potential to become a serious threat and challenge for the agriculture and fisheries sector. Climate change not only has an impact on the economy but also the health of farmers and fishermen. Farmers and fishermen must have health adaptation behavior to anticipate the adverse effects of climate change. This study aims to look at the individual's adaptive behavior and the factors that influence it. This study uses a cross sectional design on the heads of families of farmers and fishermen affected by climate change in the Province of West Sumatra, Indonesia. The number of samples as many as 150 samples were taken by probability proportional to size (PPS). Collecting data using primary data with interviews method. Data processed by computer and multivariate analysis with logistic regression test. The results of this study found the influence of husband's education, family income, self-efficacy, self-awareness, attitudes, perceptions, life skills, health care support, access to information about climate change together on health adaptation behavior. The most important determinants of health adaptation behavior are husband's education and self-awareness. There is a need for non-formal education in the form of socialization and training on adaptation of public health in the face of climate change. The government must integrate health and climate programs, climate socialization for health workers and provide compensation for people exposed to climate change.*

**Keywords:** *Behavior; adaptation; health; climate change.*

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### **INTRODUCTION**

Climate change is one of the toughest challenges in the world today, because it has affected the homes and livelihoods of the world's population.<sup>1</sup> Climate Change is related to human activities due to climate variability over long periods of time.<sup>2</sup> The impact of climate change on the health of farming communities is caused by drought, which reduces agricultural production, low food consumption and low body resistance and causes disease.

In Southeast Asia, temperature increases were recorded in the range of 0.4–1<sup>0</sup>c and it is estimated that the temperature increase will be in the range of 2–4<sup>0</sup>c. Indonesia is projected to increase the temperature between 0.8 - 1<sup>0</sup>c for the period 2020-2050, the largest on the island of Sumatra (4<sup>0</sup>c). Also rainfall is expected to increase and sea level rise will reach 50 -100 cm in 2090.<sup>3</sup> Climate change has the potential to be a serious threat and challenge for the agriculture and fisheries sector. Climate change leads to increased vulnerability and poverty.<sup>4</sup> Most smallholders in developing

countries are likely to suffer more from climate change than in developed countries, due to their heavy dependence on agriculture and natural resources. Adaptation measures to these pressures are urgently needed.<sup>5</sup>

According to Nguyen et al. (2016) concluded that adaptation is an individual's cognitive process which includes people's values and belief systems, attitudes and perceptions, personality, motivation, goals, and culture.<sup>4</sup> The strongest determinants of adaptive behavior are awareness and self-confidence.<sup>6</sup> Farmers and fishermen's beliefs about climate change are very important to assess the possibilities of adaptive action. Ignorance and distrust can reduce action or resistance to the threat of climate change. Likewise, individual risk perceptions also influence individual policy preferences, adaptive behavior, and other important responses.<sup>7</sup> According to Myers (2012), perception is a person's direction to behave.<sup>8</sup> Perception can be a guide to action based on the meaning given to the perceived stimulus. Recent research on perceptions of climate change has increased understanding of the evolving response where the level of public perception and knowledge will influence community strategies in dealing with the negative impacts of climate change.<sup>9</sup>

Indonesia is known as one of the developing countries that is vulnerable to climate change. Vulnerability to climate change in Indonesia has an impact on decreasing fishery and agricultural productivity, thus affecting economic life and family health.<sup>10</sup> Based on Basic Health Research data, the prevalence of Malaria in 2007 was 2.9%, increased in 2018 by 2.37%.<sup>11</sup> Meanwhile, the incidence of DHF tends to increase from 1968 to 2013 by 41.25/100,000 population. Also the prevalence of diarrhea in 2007 was 3.5%, increased to 6.8% in 2018.<sup>12</sup>

The province of West Sumatra, Indonesia is a tropical area traversed by the equator with an equatorial rainfall pattern. Padang Pariaman Climatology Station (2017) reported an increase in the average annual temperature in the last 30 years by 0.021°C and changes in rainfall patterns in each region. This has resulted in several areas experiencing frequent droughts such as the Luak, Sijunjung, Sukarami, Lima Kaum, Lubuk Basung, Padang Laban, Dareh River and Langsat River areas.<sup>13</sup>

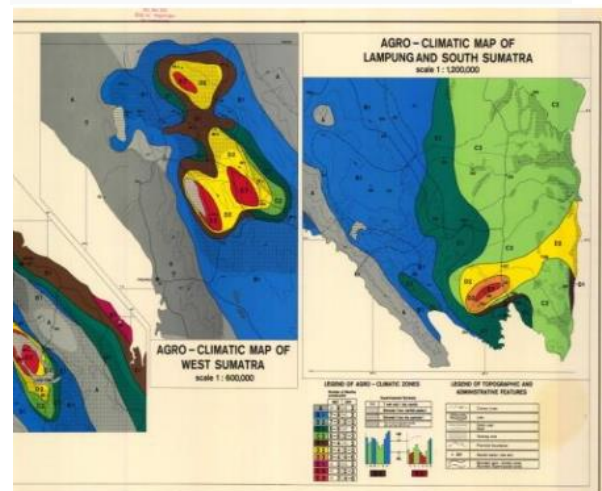
Considering the implementation of the current climate change policy, it is necessary to

get a description of the health adaptation behavior of farmers and fishermen due to climate change and its determinants. This study aims to look at the individual's adaptive behavior and the factors that influence it

## METHOD

This study uses a cross-sectional design to identify the respondent's characteristics (income and education of husband), self-awareness, attitude, self-efficacy, and life skills, and support from health workers that affect health adaptation behavior due to climate change at the time. The research population is all heads of families of farmers and fishermen affected by climate change in West Sumatra Province. Research samples were taken in areas vulnerable to climate change in 4 agricultural areas (Aie Amo Sijunjung district, Luak Sijunjung Limapuluh Kota district, Parambahan, Tanah Datar district) and 2 coastal areas (Pasir Jambak, Padang City, and Tiram, Padang Pariaman district)

Each area experienced a significant change in rainfall patterns, including a decrease in the number of wet months into humid and dry months and a shift in the peak of rainfall. The sample size determined in the survey stage research was as many as 150 samples, using the Lamesshow formula.<sup>14</sup> The number of samples for each region was taken using Probability Proportional to Size (PPS), with the criteria being that the head of the family is aged 20-55 and works as a farmer or fisherman.



**Figure 1. Agroclimatic Zone of West Sumatra Province**

Primary data collection will be done through interviews with a questionnaire instrument. the questionnaire has been tested

for validity and reliability.<sup>15,16</sup> The validity test results for each instrument on the 29 respondents in this study were obtained from the comparison between the r-table at  $df = n-2$  and alpha 0.05, with the corrected item-total correlation value must be greater than the r-table value of 0.367. Based on calculations, the calculated r value for all questions in the questionnaire is greater than the r table. Thus, all question items are declared valid.

Filling out the questionnaire by the respondent was preceded by approval after an explanation of how to fill out or informed consent by the researcher. Univariate analysis was carried out on the characteristics, knowledge, attitudes, self-efficacy, life skills and adaptation to climate change which were shown in the proportion and frequency distribution of each variable. Bivariate analysis was conducted to examine the relationship between the independent variable and the dependent variable using the Chi square test. The independent variables in this study were husband's education, family income, self-awareness, attitudes, self-efficacy, life skills, support from health workers and access to information. While the dependent variable is health adaptation behavior due to climate change. Multivariate analysis was conducted to see the effect of the independent variables together with the dependent variable and the independent variable which contributed the most to the dependent variable. Logistic regression test with 95% confidence degree and the RR value is taken from the exponential with confidence interval (CI). Logistic regression does not require assumptions (normality, homocedasticity, and linear relationship) because logistic regression follows a logistic distribution

## RESULT

### Characteristics

Characteristics of farmers and fishermen in exposed areas of West Sumatra show an average age of 48.6 years, the number of male and female family members is 2-3 people. The duration of farming and fishing activities is 8.6 hours a day. The main income of husbands of farmers and fishermen before climate change was Rp. 2.008.000 a month, but currently Rp. 1,366,000.00- a month. The wife's main income before experiencing climate change was Rp. 31,900 a month, but currently Rp. 46.340 a month. Less than half of the husband's education is elementary school (38.7%) and his wife's education is elementary school (41.3%). The status of farmers is generally the owner of their own land and fishermen who own boats, cultivators of rice fields and ship workers (24%). Production activities are dominated by husbands, especially for fishing and farming (68%). Reproductive activities are dominated by wives/women, especially for households (98.7%). Social activities are dominated by wives/women (98.7%)

### Disease prevalence due to climate change in agricultural and coastal areas

Diseases that often occur due to climate change include diarrheal diseases, dengue fever and malaria. Diseases occur due to water shortages in the dry season and an increase in the number of mosquitoes in the rainy and dry seasons. In areas affected by climate change, environmental-based diseases were found, namely diarrhea, malaria and dengue fever. Based on table 1, it can be seen that diarrheal disease due to climate change has the highest prevalence of 27.3% a year, then malaria is 2.7% in 1 year.

**Table 1. Distribution of disease prevalence due to climate change in agricultural and coastal areas**

Disease	Prevalence (%)		
	1 month	3 months	12 months
Diarrhea	10.0	10.7	27.3
malaria	1.3	1.3	2.7
Dengue fever	1.3	1.3	1.3

### Basic sanitation of agricultural and coastal areas exposed to climate change

Climate change can affect the achievement of sanitation programs in coastal areas and agriculture. Climate change results in coastal

erosion, sea level rise so that it affects the availability of clean water and damages coastal community settlements. A long drought has reduced sources of clean water and sanitation in agricultural areas

**Table 2. Distribution of basic sanitation in areas exposed to climate change**

Basic Sanitation	Category	n	%
A. Clean water supply	1. Source of clean water		
	• river	10	6.7
	• Rainwater storage	3	2.0
	• Dug well	68	45.3
	• water springs	9	6.0
	• Drinking water company	30	20.0
	• Refill water depot	30	20.0
	2. clean water facilities		
	• easy	99	66.0
	• sometimes difficult	45	30.0
	• difficult	6	4.0
	3. Clean water quality		
	• bad	15	10.0
	• good	135	90.0
B. defecating	Stool disposal pattern		
	• River/sea	4	2.7
	• latrine	142	94.7
	• haphazard	4	2.7
C. Wastewater disposal	The presence of waste water facilities		
	• no	103	68.7
	• yes	47	31.3
D. Disease vector control	Mosquito breeding place		
	• there is	113	75.3
	• there is not any	37	24.7

Table 2 shows that generally clean water sources are due to areas exposed to climate change where generally the type of clean water facilities are dug wells (45.3%); the ease of obtaining clean water is sometimes difficult (30%) with good clean water quality (90%). The majority of respondents have used latrines (94.7%), but most do not have good sewerage (68.7), and there are mosquito breeding sites (75.3%)

### Health adaptation behavior due to climate change

Adaptation behavior is assessed from indicators of disease vector prevention efforts, availability of clean water, utilization of health services, availability of medicines, nutritional intake, availability of health budgets, gender equality, and access to information. The results of the analysis are obtained as follows:

**Table 3. Distribution of health adaptation behavior of farmers and fishermen in areas exposed to climate change**

Health adaptation behavior	Farmer		Fisherman	
	n	%	n	%
1. Eliminate mosquito breeding places	57	82.6	12	17.4
2. Using mosquito repellent	56	45.9	66	54.1
3. Monitoring mosquito larvae	44	86.3	7	13.7
4. Reducing activities outside the house at night	19	76.0	6	24.0
5. Prepare medicines at home	39	52.0	36	48.0
6. Using health services	51	71.8	20	28.2
7. Allocating health costs	58	47.2	65	52.8
8. Looking for other sources of clean water	61	69.3	27	30.7
9. Access to climate information	53	54.1	45	45.9

Health adaptation behavior	Farmer		Fisherman	
	n	%	n	%
10. Gender equality	54	61.4	34	38.6
11. Cooperation between citizens	35	61.4	22	38.6
12. Cooperation between citizen	58	55.2	47	44.8
13. Local wisdom	42	59.2	29	40.8
14. nutritious food	37	58.7	26	41.3

Based on table 3, it can be seen that health adaptation behavior, especially eliminating mosquito breeding places, monitoring mosquito larvae is higher for farmers than fishermen. Likewise, the readiness of medicines and the utilization of health services is higher for farmers than fishermen. Farmers have more access to climate information than fishermen because most of them have received climate socialization. The

division of responsibilities between men and women is higher for farmers than for fishermen. Farming communities do more cooperation between residents, change jobs if crops fail, local wisdom exists in responding to climate change and consuming nutritious food. while in fishing communities, health adaptation behavior is related to cooperation between residents in finding sources. More dependent on government assistance.

**Table 4.** Distribution of the level of health adaptation behavior of farmers and fishermen in areas exposed to climate change

Health adaptation behaviour	n	%
- less	77	51.3
- good	73	48.7

Based on table 4 shows that farmers' health adaptation behavior is generally categorized as less (51.3%).

#### Determinants of health adaptation behavior

The determinants of adaptive behavior consist of husband's education and income, self-awareness, attitudes, self-skills (life skills),

beliefs/perceptions, support from health workers, access to information, and self-efficacy. The results of the univariate analysis are shown in the table.

**Table 5.** Distribution of determinants of health adaptation behavior

Variable	n	%
1. self awareness		
- less aware	76	50.7
- quite aware	74	49.3
2. attitude		
- negative	55	36.7
- positif	95	63.3
3. Life skill		
- Not enough	80	53.3
- good	70	46.7
4. Perception		
- Not enough	95	63.3
- good	55	36.7
5. Support for health worker		
- Not enough	101	67.3
- good	49	32.7
6. access information		
- Not enough	93	62.0
- good	57	38.0
7. self efficacy		
- Lack of trust	58	38.7
- believe	92	61.3

Based on table 5, it can be seen that awareness of climate change for farmers and fishermen in exposed areas in West Sumatra is more than half in the poor category (50.7%), generally the attitude is in the positive category (63.3%), generally more than half of the life skills are in the poor category ( 53.3%), generally the support for health workers is in

the poor category (67.3%), generally the access to information is in the poor category (62.0%) and generally the self-efficacy is in the capable category (61.3%). To see the relationship between the determinants of adaptation behavior, statistical calculations were carried out. The results of statistical calculations can be seen in table 6

**Table 6. Analysis of the Relationship of Factors Related to Adaptation Behavior of Farmers and Fishermen due to Climate Change**

Variabel	Health adaptation behaviour				P value	conclusion
	less		good			
	n	%	n	%		
1. Education						
- low	56	58,9	39	41,1	0,018	significant
- high	21	38,2	34	61,8		
2. Income						
- low	41	62,1	25	37,9	0,019	significant
- high	36	42,9	48	57,1		
3. self efficacy						
- Lack of trust	41	70,7	17	29,3	0,0001	significant
- believe	36	39,1	56	60,9		
4. self awareness						
- less aware	47	61,8	29	38,2	0,009	significant
- quite aware	30	40,5	44	59,5		
5. attitude						
- negative	36	63,6	20	36,4	0,022	significant
- positif	42	44,2	53	55,8		
6. Perception						
- Not enough	57	60,0	38	62,8	0,005	significant
- good	20	36,4	35	63,6		
7. Life skill						
- Not enough	48	60	32	40,0	0,023	significant
- good	29	41,4	41	58,6		
8. Support for health worker						
- Not enough	62	61,4	39	38,6	0,0001	significant
- good	15	30,6	34	69,4		
9. access information						
- Not enough	55	59,1	38	40,9	0,023	significant
- good	22	38,5	35	61,4		

Based on table 6 shows self-adaptation behavior related to husband's education ( $p = 0.0180$ ), family income ( $p = 0.019$ ), self-efficacy ( $p = 0.0001$ ), self-awareness ( $p = 0.009$ ), attitude ( $p = 0.022$ ), self-confidence/perception ( $p = 0.006$ ), life skill ( $p = 0.023$ ), health worker support ( $p = 0.0001$ ), access to information about climate change ( $p = 0.023$ ).

Based on the results of the bivariate analysis, the results of the p value value can be

used to perform screening for the next stage of analysis, namely multivariate analysis. At this stage, each variable used will be selected based on a p value of not more than 0.25. So that values greater than 0.25 are not included in the multivariate modeling. The results of the analysis are obtained as follows:

**Table 7. Analysis of the final multivariate modeling of factors that influence health adaptation behavior due to climate change of fishermen and farmers**

Variabel	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Husband education	1.430	.440	10.590	1	0.001	4,180	1.766	9,893
Self efficacy	1,125	0,442	6,471	1	0,011	3,081	1,295	7,333
Self awareness	1,307	0,426	9,399	1	0,002	3,694	1,602	8,516
Perception	1,046	0,427	5,989	1	0,014	2,846	1,232	6,578
Life skill	0,923	0,436	4,472	1	0,034	2,516	1,070	5,917
Dukungan nakes	1,160	0,462	6,311	1	0,012	3,190	1,290	7,885

Based on the results of the final model in Table 6, it can be concluded that the husband's education and self-awareness variables are the dominant variables and have a very significant influence on health adaptation behavior due to climate change of fishermen and farmers in West Sumatra, which are indicated by significance values of 0.001 and 0.002 which are less than 0.05. The value of the odds ratio Exp (B) of 4.180 indicates that the husband's education of farmers and fishermen who are low will be more likely to produce poor adaptation behavior 4.2 times compared to the husband's high education. And low self-awareness of farmers and fishermen will be more likely to produce poor adaptation behavior 3.7 times compared to good self-awareness.

## DISCUSSION

### Research limitations

This research is also limited to momentary measurements and cannot monitor (follow up) the impact of changes in health adaptation behavior due to climate change in the future. Then the measurement of climate change adaptation behavior is limited to recognition from respondents, in 2 coastal areas and agricultural areas. The generalizability of this model can specifically be applied to other areas if validation and re-testing are carried out. This is because each region has different characteristics, culture and climatic conditions.

### Health adaptation behavior

The low health adaptation behavior of farmers and fishermen in areas exposed to low climate change, provides opportunities for health problems such as diseases due to climate change. The health adaptation behavior of

fisherman farmers is generally in the form of a lack of attention to environmental sanitation problems, lack of availability of medicines and lack of allocation of health costs. The most vulnerable health adaptation behavior is the low access to health information related to health prevention and promotion. The drought causes diarrhea due to climate change during the long dry season, farmers and fishermen do not anticipate it with water reserves or other alternative water sources. Malaria is a breeding ground for mosquitoes after sea water rises to the mainland. Dengue fever occurs after the rainy season so that there are many breeding places for Aedes mosquitoes. However, according to Morin et al (2013) climate greatly influences dengue virus and its vectors, but it is not the only variable that influences disease apart from human factors, including behavior, immunity, and socioeconomic influences <sup>17</sup>.

The lack of health adaptation behavior in agricultural and coastal areas is also seen as low access to health services, especially health prevention and promotion. Health programs have not integrated health services with climate information needs. The preparedness of rural communities and health services for the health impacts of climate change depends on input from those who provide health care in this area, both doctors and health managers. Among general practitioners and health workers have not been exposed to climate science <sup>18</sup>. The high prevalence of epidemic and endemic diseases in most rural areas further exacerbates the health and misery of rural workers. Many diseases and health problems arise from poor sanitation, inadequate housing, malnutrition and various kinds of parasitic and bacterial infections that affect the entire rural population <sup>19</sup>. Extreme weather events create the kinds of environmental and social conditions in which

many infectious diseases in humans and, often times, other animals breed. Because infectious disease outbreaks occur in certain locations due to extreme climatic and weather conditions<sup>20</sup>. Despite their important role in producing food and contributing to agricultural sustainability, smallholders are subject to a vicious cycle of poverty caused by limited financial resources, environmental pressures and poor social support, as well as health and education challenges.<sup>21</sup> Health impacts related to climate change on smallholders should be given special consideration in public health policies and disaster management.<sup>22</sup>

### **Determinants of health adaptation behavior**

The results showed several determinants of health adaptation behavior in the form of husband's education, income, self-awareness, self-perception, self-efficacy, skills, access to information and support from health workers. The low education of husbands of farmers and fishermen is difficult to get access to information so that it is related to self-perception, self-awareness, self-efficacy, self-skill in adapting health to climate change. The results of the logistic regression showed that the husband's education and self-awareness had a strong influence on health adaptation behavior. According to Heitboer (2013) the pattern of health behavior is largely determined by the level of individual education.<sup>23</sup>

Husband's education is very decisive in health adaptation behavior, the higher the husband's education, the better health adaptation behavior. Health adaptation behavior eliminates mosquito breeding grounds. In line with Ajuang's research (2016) that there is a significant relationship between the education of the head of the household and the incidence of malaria.<sup>24</sup> A good husband's education has access to information and self-awareness, perception, self-efficacy and self-skills. but changes in behavior difficulties cannot be intervened with formal education, but through non-formal education (training). Through non-formal health education that is integrated with the climate, it will raise awareness, self-efficacy, perceptions and skills of farmers and fishermen in adapting to climate change. Changes in adaptation to health behavior, including issues regarding health promotion and health prevention decision-making will determine the resilience of farmers

and fishermen in areas exposed to climate change.

The results of the study found that health adaptation behavior on self-awareness was higher than good self-awareness. Self-awareness is related to health adaptation behavior. Self-awareness is very important to define problems, attribute errors appropriately, and determine appropriate behavior to solve them.<sup>6</sup> Farmers realize that felling trees when clearing land and burning waste will have an impact on climate change. The existence of mosquito breeding places around the farm and fisherman's homes is due to a lack of self-awareness of the importance of keeping the environment clean. Coastal areas are vulnerable to breeding grounds for malaria mosquitoes, so fishermen's awareness is required and must take adaptation actions. According to the research of Penalba, et al (2021) that coastal communities cannot prevent climate change, but can only take action to slow it down through changes in adaptive behavior.<sup>25</sup>

Areas exposed to climate change demand public awareness of the importance of maintaining health with the availability of medicines and easy access to health services as well as allocation of health costs. The results of the study found that fishermen and farmers' awareness of access to health services was still low and did not allocate health costs. Climate change increases the operating costs of fishing and farming, thereby reducing income. According to Patel (2020) farmers are aware that as a result of climate change there is an increase in operational costs due to increased spending on seeds, chemicals, labor.<sup>26</sup> So the government must provide compensation for people who are vulnerable to climate change, especially health insurance

### **CONCLUSIONS**

The research concludes that there is an effect of husband's education, family income, self-efficacy, self-awareness, attitude, self-belief/perception, life skills, health care support, access to information about climate change together on health adaptation behavior. The factors that have the most role in health adaptation behavior are husband's education and self-awareness. Community access to climate information quickly and accurately can be done through climate change alert villages. There is a need for non-formal education in the



form of socialization and training on health adaptation in the face of climate change. Health programs must be integrated with the climate by providing health workers with climate information and compensation for health costs for communities exposed to climate change in the future.

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### Conflict of Interest

The authors declare no conflict of interest.

### REFERENCES

1. Madumere N. Public enlightenment and participation – A major contribution in mitigating climate change q. *Int J Sustain Built Environ.* 2017;6(1):9–15.
2. Ghoneem MYM. Planning for Climate Change , Why does it matter ? *Procedia Soc Behav Sci.* 2016;216(October 2015):675–88.
3. ICCSR. Indonesia Climate Change Sectoral Roadmap. Jakarta: ICCSR; 2010. 1–4 p.
4. Nguyen LTP, Seddaiu G, Gonario S, Virdis P, Tidore C, Pasqui M, et al. Perceiving to learn or learning to perceive? Understanding farmers ' perceptions and adaptation to climate uncertainties. *AGSY.* 2016;143:205–16.
5. Azadi Y, Yazdanpanah M, Mahmoudi H. Understanding smallholder farmers ' adaptation behaviors through climate change beliefs , risk perception , trust , and psychological distance: Evidence from wheat growers in Iran. *J Environ Manage.* 2019;250(July):109456.
6. Le H, Li E, Nuberg I, Bruwer J. ScienceDirect Understanding farmers ' adaptation intention to climate change : A structural equation modelling study in the Mekong Delta , Vietnam. *Environ Sci Policy.* 2014;41:11–22.
7. Leiserowitz AA. American Risk Perceptions : Is Climate Change Dangerous ? *Risk Anal.* 2005;25(6).
8. Myers DG. Psikologi Sosial. Jakarta: Salemba; 2012. 10 p.
9. Bord RJ, Connor REO, Fisher A. In What sense does the Public need to Understand Global Climate Change. *Public Underst Sci.* 2013;9:205–18.
10. Rochmayanto Y. Tingkat Kerentanan Masyarakat Terhadap Perubahan Iklim pada ekosistem Pegunungan : Kasus Di Gunung Talang Kabupaten Solok Sumatera Barat. *J Anal Kebijak Kehutan.* 2015;12 No 2:189–201.
11. Kemenkes. Laporan Nasional Riset Kesehatan Dasar tahun 2018. 2018.
12. Kementerian Kesehatan R.I. Riset Kesehatan Dasar. Jakarta: Badan Penelitian Dan Pengembangan Kesehatan Kementerian Kesehatan RI; 2013.
13. BMKG. Perubahan Iklim dan Dampaknya di Sumatera Barat. Padang Pariaman; 2018.
14. Lemeshow S, Jr DWH, Klar J, Lwanga SK. Adequacy of Sample Size in Health Studies. West Sussex England: John Wiley & Son Ltd; 1990.
15. Arikunto S. Prosedur Penelitian: Suatu Pendekatan Praktik. Jakarta: Rineka Cipta; 2013.
16. Barlian E. Metode Penelitian Kualitatif & Kuantitatif. Padang: Sukabina Press; 2016.
17. Morin CW, Comrie AC, Ernst K. Climate and Dengue Transmission : Evidence and Implications. *Environ Heal Perspect.* 2013;1264(11):1264–72.
18. Purcell R, Mcgirr J. Preparing Rural Health Services for Climate Change. *Aust J Rural Health.* 2015;22(1):8–14.
19. ILO. Safety and Health in Agriculture. Geneva, Switserland: Programme on Safety, Health and The Environment; 2000. p. 13.
20. Mc Michael AJ. Extreme Weather Events and Infectious Disease Outbreaks. *Virulence.* 2015;66:543–7.
21. SSI. Smallholder Farmers and Enabling Their Access to Sustainable Markets. 2016. p. 1–6.
22. Talukder B, Loon GW Van, Hipel KW, Chiotha S, Orbinski J. Health impacts of climate change on smallholder farmers. *One Heal.* 2021;13:100258.
23. Heijboer AM. Erasmus School of Economics “ The influence of dietary awareness on the relationship between education and health behaviour .” Rotterdam: Erasmus Shool of Economics; 2013. p. 15–6.
24. Ajuang CO, Abuom PO, Bosire EK, Dida GO, Anyona DN. Determinants of climate change awareness level in upper Nyakach Division , Kisumu County , Kenya. *Springerplus.* 2016;5(1015):1–20.
25. Peñalba EH, David APJ, Mabanta MJD, Samaniego CRC. Climate Change Adaptation: The Case Of Coastal Communities In The Philippines. *J Geogr Inst “Jovan Cvijić” SASA.* 2021;71(2):115–33.

26. Patel P, Gupta S. Awareness of farmers regarding climate change. Int J Home Sci.

2020;6(2):463-5.