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# Primary Healthcare in Community-Based Disaster Risk Management as Strategy for Climate Change Adaptation

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## Abstract

Disaster preparedness will be determined by the vulnerability of communities and might include preparation for reducing health risk due to climate change and rapid urbanization. This article overviews the evidence for human-induced climate change, its health impacts, and the role of health cadres in flood risk management and primary healthcare as strategies for CCA and DRR. Climate change has substantial potential health effects. Transmission of DHF is also sensitive to periodic fluctuations in the climate factors. Displaced persons may face more environmental threats that harm their health. Primary healthcare implemented by health cadres plays an important role in preparing for flooding and responding to infectious disease outbreaks due to changing patterns of vector- and water-borne diseases. However, there is a challenge for system shift towards more inclusive approach to DRR and CCA comprising primary healthcare measures, that is inadequate the mechanism of protection and compensation for health cadres. Building health cadres' capacity for flood risk management and strengthening their roles into the integration of primary healthcare as strategies for CCA and DRR, can help to meet the goal of the SFDRR 2015-2030 that calls for the participation of people disproportionately affected by disasters.

**Keywords:** Climate change adaptation; Disaster risk management; Health cadres; Primary healthcare; Sustainable development

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**Abbreviations:** CBDRM: Community-based Disaster Risk Management; CCA: Climate Change Adaptation; CHVs: Community Health Volunteers; DHF: Dengue Hemorrhagic Fever; DRR: Disaster Risk Reduction; IPCC: Intergovernmental Panel on Climate Change; SD: Sustainable Development; SDGs: Sustainable Development Goals; SFDRR 2015-2030: Sendai Framework for Disaster Risk Reduction 2015-2030; SLR: Sea Level Rise; WHO: World Health Organization

## Introduction

There is a high level of consensus that climate change is occurring now [1]. One of the potential consequences of climate change is sea level rise (SLR) that may threaten the coastal regions of the world and impact human life. Due to climate change, the global mean sea level has been observed to rise about 15-20 cm in the past century [2-4], and it is predicted that this rise will continue in the 21<sup>st</sup> century [4]. Further, climate change is also predicted to cause more flooding in some regions due to more frequent heavy rainfall events. Coastal communities are especially vulnerable

to coastal surges exacerbated by a combination of rising sea levels and more intense storms [3,5,6]. Indonesia is already experiencing prolonged droughts, increases in temperature, and increased frequency of extreme weather events and heavy rainfall, all of which are expected to intensify with climate change [7]. As an archipelago, the country is exceptionally vulnerable to SLR and the flooding in coastal areas. Global estimates of the Intergovernmental Panel on Climate Change (IPCC) predict that the sea level in Indonesia will rise 100 cm due to increased sea water temperature from 1.3 degree Celsius to 4.6 degree Celsius in the year 2100 [8,9]. It will clearly deepen the stress of coastal

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areas, causing floods, erosion of the shores and destruction of coastal structure [5,9] and will increase health problems that it is largely attributable to decrease in water quality and seawater intrusion into the freshwater sources. Kemijen urban village is located in the northeast part of East Semarang Sub-district on the northern coast of the island of Java, Indonesia which is one of the slum areas in Semarang City. In Kemijen, the worst floods occur as tidal floods; these are caused by a combination of coastal flooding and high tides [5,6]; this is then further reinforced by possible waves and SLR [6]. Floods happened has the potential to be in health insecurity for inhabitants. Floods can negatively affect to drinking water, sanitation, access to healthcare and safe food. Key health impacts of climate change are considered from the perspective of flooding, infectious diseases, and the displacement of communities. This article overviews the evidence for human-induced climate change, its impacts of health, and the role of health cadres in flood risk management and primary healthcare as strategies for CCA and DRR.

## Climate Change, Hazards, and Urban Vulnerability

The urban communities that are living in some parts of Semarang City, particularly marginalized communities and those geographically vulnerable to extreme weather events and SLR, are at high risk of climate change impacts from floods and coastal flooding. Recent climate observations indicate that the changing rainfall pattern in Semarang have contributed to existing problems related to flooding [2]. Currently, almost all of Semarang regions experience severe disruption of unclean water, pollution of sanitation system, infectious diseases, inadequate access to healthcare services, and unsafe from flooding and coastal inundation [2,7-9]. Flooding is often made worse by uncontrolled city development that builds over natural drainage channels and floodplains or by a failure to maintain drainage channels (often blocked by solid wastes where waste collection is inadequate). These problems are most evident in cities where there are no drains or sewers to help cope with heavy precipitation [10] and no service to collect solid wastes (in many cities in low-income nations, less than half the population has regular solid waste collection) [11]. In addition, residents who live along the coast are also at high risk of experiencing floods due to land subsidence. Human activities such as infrastructure development and groundwater exploitation became the driving factors of the land subsidence, particularly in the northern part of Semarang [5]. The soil structure in this area tends to be sandy so it is very easy to subside [6]. There are some concerns that this might stimulate migration from coastal areas to other parts of the city, creating additional social and demographic pressures. Displaced persons may face more environmental threats that harm their health (e.g., poor sanitation, hygiene, and water quality).

## Climate Change and Health Risk

The potential impact of extreme weather events precipitated by climate change is the most direct example of how climate change may impact on health. Water availability is becoming less predictable in many places and increased incidences of flooding

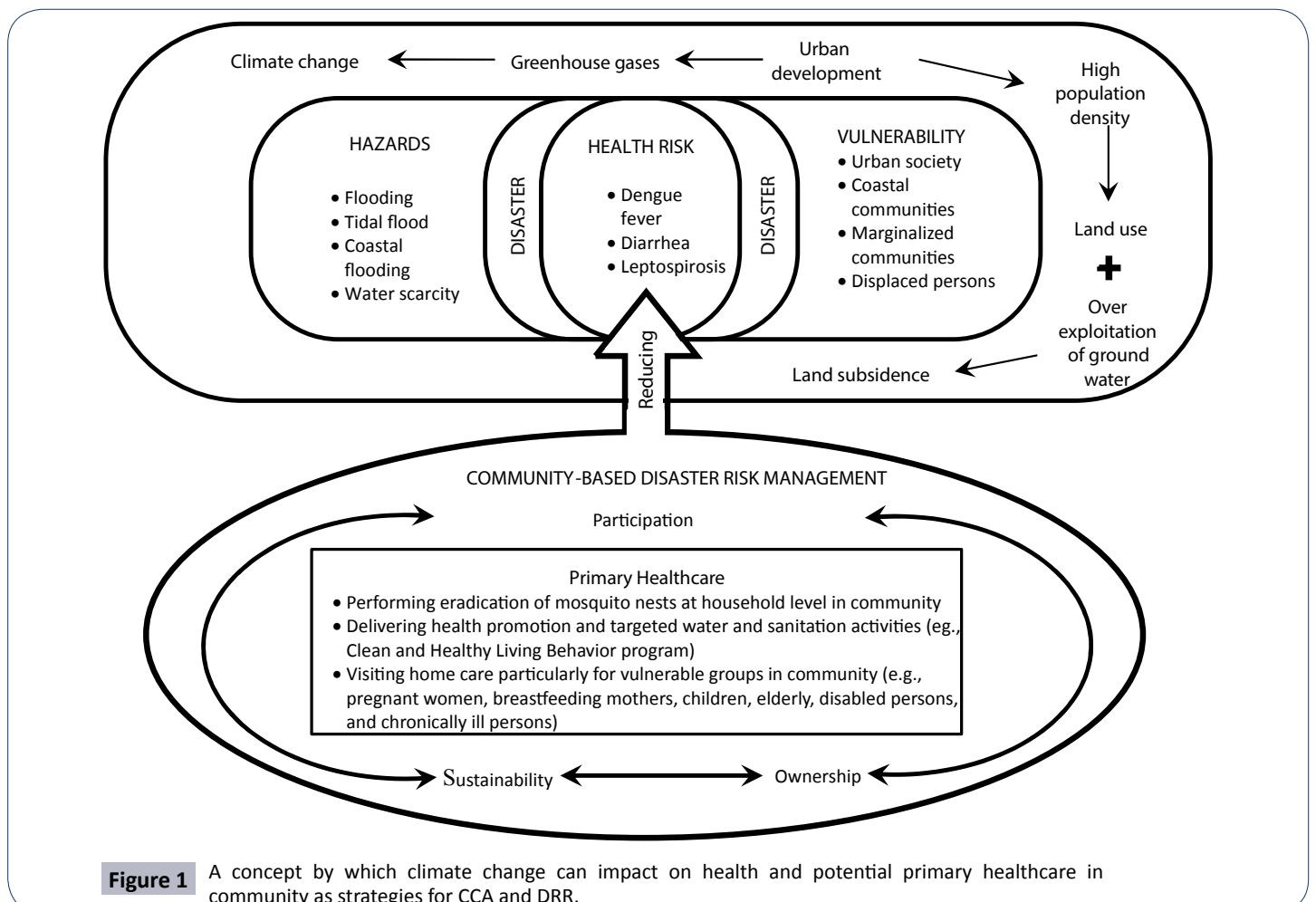
threaten to destroy water points and sanitation facilities and contaminate water sources. Human infection can result following exposure to water in which these hosts and parasites live (water-based diseases) or through the bite of insects that live or breed in water (water-related diseases) [12,13]. In addition, there are some infectious diseases that sensitive to climatic conditions. Temperature, rainfall, and humidity variously affect the replication, maturation and viability of the pathogen, the vector organism (where applicable), and the range and abundance of any reservoir or intermediate animal species [14]. Transmission of vector-based diseases such as DHF, which is spread by the *Aedes aegypti* mosquito are sensitive to periodic fluctuations in the climate factors [15,16]. Pattern outbreak of dengue virus infection is also influenced by climate and humidity, where the hot temperatures (28-32°C) and high humidity is an intermediate vector of dengue virus in order to stay alive [17]. In Semarang, one disease thought to be particularly susceptible to climate change is dengue fever [18,19], which is difficult to treat and can be fatal. The DHF is a disease caused by the dengue virus which transmitted to humans by the bite of infected *Aedes aegypti* throughout the tropical and subtropical world [20]. DHF is one kind of diseases which becomes the public health problem and endemics in Semarang since this area is also frequently affected by the floods. Stagnant water or slow flowing water attracts mosquitoes that use the water as breeding grounds. Furthermore, leptospirosis cases were also found in Semarang. Leptospirosis is one of rodent-borne neglected diseases but health problem in day. Transmission of leptospirosis occurs by contact with water or humid soil contaminated with urine from rodent infected with *Leptospira Sp* [21]. Leptospirosis cases tended to increase in the rainy season, particularly in times of floods. Flooding can cause the rats to come out of hiding and wandering in a residential neighborhood. The flood waters can be the medium transmission of *Leptospira Sp*, and can be a place to live *Leptospira Sp*. Flooding can expand *Leptospira Sp* transmission so that it can increase the risk of exposure to human [22].

## Primary Healthcare, Community-based Disaster Risk Management, and Climate Change Adaptation

Disaster impacts are strongly influenced by physical, social, economic and environmental factors [23]. Reducing disaster risk, hence, requires concerted action across a wide range of sectors, institutions and disciplines. The SFDRR 2015-2030 calls for an all-off society engagement and partnership to reduce disaster risk, with inclusive and accessible participation of people disproportionately affected by disasters. It also identifies the need to strengthen the link between health security and human resources management and DRR [24]. The SFDRR 2015-2030 highlights concerns on human health and well-being that are common to DRR, climate change, and sustainable development [25]. Meanwhile, primary healthcare focuses on basic healthcare services to improve health status, which in turn builds community resilience and provides the foundation for responding to emergencies and disasters [26]. Primary healthcare may have a role in mitigation of climate change through encouraging

environmentally sustainable healthcare services [14,27]. Policies and strategies focusing on primary healthcare may contribute to decreasing vulnerability and preparing households, communities and health systems for emergencies and disasters, including climate change. The health impacts of climate change can occur through a number of direct and indirect causal pathways, and the severity is in part determined by the adaptive capacity of the population [8]. Within the context of DRR, Community-based Disaster Risk Management (CBDRM) is one of the important pillars in efforts to reduce risks of disasters that will lead to sustainable DRR from the grassroots level of community [28]. It is to be understood that the impacts from disasters, which originate either from long-term climate change, are due to the underlying vulnerabilities of individuals, societies, regions and nations. In a way, most vulnerabilities work as common denominators for CCA and DRR and hence for the sustainable development (SD) [29]. For this reason, addressing underlying vulnerabilities has to be the first step for achieving any of the outcomes of CCA, DRR, and SD [30,31]. Disaster preparedness will be determined by the vulnerability of communities and might include preparation for reducing health risk due to either climate change impacts or rapid urbanization. Much of the climate change-related displacement will occur in developing regions where public health resources are inadequate [8,14]. Given the broad range of potential health impacts attributable to climate change, regional responses from the health professional will be required.

WHO had demonstrated the important role of community health volunteers (CHVs) in achieving Goal 3 related to health indicators in the Sustainable Development Goals (SDGs). The CHVs in Indonesia are known as health cadres, was established by the Indonesian National Women Organization Family Welfare Movement in 1970s [32]. Health cadres are selected by their communities based on a set of characteristics, including educational achievement, how integrated they are within the community, personality, dedication to service and willingness to commit to the time requirements to support services at the integrated health services post (*Posyandu*). Further, they were trained to conduct health and nutrition promotion activities in each village. In Semarang, early monitoring for vector-borne diseases or water-borne illnesses may be an important role for health cadres. In communities vulnerable to floods, the focus would be on providing primary healthcare. For example, health cadres may perform the eradication of *Aedes aegypti* nests, in particular periodically monitoring on inspecting mosquito larvae in the bathroom and water tank by visiting each household in the community. Further, health cadres may deliver health promotion and targeted water and sanitation activities through Clean and Healthy Living Behavior program in the community in urban areas and those most affected by the floods. Ensuring that everyone has access to sustainable water and sanitation services is a critical CCA strategy for the years ahead. **Figure 1** shows an overview of the concept by which climate change can impact on health



**Figure 1** A concept by which climate change can impact on health and potential primary healthcare in community as strategies for CCA and DRR.

and potential primary healthcare in community as strategies for CCA and DRR developed by authors from the previous studies [2,3,5-8,12-14,27-31]. We recognized the involvement of health cadres at community is critical for the success and sustainability of CBDRM, and have a role in reducing impacts of climate change and disaster risks through strengthening community capacity and improving environmentally sustainable primary healthcare services. Primary healthcare that implemented by health cadres plays an important role in preparing for flooding, monitoring and responding to infectious disease outbreaks due to changing patterns of vector- and water-borne diseases by providing extra support for communities. However, the CBDRM approach has difficulty achieving the desired level of community participation, including health cadres because mostly they are females who have a responsibility to keep their family and children, and usually work to gather neighborhood's data voluntarily. Moreover, there is a challenge for a system shift towards a more inclusive approach to DRR and CCA comprising primary healthcare measures, that

is the lack of rewards system and inadequate the mechanism of protection and compensation for health cadres.

## Conclusion

Climate change is a global public health problem which will manifest in Indonesia even more over coming decades. Key health impacts of climate change are considered from the perspective of flooding, infectious diseases, and the displacement of communities. Ensuring that everyone has access to healthcare services, sustainable water and sanitation services is a critical CCA strategy for the years ahead. Implementing an appropriate adaptive response to inevitable climate change in the coming decades will require adequate support from the primary healthcare providers, particularly in vulnerable areas of Indonesia. Hence, building health cadres' capacity for flood risk management and strengthening their roles into the integration of primary healthcare as strategies for CCA and DRR, can help to meet the goal of the SFDRR 2015-2030 that calls for the participation of people disproportionately affected by disasters.

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