

## ORIGINAL ARTICLE

# Public Health Center Capacity in Managing The Risk of Climate Change. A Case Study in The City of Padang, Indonesia

Putri Nilam Sari<sup>1</sup>, Aria Gusti<sup>1</sup>, Defriman Djafri<sup>2</sup>

<sup>1</sup> Department of Occupational and Environmental Health, Faculty of Public Health, Andalas University, 25613 Padang, Indonesia

<sup>2</sup> Department of Biostatistics and Epidemiology, Faculty of Public Health, Andalas University, 25613 Padang, Indonesia

## ABSTRACT

**Introduction:** Indonesia already has a regulation regarding capacity of public health sector to deal with climate change issue to overcome the adverse effects on health. This regulation is based on Indonesia's vulnerability to climate change and extreme weather. Despite having commitments and regulations about this issue, implementation of this policy is still not maximal in line with government expectations. Thus, the purpose of this study is to identify capacity of the health sector to be actively involved in minimizing the risks of climate change in Public Health Center (PHC) as the first level of health service for community. **Method:** This research is carried out to nine informants at three PHCs in the city of Padang. The study is conducted with a qualitative approach by reviewing the capacity of PHCs which regards to perception of climate change, health services provision for climate-based diseases, institution management, surveillance and early warning systems, and intersectoral coordination in managing climate change. **Results:** The results show that almost all informants in PHCs do not understand climate change issues correctly and do not have specific planning documents about climate change. Almost all PHCs do not utilize climate data that available from relevant stakeholders to predict climate-based diseases. **Conclusion:** The government is expected to apply existing climate change regulations in regional level so that PHCs can work through promotive and preventive approaches to address health problems caused by climate change.

**Keywords:** Public Health Center, Climate change, Human health

## Corresponding Author:

Putri Nilam Sari, MPH

Email: nilam@ph.unand.ac.id

Tel: +62751-38613

## INTRODUCTION

Southeast Asia countries are committed to improving the health system's resilience to climate change through the Malu Declaration. This activity is motivated by the issue of climate change which has direct and indirect impact on health. These impacts are caused by the increasing intensity and frequency of extreme weather that endanger the community, especially health status of vulnerable populations (1). Along with that, in the 13th goal of Sustainable Development Goals, it was stated that steps needed to deal with the threat of climate change include strengthening resilience and adaptive capacity, integrating climate change issues in policy making, and promoting and enhancing management capacity related to climate change that is focused to the community (2). The health sector's commitment to climate change is also based on the agreement declared in the Sendai Framework on disaster risk reduction. It is stated that by strengthening the health system's resilience to disaster

will reduce the risk of morbidity, mortality and improving human welfare (3).

Indonesian Ministry of Health already has regulations about the adaptation strategy of the health sector to the impact of climate change and guidelines for identifying health risk factors due to climate change as a reference for health workers and climate change observers (4,5). Despite many emerging threats, the involvement of health sector to adapt to this problems has not been fully implemented in accordance with all the indicators contained in existing regulations, especially at the regional level.

The health sector has created a climate change surveillance system which consists of a systematic and continuous system in processing, analyzing and interpreting data to provide information about health problems caused by climate change. However, the implementation has not been optimal (6). Several studies show that the health effects of climate change require serious attention. The risk of diarrhea, lack of water provision and respiratory disorders are classified into high risk in urban heat island areas (7). Furthermore, in flood-prone areas, climate calamities affect the

incidence of diarrhea and water quality deterioration. These conditions are exacerbated by poor sanitation behavior of the affected population (8,9). Then, food shortages also become a threat due to lack of water supply (10).

The city of Padang has a high risk of heat waves. In addition, 91.8 percent of this area is also risky for flooding (11,12). Therefore, it is necessary to assess the resilience and capacity of the Public Health Center (PHCs) as a first-level health facility in every sub-district to become a center for community health development, fostering community participation and providing maximum health services to prevent the widespread impact of climate change. Because of these problems, this research intends to explore the capacity of PHCs in deal with climate change impact.

## MATERIALS AND METHODS

### Study Design and Sampling Method

This research was conducted with a qualitative approach. This is used to understand the condition of a problem in-depth and thoroughly to reveal the situation as it is. Data were collected using in-depth interviews, guided by semi-structured questions known as a research guide. This method allowed interviewer to probe for explanations of responses and clarified by reviewing documents related to research and observation. Informant were asked about perception of climate change; provision of health services for climate-based problems; management of institutions to anticipate climate problems; surveillance and early warning systems; and cross-sectoral collaboration (13).

The study was conducted at three PHCs in Padang City from three sub-districts. These three sub-districts have the most vulnerable population to the risk of climate change compare to other sub-districts in Padang City (14). They are PHC A (Padang Timur sub-district), PHC B (Kuranji sub-district), and PHC C (Koto Tengah sub-district). Sample determined by purposive sampling as many as three informants in each PHC. The consideration of informants selection because the climate problem is related to their division at PHC. Their background are shown in Table I.

### Data Analysis and Validation

Data analysis was performed by content analysis, which classified research data in accordance with the similarity of features and compared with theory. To ensure the validity of the data, triangulation was carried by re-checking the data from various sources and methods.

### Research Ethics Considerations

This study was carried out after obtaining official permission from the Padang City Government and Padang City Health Office. Then informants were interviewed after signing the agreement. To guarantee the

**Table I: Informants' background**

Test	Code	Occupation	PHC	Working Experience
Informant 1	Inf-1	Head of PHC	A	24 years
Informant 2	Inf-2	Environmental health officer	A	33 years
Informant 3	Inf-3	Disease control and eradication officer	A	3 years
Informant 4	Inf-4	Head of PHC	B	36 years
Informant 5	Inf-5	Environmental health officer	B	11 years
Informant 6	Inf-6	Disease control and eradication officer	B	10 years
Informant 7	Inf-7	Head of PHC	C	10 years
Informant 8	Inf-8	Environmental health officer	C	28 years
Informant 9	Inf-9	Disease control and eradication officer	C	14 years

confidentiality of provided information, all transcripts, responses, and records are stored in a security folder. The personal data of the interviewee is not published without individual consent.

## RESULTS

### Perception of Climate Change

The opinion about climate change is that the climate in Indonesia is unpredictable, usually in the month ending in “-ber” like September, October, November and December. In those months, there will be rain and otherwise there will be a dry season. However, due to climate change, the weather in Indonesia is uncertain and unpredictable.

*“Climate in Indonesia is now unpredictable. In the month that ends with “-ber”, it usually rain, and in January and February there is a dry season.” (Inf-1)*

*“The current climate in Indonesia is unclear and unpredictable. Sometimes it rains, then suddenly it gets hot.”(Inf-3)*

At this time, in one day the weather can change unpredictably. If there is a dry season, the diseases that are often faced by PHCs are Acute Respiratory Infection and clean water problems. Whereas in the rainy season, the most frequently encountered problems is Dengue Hemorrhagic Fever (DHF).

*“There are two types of climate problems that often occur. The first is an increase in temperature caused by forest fires, causing air pollution which will have an impact on public health, for example Acute Respiratory Infection (ARI). ARI is the highest case faced by our PHC. The second is the increase in rainfall, this will cause catastrophic floods that will damage water sources. In addition, in the rainy season there is also an increase in the population of disease vectors such as mosquito vectors for DHF (spread)”.* (Inf-4)

The majority of informants said that climate change was caused by poor community behavior. However, there is a misunderstanding that the depleting ozone layer can

cause a greenhouse effect.

*"Bad human behavior will also have a negative impact on human health, for example if humans cut down forests carelessly, this will have a flooding effect that can cause disease in humans. In addition, poor behavior can also result in depletion of the ozone layer." (Inf-9)*

*"Many factors can cause climate change, for example the depletion of the ozone layer which makes the climate more extreme" (Inf-1)*

Climate change adaptation is needed because the role of the PHC should be focused on promotion and prevention. By providing counseling to the community, it will be able to change the behavior of the community towards a better way to prevent diseases caused by climate change.

*"With counseling, it is expected that people who receive our information can influence other communities". (Inf-9)*

*"PHC emphasize more on health promotion efforts, so that the incidence of diseases on climate change can be reduced". (Inf-1)*

### **Provision of Health Services for Climate-Based Problems**

Almost all of PHCs do not have an annual plan related to climate change and still focus on disaster like tsunami and earthquake. However, the activities and programs carried of PHC should considered the risks caused by climate change. The PHC planning document already exists to address the risks of climate change, but only limited to certain diseases and focuses on months that have health risks due to climate.

*"The detailed health risks of climate change have not been discussed in the annual PHC planning. However, routine tasks carried out by surveillance programs or environmental health division are already related to the problem". (Inf-8)*

*"PHC's planning is more directed towards the earthquake and tsunami disaster preparedness management. For the prevention of floods, storm has not yet discussed in the annual health center planning". (Inf-6)*

In managing climate-related diseases, obstacles often arise from the community because it is associated with changes in community behavior.

*"To change people's mindset and behavior is very difficult, because not all people understand and their awareness is still poor". (Inf-1)*

*"Climate change can cause vulnerability to health problems because of the many people who behave unhealthy" (Inf-6)*

Efforts PHC to prevent climate-based problems are providing information to the public and give maximal curative activities. The majority of informants said that if a crisis situation arises due to climate change disasters,

the PHCs is ready to provide services to the community. However, at present the PHCs are more focused on the earthquake and tsunami disasters.

*"In the field of prevention, PHC conducts repeated counseling so that the community can realize the importance of health. Whereas in terms of curative, PHC provides treatment if the community suffers from a disease due to climate change" (Inf-5)*

*"PHC has no plan to deal with disaster caused by climate, but we are ready for other disaster preparedness such as the earthquake and tsunami". (Inf-6)*

### **Institutions Management**

The majority of PHCs never received specific information from the government regarding climate change. However, some health workers in the PHC have received information related to health problems caused by climate change in accordance with the trends of the disease.

*"In particular, we have never received any socialization from the government regarding the participation of PHC to anticipate climate change. However, for the dissemination of diseases related to climate has often been carried out before". (Inf-7)*

*"Environmental health officer have never received any socialization from the government regarding the participation of PHC to anticipate climate change." (Inf-5)*

*"We have received socialization from the government in 2014 and regarding waste management projects but not specifically on climate problems." (Inf-8)*

Furthermore, special funding and budget from the government is needed to improving PHCs involvement in climate change adaptation. At this time, PHC's activities related to the handling of health problems related to the climate are still integrated with other programs.

*"For the mechanism of budgeting is limited to diseases caused by climate change". (Inf-7)*

*"Because of handling climate change requires a special team, special funding from the government needs to be budgeted. Because it is not possible for the funds to be taken from the PHC budget". (Inf-1).*

### **Early Warning and Surveillance System**

The majority of PHCs can access climate data which available online but this is limited to data provided in social media. In fact, there are more accurate climate data that can be obtained from meteorological agencies that carry out routine measurements.

*"PHC can access climate data as long as the internet network is available". (Inf-6)*

*"Climate data can be seen on social media" (Inf-8)*

*"PHC can access climate data and public health conditions through social media" (Inf-1)*

Collection of public health data is carried out every two week using spesific form. Specifically for surveillance

data related to diseases related to climate, if there is an increase of a cases, special prevention activities will be carried out.

*"Surveillance data are collected twice a week". (Inf-2)  
"Climate related surveillance data collection is carried out if there are cases that occur in the community". (Inf-5)*

PHC report their data including climate-related diseases through online and manual. Using online system, data are reported weekly and submitted to the Ministry of Health application, while manually reported every month in to the Health Office. Head of surveillance program is responsible for collecting, managing and disseminating data. The majority of surveillance officer have received training related management of diseases data an information.

*"The reporting system is done online manually to the health office. The surveillance coordinator summarizes all disease data in PHC. Surveillance officers have received training on this activity". (Inf-2)  
"Health workers report to the head of surveillance program, then she reports all of the data to the health department (manually). While online, the surveillance will report directly to the Ministry of Health application." (Inf-4)*

#### **Cooperation and coordination across sectors**

The majority of PHCs have cross-sectoral coordination. They work together with neighborhood association, head of sub-district region and schools to prevent health problem and potential disease that will emerge. They carry out workshop every 3 months, as well as village community meetings. However, they have not collaborated with institutions that also deal with climate change issues such as the environmental office, meteorological agencies and disaster mitigation sectors.

*"A coordination mechanism with other agencies already exists, one of them with the sub-district leader. At the beginning of the year a workshop was held. During the meeting the roles of each party were discussed. In this case the PHC would provide socialization about our program, and the they would provide support for PHC program."(Inf-3)*

*"There is already coordination with other sectors. For example for the prevention of DHF in the community we have "mothers handling larvae" and for the school level there are already "larvae army troops"."(Inf-9)*

#### **DISCUSSION**

Opinion about climate change is driven by the perceived of this issue as a global problem and has less impact on local conditions (15). In fact, this problem is not limited to the unpredictability of weather, rainy and dry months. Climate change has a broad context, especially regarding the issue of anthropogenic pollution carried out by all sectors. The health sector is also responsible for this, because it also contributes to greenhouse

gas emissions. Therefore, each sector has its own responsibility for preventing broader impacts, rather than just focusing on its impacts (16). Health practitioners need proper understanding especially those who engage in promotive and preventive fields. Concern for climate change can be increased through communication with other practitioners who already understand the concept of climate change and the importance of thinking far ahead of the impact (17).

There is a common misconception between climate change and ozone depletion. As stated in previous studies, there are many people interpret that the ozone depletion concept is the same thing as climate change. This misunderstanding also occurs in the mechanisms and compounds in the atmosphere that cause deteriorating environmental conditions (18). Energy producing become the most prominent sector that emits greenhouse gasses into the atmosphere. This followed by industrial activities, agriculture, and waste generated from various human activities (19). However, there is a strong interaction between ozone depletion and climate change caused by rising greenhouse gases (GHGs). Ozone depletion affects the climate, and vice versa (20), but this is not a direct cause for each other. Over the last few decades, climate patterns have changed due to the rapid cooling of the earth's temperature. In winter, strengthening and shifting of the polar vortex and western wind belt occur on the earth's surface. In addition, ozone depletion happens in the stratosphere at the north and south poles (21).

Having said that, this will be a problem in the coming years if human anthropogenic behavior not comprehensively addressed. As previous studies have calculated that the health sector can produce 7%-8% of greenhouse gases (22). It is expected that there are health sector innovations to minimize carbon emissions without reducing health services provided to the community. In addition, they can also contribute to greenery, saving energy, and the use of environmentally friendly transportation for employees and operational activities that have no impact on medical services.

Health practitioners also need to understand that climate change affects human health through complex pathways and the effect varies according to the geographical, topographical, and vulnerability of society. The direct impacts are catastrophic event due to extreme weather, symptoms of heat waves, air pollution, and an increase in aeroallergens (23–25), whereas indirect impacts are decreasing food supply and production, vector and water-borne diseases, and socioeconomic disruption (23,26).

Therefore, adaptation policies made by the government should be implemented immediately in regional scale. Adaptation is an activity that includes strategies, policies, and actions taken to reduce health problems

that are vulnerable to climate. Adaptation can be a spontaneous response when climate problems occur. However, adaptation in the form of anticipatory actions before climate change is better prepared by affected individuals, governments or other institutions (27). Furthermore, health problems are closely related to water supply, sanitation, agriculture, education, tourism, transportation, development, and agriculture. It is not expected that health sector to work alone but rather to work across sectors to reduce the potential health impacts of climate change (28). The community must increase their understanding that climate issues can affect health. Especially diseases that often occur in specific climate events. With a good education, people can adapt, especially climate phenomena that arise at any time and prepare for the bad possibilities that will occur.

As a result of several disasters that ever happened, Padang City is declared as a "Resilient City" (29). However, the concept of "resilient" requires proper planning, especially in unpredictable disaster conditions. The plan must be oriented to uncertainty and not just adapt to conventional planning approaches. These conditions challenge the health government to make useful concepts, procedures, and scope of conventional approaches to planning, creating the need to rethink and revise current planning methods (30). Although the responsibility for reducing greenhouse gas emissions is outside the responsibility of the health area, at least the health sector can increase the professionalism of health workers to mitigate climate change in terms of reducing morbidity and mortality. Furthermore, through various health researches can provide evidence about health impacts as input in policymaking (31).

Specifically in Indonesia, PHCs have main activities and specific development programs that do not yet cover comprehensive climate issues (32). The impacts of climate change such as DHF, malaria, diarrhea, ARI and other diseases are integrated with the main program of the PHC. The budgeting and allocation of health resources are also included in those activities. However, the recurring nature of climate-based health problems continues to be a burden on PHC due to the lack of public awareness to change their conditions. PHC has worked according to procedures, but many factors have influenced the repeated of same diseases due to climate in the community. This is affected by the difficulty of changing people's behavior. In accordance with behavioral theory, a person's behavior will be influenced by knowledge, then change a person's attitude and influence the way they act (33). It also requires predisposing, reinforcing and enabling factors in forming the proper behavior in order to live healthily and prevent diseases that will arise (34).

Nevertheless, the health sector still has a great responsibility to change people's behavior with a

variety of effective communication methods to be able to prevent health problems (35), especially climate-related diseases. PHC should have a communication, information and education mechanism to increase public awareness about climate change (36). Due to the absence of special programs specified to climate, health promotion activities can be integrated with existing PHC activities such as Healthy Life Movement (GERMAS), Clean and Healthy Behavior (PHBS), Mosquito Nest Eradication (PSN) and Community-Based Total Sanitation (STBM) programs. Then, PHC is also suggested to use technological approach in promoting climate change. Information technology is more effective in changing behavior because of continual exposure to social media facilitated by the internet and other information system technologies (37).

However, the prevention of other health impacts due to climate has not been fully accommodated by the preventive programs in PHC and still uses a curative approach. The limited human resources and funds become common obstacle that made PHC focus their activities on the primary program. Therefore, it is necessary for the role of health cadres as part of the community to be more concerned with current issues due to an increasing climate problem (38). This issue needs to be raised to increase community awareness of health problems that might arise unpredictably.

Adequate infrastructure to provide health services must become part of the health response to climate change. To prepare for disasters such as hurricanes, floods and heat waves, it is necessary to develop an emergency medical system to increase disaster response capacity, including special services for victims. These activities must also consider the sustainability of services normally gave by PHC, because medical activities will focus on emergency services and trauma care (39). In addition, PHCs need to improve mental health services because the burden of health after an acute disaster is large, especially for vulnerable groups who have high risk of chronic mental disorders if not treated immediately (40).

In terms of regulation, policies related to health problems caused by climate change already exist, but the implementation needs to be maximized. In addition, there are regulations made by the local government such as the prohibition of littering, but it tends to be ignored by the community. The central government and the role of politics becomes important when the regulatory documents are not only limited as written rule, but there are real applications at the PHC level. To be able to increase the role of the health sector, health practitioners are necessary integrate in government coordination to actively participate in climate change policy management (41).

In climate change related to health policies, Indonesia has a five-year roadmap that starts with the data inventory

stage (2010-2014), then followed by implementing adaptation action (2015-2019). At this time, Indonesia should be in a period of implementation stability with ongoing monitoring and evaluation of climate issues (2020-2024). However, activities in PHC are still minimal rather than working comprehensively (42). Nevertheless, policy transfers are still dominated by the prevention and handling of certain diseases due to climate through some training for health workers. Although Indonesia already has a "Climate Village" Policy in almost all Regencies / Cities, this activity is just limited to environmental sustainability issues and not yet involve PHC. Whereas this program also can prevent health problems due to the climate issue. If it returns to the actual function of PHC, which is promotive and preventive, PHC can be integrated with community services in every village and hamlet to collect vulnerability data from the community and then move the community movement to care more about the climate .

Other research states that when making policy considering climate change issue, it turns out that funding will only be available when a disaster actually occurs (43). As is known, handling climate change in health sector will require significant financial resources. A common problem that occurs is that the government cannot allocate satisfactory financial resources (44). Change health funding mechanism more to preventive approaches will help PHC to increase their activity to promote climate instability and the follow-up health problems.

Other than that, utilization of climate data is needed to predict the risks that will arise. Climate data variability is available and can be accessed through the website and application provided by Meteorological Agency (45). In Indonesia, climate data can be accessed at available climate observation stations. In collaboration with data management experts, PHC and health offices can predict diseases that can arise if extreme weather occurs. As conducted by a study in the agricultural sector, they can predict shifting climate indicators so that they can anticipate the impacts that will emerge (46).

At present, a number of early warning systems in PHC are available to monitor diseases. The traditional early warning system detects outbreaks mainly from clinical data collected through the Department of Health, reports by telephone, and public surveys. This system has weakness because of the limited time of reporting, loss of climate data and diseases that appear quickly (47). The Ministry of Health also has a climate change surveillance system. However, research findings at the PHCs find that this activity had not yet been carried out optimally even though the government has equipped this system with a guidebook that can be applied by surveillance personnel (6).

PHC must be able to collect some data systematically in order to the climate change surveillance system can run smoothly. These data include environmental risks (e.g., temperature, mosquito's density), vulnerabilities (e.g., infrastructure, facilities, isolation, poverty) and diseases that are usually collected in the current PHC programs routinely (36,39). This program also need cross sector cooperation to provide sufficient data. For example, to reduce health impact of flood, PHC should use meteorological data provided by Meteorological Agency. Then, PHC focus to promote and prevent flood affected diseases (e.g., diarrhea and leptospirosis) especially to prone community (48).

As a manifestation of climate action in the 13th SDGs goal, this program requires fast action to reduce the impact of climate change including health problems in vulnerable groups. This include people who live in remote areas which are very vulnerable to disease because most of them have problems with water availability, sanitation mechanisms and live in hazardous locations (49). Health workers have a role to support this condition and provide a bridge for health and remote population so that they can avoid the diseases caused by climate change (36).

Targets which need to be achieve consist of increasing resilience, adaptive capacity, and awareness of the community and institutions related to mitigation, adaptation, impact reduction, and early warning (50). This will be better if a multidimensional system is implemented in the form of collaboration from various sectors including the health sector, the environment and policy makers to reduce its negative impacts. Partnerships between the public health sector and other institutions that are also responsible for climate-related issues will help PHC to prevent climate-related health problems at the regional level, especially applied at the PHC level.

## CONCLUSION

Almost all informants in PHCs still do not understand correctly about climate change and the health effect. This needs to be improved in order to be able to implement promotive and preventive approaches to reduce health impacts due to climate calamities. The majority of PHCs also do not have annual plans related to climate change, but already have plans to address some of the main health problems that occur during extreme weather. Many factors influence the re-occurrence of health problems due to climate in the community due to the difficulty of changing people's behavior. Therefore, concept of resilient city launched by the city of Padang should also accommodate the involvement of the health sector to prevent further health problems mainly due to climate change.

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