Climate Change: How is the Adaptation of Public Health Services? Case Studies in the City of Padang

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Abstract. Although the implications of climate change for public health continue to be explained, Indonesia still needs a lot of work to guide the development of comprehensive strategies to support health system adaptation. Existing regulations have not been able to increase the participation of Public Health Centers (PHCs) as first-level services to reduce problems that will arise due to the climate. The purpose of this paper is to see the extent of adaptation by PHCs to deal with climate change. This research was carried out by observing the indicators of the adaptation of the PHCs, in-depth interviews and review of related documents in three PHCs. The finding indicates that adaptation activities that need to be improved by PHCs are early warning systems about drought risk, collaboration with institutions concerned with climate change, and participation in reducing greenhouse gas emissions by using a pro-environment transportation system. In conclusion, the adaptation systems of PHCs have begun to be good, but there is no special attention to the risk of climate change that will be increasing in the future.

1. Introduction

Issue of climate change has many impact on health. This is because of the increasing of intensity and frequency of extreme weather endanger the society, especially in vulnerable community [1]. As stated in 13\textsuperscript{th} goal of the Sustainable Development Goals, strengthening adaptive capacity, integrating climate change issues in policy making, and promoting and improving management capacity are needed to deal with the threat of climate change [2].

Indonesia has a regulation regarding the Health Sector Adaptation Strategy on the Impact of Climate Change which is regulated by the Republic of Indonesia Minister of Health Number 1018 of 2011. This regulation emphasizes that adaptation for climate change need to be implemented to mitigate the adverse of health effects [3]. This regulation is based on geographical and geological characteristics of Indonesia that increase the vulnerability to climate change (a very wide country and consists of many islands), extreme weather (erratic rainfall patterns, increased frequency of drought),
high pollution levels in urban areas, have vulnerable ecosystems due to changes in land use, and socioeconomic activities that require and emit fossil fuels [4].

The high climate-related health risks in Indonesia are caused by rainfall, which is the main climate agent to influence geographical distribution, temporal patterns and temperatures. These conditions also increase the intensity of outbreaks such as DHF and malaria [5], [6]. In addition, the issue of nutrition fulfillment due to lack of food availability caused by drought and the uneven distribution of rainfall patterns become a threat to vulnerable populations [7]. Despite the many conditions that will emerge, the involvement of the health sector to adapt to climate change has not been fully implemented in accordance with all the indicators contained in existing regulations, especially at the regional level.

The city of Padang is at risk of heat waves and has high potential for the danger of flooding that is equal to 91.8% of all existing regions [8], [9]. In this city, there are three sub-districts which have the high number of population which are vulnerable to the effects of climate change (Koto Tangah, Kuranji, and Padang Timur) [8]. Therefore, it is necessary to find out the adaptation of Public Health Center (PHC) to the risk of climate change as a first level health facility to prevent the widespread impact of climate change.

2. Method
This research was carried out by observing the indicators of the adaptation of the Public Health Center (PHC). Data obtained was cross-checked with in-depth interviews and review of documents. The study was conducted on three PHCs in the three sub-districts that had the most vulnerable population against climate change. They are Lubuk Buaya PHC (Koto Tangah sub-district), Kuranji PHC (Kuranji sub-district) and Andalas PHC (Padang Timur sub-district).

Data collection on the adaptation of PHC to the risk of climate change was done by using checklist that was filled with observation and interview methods. These guidelines were modified and adapted to the needs of research sourced from the Sustainable and Climate Resilient Health Care Facilities Toolkit (Health and Human Services) [10]. To ensure the validity of the data, several data checking method were done by triangulation techniques. Triangulation was used to increase trust in the data obtained by re-checking data from various sources and methods.

3. Result and discussion
3.1. Immediate notification of danger conditions related to climate change
The research found that early warning of drought had not been received by two PHCs. Furthermore, early warning systems about extreme heat, forest fires, decreasing air quality have not been received by every PHCs.

| No | Danger Condition          | Lubuk Buaya PHC | Kuranji PHC | Andalas PHC |
|----|--------------------------|-----------------|-------------|-------------|
| 1  | Extreme heat             | Yes             | Yes         | No          |
| 2  | Drought                  | No              | Yes         | No          |
| 3  | Forest fires             | No              | Yes         | Yes         |
| 4  | Storm                    | Yes             | Yes         | Yes         |
| 5  | Flood                    | Yes             | Yes         | Yes         |
| 6  | Landslide                | Yes             | Yes         | Yes         |
| 7  | Decreasing air quality   | Yes             | Yes         | No          |
| 8  | Vector outbreaks         | Yes             | Yes         | Yes         |
Because of the early warning received by PHCs has not been maximized, they are expected to also consider for implementing an early warning system to prevent more widespread impact. The determination of resources may be needed which enables an increase the level of readiness; the strengthening of personnel who is placed in a standby position to act immediately in the event of an emergency concession; a 'call-out' system that is a request to use resources and a 'stand-down' or controlling condition to withdraw the alerted personnel. To implement this system, organization of PHCs need protocols or Standard Operating Procedures. These are regards to the division of tasks, staff willingness to be contacted outside working hours, and job descriptions to deal with drought, extreme heat, forest fires, decreasing air quality [11].

Because disasters are not only the responsibility of the government, the community and PHCs must be equally responsible for the preparedness of disasters that will emerge. If the initial notification is carried out before the strikes, the effectiveness of emergency preparedness measures can be greatly improved, especially during the early stages of an emergency. Where warning of impending emergencies is possible, the community should be encouraged to obtain a basic supply for personal consumption in the immediate aftermath of the emergency, such as safe water, foods or clothes.

3.2. PHC readiness in dealing with climate change

In terms of the readiness in dealing with climate change, some PHCs do not cooperate with university or institution, doing analysis of health impact, have trained human resources to provide information in the community, and consider climate change issues during annual policy making.

| No | Readiness in dealing with climate change | Lubuk Buaya PHC | Kuranji PHC | Andalas PHC |
|----|----------------------------------------|----------------|-------------|-------------|
| 1  | Local governments conduct health risk assessments due to climate change | Yes | Yes | Yes |
| 2  | Local governments notify the possibility of climate hazards to the PHC and the community | Yes | Yes | Yes |
| 3  | PHC has cooperation with universities or institutions that deal with climate change | Yes | No | No |
| 4  | The PHC has carried out an analysis of the risk of climate change on health impacts | Yes | Yes | No |
| 5  | PHC has trained human resources to provide information on climate-related health problems in the community | Yes | No | Yes |
| 6  | There are PHC staffs who participate in disaster management in the community / government | Yes | Yes | Yes |
| 7  | PHC provides information to the public about the effects of climate change | Yes | Yes | Yes |
| 8  | PHC considers the phenomenon of climate change during annual policy making | Yes | Yes | No |
Collaboration with other institutions and universities that are concerned with climate change issues is needed to determine the policies that will be taken to prevent unexpected health problems. Collaborative research can also be done for risks mapping in vulnerable areas. Therefore, the community and health workers can be prepared if an unwanted impact occurs.

Policy makers need practical options to adapt health systems to climate change. Health workers become an important element of every response to climate change; specifically providing information to the community and front line primary health care providers [12]. This needs to be discussed in annual planning activities and special or integrated policies need to be made between health services that are usually affected by climate-related conditions.

3.3. Facilities and access to minimize the risk of climate change

This study found that some PHCs does not have evacuation area for their community, does not have disaster-resistant construction buildings, and does not have adequate supplies of clean water in case of drought / flood.

| No | Facilities and access | Lubuk Buaya PHC | Kuranji PHC | Andalas PHC |
|----|-----------------------|----------------|-------------|-------------|
| 1  | PHC is built in areas that are safe from flooding | Yes | Yes | Yes |
| 2  | PHC is built in areas that are safe from landslides | Yes | Yes | Yes |
| 3  | PHC has alternative routes to referral facilities in the event of a flood | Yes | Yes | Yes |
| 4  | There is an evacuation area for the community in the event of a disaster | Yes | Yes | No |
| 5  | Health centers has buildings with disaster-resistant construction | Yes | No | Yes |
| 6  | Health centers has alternative sources of electricity | Yes | Yes | Yes |
| 7  | Health centers has adequate supplies of clean water in case of drought / flood | Yes | No | Yes |
| 8  | PHC has communication facilities besides cellular / internet networks | Yes | Yes | Yes |
| 9  | The recording and reporting system of PHC have used electronic system and safe from disasters | Yes | Yes | Yes |

Some climate-related disasters such as floods and landslides require adequate evacuation locations for the community. This condition is important as having buildings which are resistant to climate problems that will emerge and have clean water reserves in the event of a disaster.

Because these areas are vulnerable in the case of climate change disasters, they need a location and equipment to evacuate the community when the disaster happens and destroying people's houses. This can be done by collaborating with disaster management agencies and other institutions that responsible for disasters. The resilience of physical buildings and PHCs facilities is also important so that they are not easily damaged, because it will reduce health services quality to the community when there are weather and climate problems.
Water is an important component of health services basic provision that has function to prevent infection and spread of disease, protect staff and patients, and vulnerable populations including pregnant and disabled women. However, many health care facilities in vulnerable areas have inadequate access to water. The quantity of water needed for PHCs according to WHO standards is 5-400 liters / person / day. Moreover, access to clean water must be available in all services room and waiting area. Moreover, drinking water must comply with WHO Guidelines for Drinking Water Quality for microbial, chemical and physical aspects [13]. PHCs also must adopt a risk management approach to ensure safe drinking water especially for emerging situation.

3.4. PHC participation in environmental protection

Some PHCs do not use environmental friendly fuels for official transportation and have biopores. Moreover, they do not have policy of energy and water saving and do not support cycling/walking transportation.

Table 4. PHC participation in environmental protection

| No | PHC Participation                                      | Lubuk Buaya PHC | Kuranji PHC | Andalas PHC |
|----|--------------------------------------------------------|-----------------|-------------|-------------|
| 1  | The PHC has a policy of energy saving                  | Yes             | No          | Yes         |
| 2  | PHC has a policy of water saving                       | Yes             | No          | Yes         |
| 3  | PHC support cycling/walking transportation activities rather than using motorized vehicles | Yes             | No          | Yes         |
| 4  | PHC uses environmental friendly fuels for official transportation | Yes             | No          | No          |
| 5  | PHC has biopore                                        | No              | Yes         | No          |
| 6  | PHC has used roofs and bright colored paint to reflect heat | Yes             | Yes         | Yes         |
| 7  | There are green plants around the PHC                  | Yes             | Yes         | Yes         |

Government has regulated official vehicles do not use subsidized fuel aims to reduce CO$_2$ emissions. This is caused non-subsidized fuel more effective in combustion and reducing exhaust gases which endanger health and the environment [14]. In addition, to reduce greenhouse emissions, accustom cycling or walking (if possible) to the office for employees also give great contribution in reducing the risk of climate change. In line with that condition, PHCs could make biopore infiltration holes help reduce the city's vulnerability to flooding and drought. The formation of biopore will increase the rate of infiltration of water into the soil and help water and soil conservation. It will increase the capacity of the soil against rainwater, reduce water logging and reduce rainwater overflow [15]. A study of the environmental impact of energy and water savings in health service buildings also concluded that it was possible to reduce annual emissions by around 6.88 kg from CO$_2$ to the atmosphere and contribute to environmental sustainability [16].

4. Conclusions

Indicators of adaptation that need to be improved immediately are an increase in the early warning system regarding the risk of drought, cooperation with institutions that care about climate change, and participate in reducing greenhouse gas emissions by using an environmentally friendly transportation system. It is recommended to the government to immediately apply climate change adaptation policies to the lowest health services to reduce community vulnerability. In addition, cooperation with
institutions related to emergencies and disasters must proceed well, especially for early warning systems and provision of facilities in the event of a climate calamities.

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References
[1] Regional Committee for South-East Asia 2017 Malé declaration building health systems resilience to climate change. [Online]. Available: http://www.who.int/iris/handle/10665/259578. [Accessed: 02-Feb-2019].
[2] UN Environment, Goal 13: Climate Action. [Online]. Available: https://www.unenvironment.org/explore-topics/sustainable-development-goals/why-do-sustainable-development-goals-matter/goal-13. [Accessed: 20-Mar-2019].
[3] Ministry of Health 2011 Permenkes 1018/2011. [Online]. Available: https://peraturan.bkpm.go.id/jdih/userfiles/batang/permenkes_1018_2011.pdf. [Accessed: 10-Jun-2018].
[4] Kemenkes RI 2012 Peraturan Meneteri Kesehatan Republik Indonesia Nomor 1035/MENKES/PER/V/2012 /Menks/SK/V/2009 tentang Pedoman Identifikasi Faktor Risiko Kesehatan Akibat Perubahan Iklim.
[5] Arcari P, Tapper N and Pfueller S 2007 Regional variability in relationships between climate and dengue/DHF in Indonesia Singap. J. Trop. Geogr. 28, 3 251–272.
[6] Suwito, Hadi U K, Sigit S H and Sukowati S 2015 Hubungan iklim, kepadatan nyamuk Anopheles dan kejadian penyakit malaria J. Entomol. Indone. 7, 1 42.
[7] Asnawi R 2015 Perubahan iklim dan kedaulatan pangan di Indonesia. Tinjauan produksi dan kemiskinan Sosio Inf. 1, 3.
[8] BNPB Padang 2013 Kajian Risiko Bencana Kota Padang Sumatera Barat 2014 – 2018 Padang: Deputi Bidang Pencegahan Dan Kesiapsiagaan Badan Nasional Penanggulangan Bencana.
[9] Fajrin and Driptufany D M 2017 Variasi suhu permukaan daratan Kota Padang berdasarkan citra landsat 7 ETM+ dan landsat 8 OLI/TIR J. Momentum 19, 2 p. 34–40.
[10] NOAA Climate Governance 2016 Building Health Care Sector Resilience. [Online]. Available: https://toolkit.climate.gov/topics/human-health/building-climate-resilience-health-sector. [Accessed: 22-Mar-2019].
[11] WHO 1998 Health sector emergency preparedness guide: Making a difference to vulnerability 114 Geneva: WHO.
[12] Blashki G et al 2011 Preparing health services for climate change in Australia Asia Pacific J. Public Heal. 23, 2_suppl p. 133S-143S.
[13] WHO 2015 Water, sanitation and hygiene in health care facilities: status in low and middle income countries and way forward Geneva: World Health Organization.
[14] As’adi M and Djaia Y, 2017 Kaji eksperimental penggunaan liquid gas for vehicle (LGV) dengan Pertamax terhadap performa dan emisi gas buang motor bensin 2000 cc J. Tek. Mesin Mercu Buana 6, 2. 62–68.
[15] Mulyaningish T, Purwanto P and Sasongko D P 2015 Status Keberlanjutan Ekologi pada Pengelolaan Lubang Resapan Biopori di Kelurahan Langkapura Kecamatan Langkapura Kota Bandar Lampung Sains Tanah-Journal Soil Sci. Agroclimatol. 11, 2 85–94.
[16] Garcia S C J, Al-Kassir A and Yusaf T 2018 Economic and environmental impact of energy saving in healthcare buildings Appl. Sci. 8, 3 440.