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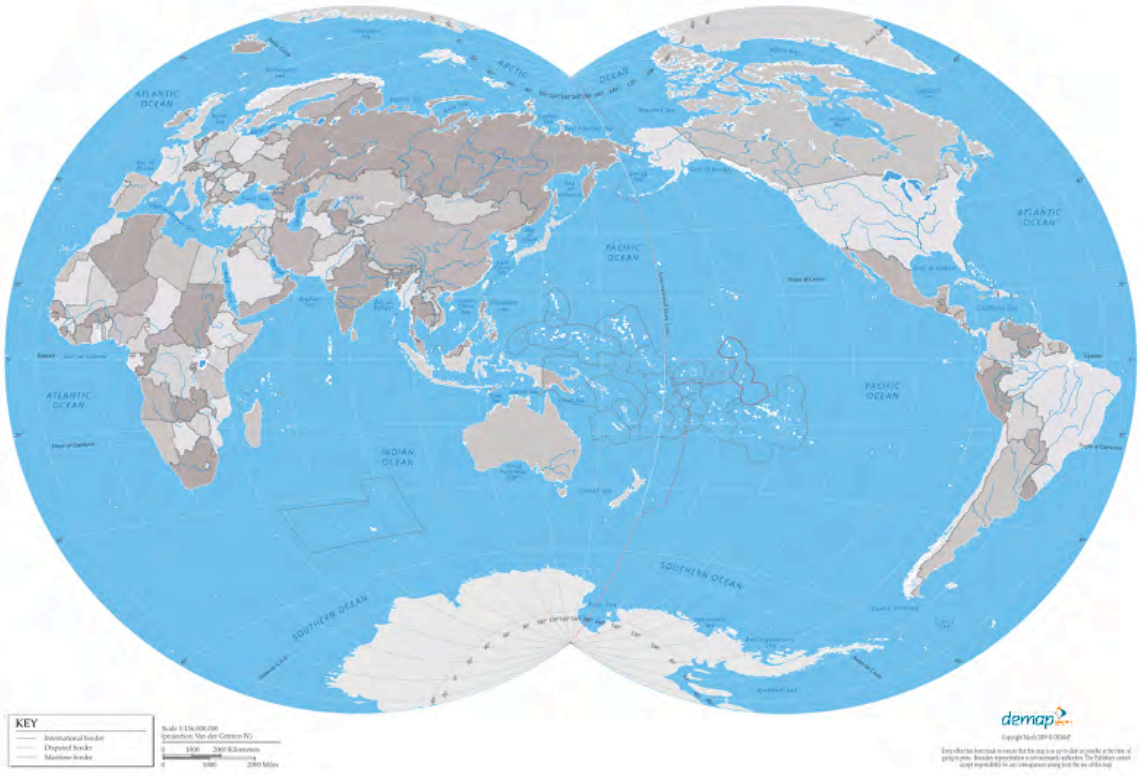
Climate Change and Public Health in Indonesia
Impacts and Adaptation



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Synopsis

Budi Haryanto of the University of Indonesia reviews expected global health impacts of climate change, and then outlines both direct and indirect health impacts specific to Indonesia. After setting out specific drivers of the climate change-health nexus in Indonesia, Haryanto summarises the range of current Indonesian research on health impacts. He then sets out adaptation issues and a method for approaching health adaptation assessment. Haryanto concludes by proposing a suite of adaptation measures, including health early warning systems; improved disaster response; capacity building for government, private sector, and civil society on managing prevention and control climate change on human health; empowering public health services system for disease prevention and control; and generating epidemiology and medical research to identify approaches for breaking disease transmission chains.

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Introduction

Global climate change will influence the functioning of many ecosystems and their member species. Likewise, there will be impacts on human health. The first detectable changes in human health may well be alterations in the geographic range (latitude and altitude) and seasonality of certain infectious diseases – including vector-borne infections such as malaria and dengue fever, and food-borne infections such as salmonellosis, which peaks in the warmer months. Warmer average temperatures combined with increased climatic variability would alter the pattern of exposure to thermal extremes with resulting health impacts, in both summer and winter. By contrast, the public health consequences of disturbances to natural and managed food-producing ecosystems, rising sea-levels and population displacement for reasons of physical hazard, land loss, economic disruption and civil strife, may not become evident for up to several decades.

Climatic changes over recent decades have already had numerous damaging impacts on human health. Spreading infectious disease, longer and hotter heat waves, and extreme weather will all claim thousands of additional lives nationwide each year. The warming of the climate is also creating the ideal conditions for spread of infectious disease, putting millions of people at risk. In addition, climate change has led to increased outbreaks and the spread of Dengue Hemorrhagic Fever (DHF), malaria, cholera, encephalitis, hantavirus, and other diseases all over the world, not only in third world countries but also in developed countries. Ironically, the countries which have contributed less to global warming are highly susceptible and suffer more outbreaks of diseases and deaths due to global warming.

The health impacts of known weather and climate changes are as follows:

1. Cardiovascular respiratory mortality and heat stroke mortality:
    - Short-term increases in mortality during heat-waves
    - V- and J-shaped relationship between temperature and mortality in populations in temperate climates
    - Deaths from heat stroke increase during heat waves
2. Allergic rhinitis:
    - Weather affects the distribution, seasonality and production of aeroallergens
3. Respiratory and cardiovascular diseases and mortality:
    - Weather affects concentrations of harmful air pollutants
4. Deaths and injuries:
    - Floods, landslides and windstorms cause death and injuries
5. Infectious diseases and mental disorders:
    - Flooding disrupts water supply and sanitation systems and may damage transport systems and health care infrastructure
    - Floods may provide breeding sites for mosquito vectors and lead to outbreaks of disease
    - Floods may increase post-traumatic stress disorders
6. Starvation, malnutrition and diarrhea and respiratory diseases:
    - Drought reduces water availability for hygiene
    - Drought increases the risk of forest fires
    - Drought reduces food availability in populations that are highly dependent on household agricultural productivity and/or economically weak
7. Mosquito, tick-borne diseases and rodent-borne diseases:

- Higher temperatures shorten the development time of pathogens in vectors and (such as malaria, dengue, tick-borne encephalitis and Lyme diseases) increase the potential transmission to humans
- Each vector species has specific climate conditions (temperature and humidity) necessary to be sufficiently abundant to maintain transmission

8. Malnutrition and undernutrition:
    - Climate change may decrease food supplies (crop yields and fish stocks) or access to food supplies
9. Waterborne and foodborne diseases:
    - Survival of disease-causing organisms is related to temperature
    - Climate conditions affect water availability and quality
    - Extreme rainfall can affect the transport of disease-causing organisms into the water supply

Current causes of impacts of climate change on human health in Indonesia

In Indonesia, cases of malaria, dengue, diarrhea and cholera are predicted to increase as temperatures rise and water becomes contaminated, affecting scores of poor populations that do not have the resources to cope. Water scarcity is an additional issue as a result of global and regional climate change in which between 2010 and 2015 the country is predicted to experience a major clean water shortage, and this is expected to occur mainly in urban areas (Boer et al., 2007). Air pollution is proven as a major environmental hazard to residents in Jakarta, regardless of their socioeconomic status. Transportation comprises 27% of Indonesia's GHG emissions, and traffic congestion is a huge problem in Jakarta (Pelangi, 1999). Diseases stemming from vehicular emissions and air pollution include acute respiratory infection, bronchial asthma, bronchitis, and eye and skin irritations (Boer et al., 2007), and it has been recorded that the most common disease in northern Jakarta communities is acute upper respiratory tract infection – at 63% of total visits to health care centers (Indriyanti and Pedrique, 2006).

Among other indirect impacts of climate change, the impact on human health has unique pathways transmission and is specific for every single disease. Once the impact occurs, the spreading of disease will continue from one infected person to others and from the new infected people to broader population due to the snowball phenomenon. It can be noted that each step of the pathway has a set of unique circumstances that will determine vulnerability. This spreading of disease may not be controlled directly even by manipulating or modifying the environment. Analysis of each of these steps allows a logical determination of vulnerability and subsequent development of adaptive measures that aim to decrease vulnerability. It will need specific technology, methods, and expertise such as public health, environmental health, epidemiology, medical, and pharmacy specialists to deal with the prevention and control to the impacts.

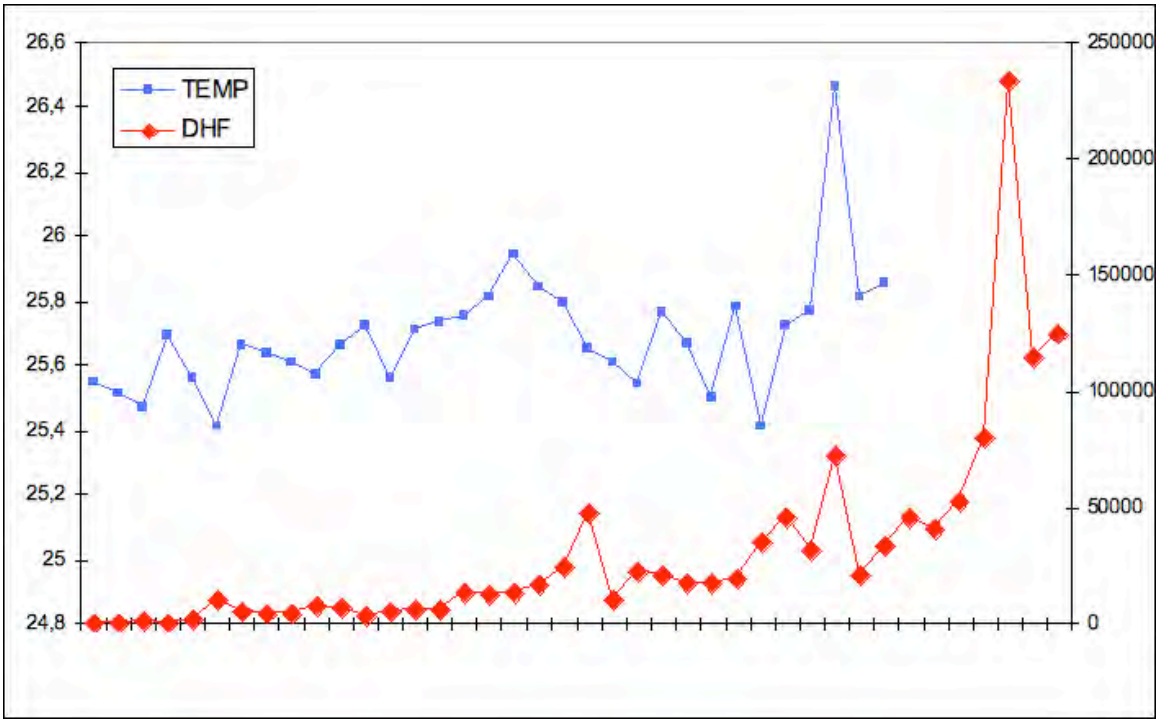

Figure 1. Temperature and DHF Cases in Indonesia, 1968 - Sept. 2007

Current research and reviews

The epidemiology of infectious diseases is changing rapidly; either new pathogens or old pathogens re-emerge into old and new regions. The changing epidemiology is certainly explained, at least in part and to a growing extends, by climate changes with different effects on different pathogens, diseases and communities. The problem is not restricted to specified regions, but it is a matter of global concern in which communities are confronted with new health care problems or face an increase in the current burden of infectious disease.

In Indonesia, research has focused on the identification of potential health impacts arising from the various types of climatic effects and the possible environmental consequences. The identification of potentially vulnerable groups and regions and an assessment of current coping capacity were included. Potential health impacts were considered for:

- Increases in extreme events.
- Increases in temperature.
- Increases or decreases in rainfall.
- Raises water sea levels and waves.

A lot of complete and ongoing research, and reviews concerning the relationship between climate change and health impacts in Indonesia, that have been conducted since 2006, include direct and indirect effects as follows:

Direct effects:

- Increase in injuries associated with extreme weather events

Indirect effects:

- Increase in vector borne diseases (malaria, dengue, filariasis) associated with increase in temperature, rainfall, humidity, and vector density.
- Increase in water borne diseases (diarrhea, cholera, typhoid, leptospirosis) associated with a decrease in water quality and water supply as well as floods and droughts.
- Increase in malnutrition cases related to food production and land use shifts
- Increase in cardio cerebral vascular diseases, hypertension, and mental disorders associated with urban stress, life style, displacements and conflicts.
- Increase in influenza (ARI) and respiratory diseases (asthma, pneumonia) associated with increasing of air pollution outdoor as well as indoor
- Increase in food borne diseases is associated with contamination, food handling, and poverty.

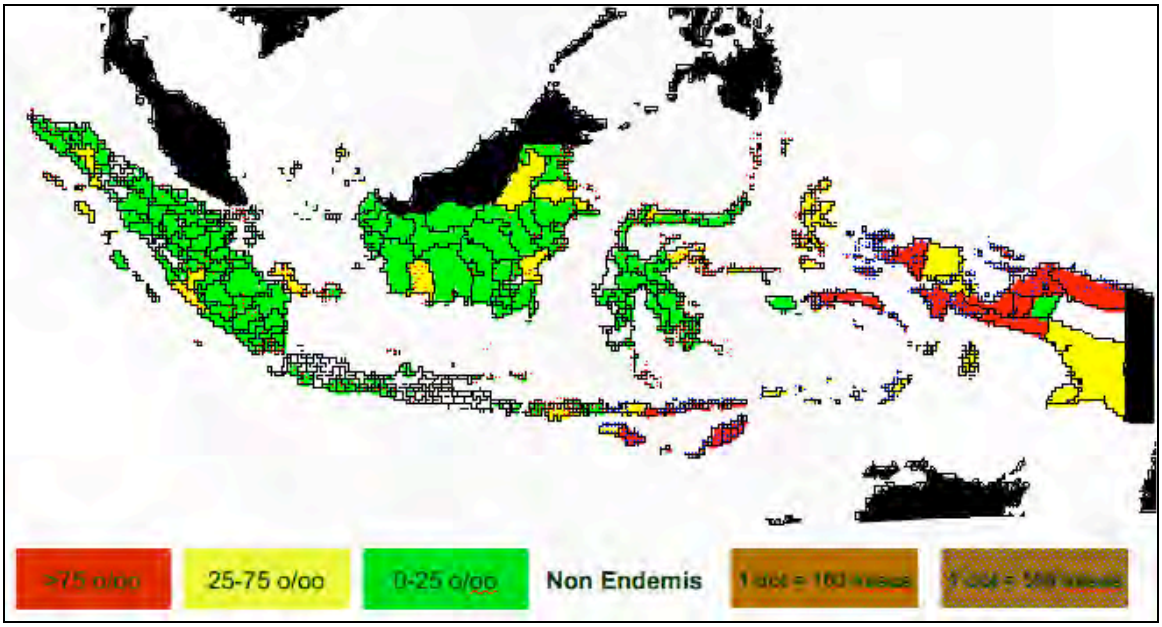

Figure 2. Malaria endemic areas

Public health response and adaptation in Indonesia

Adaptive capacity describes the general ability of institutions, systems and individuals to adjust to potential damages, to take advantage of opportunities and to cope with the consequences. In health terms, coping capacity is a measure of what could be implemented to minimize the negative health impacts of climate change that may arise in the future and maximize any positives that may occur. An assessment of coping capacity is necessary to determine current vulnerability and to plan appropriate adaptations. Assessment of coping capacity at all levels and for all relevant sectors will provide a thorough understanding of what is needed for management of potential health impacts from climate change.
Approaches to assessing the potential effects of climate variability and change on human health vary depending on the outcome of interest. Conventional environmental health impact assessment is based on the toxicological risk assessment model that addresses population exposure to environmental agents, such as chemicals in soil, water or air. Most diseases associated with environmental exposure have many causal factors, which may be interrelated. These multiple, interrelated causal factors, as well as relevant feedback mechanisms, need to be

addressed in investigating complex associations between disease and exposure, because they may limit the predictability of the health outcome.

Assessments of the potential health effects of climate variability and change have used a variety of methods. Both qualitative and quantitative approaches may be appropriate depending on the level and type of knowledge; the outcome of an assessment need not be quantitative to be useful to stakeholders. An integrated approach is likely to be most informative, as the impact of climate is likely to transcend traditional sector and regional boundaries, with effects in one sector affecting the capacity of another sector or region to respond.

Health impact assessment should include:

- an evaluation of the impact of climate variability and change in a range of areas and populations, especially among vulnerable populations and, when possible, to determine the attributable burden of weather and climate, including extreme events, to climate-sensitive diseases;
- an evaluation of possible threshold effects;
- an evaluation of the effects of multiple stresses, including changes in socioeconomic systems;
- an evaluation of uncertainty and its implications for risk management;
- an evaluation of the effects of reducing emissions, such as by comparing the impact under scenarios with business-as-usual and stabilization of emissions; and
- an evaluation of coping capacity, especially under different socioeconomic futures and in the context of sustainable development.

Assessment of vulnerability and adaptation uses similar concepts to those used in a health impact assessment. The following steps are commonly used for assessing vulnerability and adaptation of climate change health impacts:

1. Determine the scope of the assessment

The first step is to specify the scope of the assessment in relation to:

- the health and community security issues of concern today and of potential risk in the future;
- the geographical region to be covered by the assessment; and
- the time period.

Interactions between weather and climate and health are location-specific; using epidemiological evidence based on local data if they are available is therefore important. Evidence of an association between weather and health outcomes may not imply an increased burden from climate change. Assessments should include current vulnerability to climate variability to inform an understanding of what could occur with climate change. The extent to which an assessment addresses these issues depends on the goals of the assessment and the resources available.

The national boundaries may not be the most appropriate geographical framework for the assessment. Climate, diseases and vectors do not respect national boundaries, and other countries may therefore need to be considered to assess the national risk. Countries with similar health and climate problems may work together for a regional assessment.

2. Describe the associations between disease outcomes and climate variability and change

For each chosen disease outcome, determining the factors that could modify its association with weather and climate variables is important. Modifying factors will vary by disease outcome and could include socioeconomic and other variables. Consideration should be given to interacting effects. For example, morbidity and mortality may be increased during periods of both extreme heat and high levels of air pollutants. If epidemiological analyses cannot be conducted, because, for example, if the data is not of sufficient quality and quantity, the available literature can be reviewed to produce a qualitative assessment.

The current burden of the climate-sensitive diseases can be described using the following indicators:

- the current incidence and prevalence of the disease and the trend (is the disease increasing or decreasing), which may be available from routine statistics from the appropriate national agency; and
- the attributable burden of a disease to climate and/or weather, such as what proportion of all cardiovascular deaths are attributable to high or low temperatures or the number of deaths caused by floods.

For vector-borne diseases, having a map showing the current geographical distribution of human cases and vectors may be useful. Finally, environmental and socioeconomic conditions also influence human vulnerability and need to be considered within the assessment.

3. Identify and describe current strategies, policies and measures that reduce the burden of climate-sensitive diseases

For each health outcome, activities and measures individuals, communities and institutions currently undertake to reduce the burden of disease should be identified and evaluated for effectiveness.

4. Review the health implications of the potential impact of climate variability and change on other sectors

Climate change is likely to affect natural and human systems. Assessments should therefore be integrated across the concerned scientific disciplines and non-health sectors. International agencies (the IPCC) or regional or national authorities may have assessed the potential impact of climate change on the environment (habitat and land use) at the relevant spatial scale. These effects should be included in the assessments to better understand issues such as the health implications of the direct impact of climate change on the food supply and the risk of disasters (such as coastal or river flooding).The impact of implemented strategies, policies and measures in response to actual or projected climate change needs to be evaluated in terms of potential health effects. For example, in cases where domestic water storage is recommended, the implementation of this measure may have implications for vector breeding and the transmission of dengue. Water development projects should be subject to an environmental and health impact assessment. Information at the regional, national or local scale about climate variability and change should be used whenever possible.

5. Estimate the future potential health impact

Climate variability and change are adversely affecting human health and well-being and will continue to do so. The inherent inertia in the climate system means that the impact of current greenhouse gas emissions will be delayed for decades to centuries. The IPCC projections for the increase in mean surface temperature for the 21st century range from 1.4°C to 5.8°C. As a consequence, anthropogenic warming is projected, on average, to range from 0.1°C to 0.5°C per decade during this century. Even larger changes may be expected beyond the 21st century. Greater climatic changes are expected in higher latitudes in both hemispheres, with increasing risks of heat-waves, flooding and drought events and the spread of infectious diseases. This emphasizes that health and civil defense authorities need to design and implement adaptation strategies, polices and measures to reduce potential health impact. The climate change community often chooses reference periods for projecting the impact of climate change from the present until 2050 or until 2100. This requires using climate scenarios. Climate scenarios are now available for a range of time scales. The time scale of the assessment depends on the scope and purpose of the assessment. However, addressing potential effects both in the near term (the next 20 years) and the long term (up to 2050 or 2080) is advisable. The focus on the near term provides relevant information within the usual planning horizon of health agencies. A further need is looking beyond the near term to develop comprehensive adaptation measures.

The potential future impact of climate variability and change on health may be estimated using a variety of methods. These methods imply a top-down approach in which scenarios of climate change (and other changes) are used as inputs into a model on climate and health. Such models can be complex spatial models or be based on a simple relationship between exposure and response.

Models of climate change should include projections of how other relevant factors may change in the future, such as population growth, income and fuel consumption. Projections may be incorporated from models developed for other sectors, such as flood risk, food supply and land-use changes. An assessment needs to address uncertainty explicitly. Scientists, policy-makers and the public must recognize the existence of multiple sources of uncertainty, from climate projections to the potential future public health effects. This step should be realistic about the likelihood that the uncertainty can be resolved in a meaningful time frame. Carefully estimating uncertainty can help in further understanding the level of confidence in what is known and can provide input into future research directions and policy-making.

Future capacity to adapt to the effects of climate change depends on the future levels of economic and technological development, local environmental conditions and the quality and availability of health care and of public health infrastructure. Social, economic, political, environmental and technological factors strongly influence health. These determinants of health are complex enough that future projections about stresses on population health, including but not limited to projections of the potential effects of climate variability and change on health, become increasingly uncertain with expanding timelines. Future projections must make explicit their assumptions about adaptive capacity.

The adaptation focus for climate change on human health generated by the World Health Organization (WHO) and adopted by the Government of Indonesia (GOI) comprises the following points:

- Health security
- Strengthening health systems
- Health development
- Evidence and information
- Delivery
- Partnership

National Program of Adaptation and Mitigation for Health Sector (GOI):

- Infectious disease surveillance
- Health action in emergencies
- Safe drinking water
- Integrated vector management
- Environmental health capacity building
- Healthy public policy (healthy housing, school, forest, industry, city)

In order to bridge the GOI response and action for climate change adaptation especially on human health, several preliminary steps and or scenarios should be generated to assure the maximum efforts and significant results. They should at least include:

- Empowering a ecological-disease surveillance system and developing a public health early warning system
- Development of a response to disaster effects of climate change
- Enhancing capacity building for government, private sector, and civil society on managing prevention and control climate change on human health
- Increasing political awareness of the relationship between climate change and human health
- Empowering public health services system for disease prevention and control
- Generating epidemiology and medical research to identify approaches for breaking disease transmission chains
- Preventing and eradicating climate change vector-related diseases

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