

# The impact of extreme weather phenomena on public health: An analysis of Indonesia national policies on adaptation/mitigation strategies

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**Abstract.** Global climate change has led to an increase in the frequency of extreme weather phenomena, which have major impacts on public health. In response, Indonesia has developed the National Action Plan for Climate Change Adaptation (RAN-API) to enhance climate resilience. The RAN-API recognizes the health sector as a critical subject for adapting to climate change and establishes three primary goals: (a) Strengthening and updating of information on health risk and vulnerability due to climate change, (b) Development of policies, planning, networking, and cooperation among government agencies at the local, regional and national levels regarding climate change health risk, and (c) Strengthening capacity and early awareness of climate change-related threats to health in the community. However, despite the presence of national policies responding to health impacts due to climate change, the effectiveness of the RAN-API remains limited. This study will analyse the existing national policies regarding mitigation and adaptation programs designed to address climate change impacts of extreme weather phenomena on public health, and giving the contribution to strengthening adaptation and mitigation strategies, including strengthening climate resilience for vulnerable communities.

## 1 Introduction

In the Conference of Parties Special Report on Climate and Health, it was stated that climate change has had a significant impact on health. This health impact is caused by various factors, one of which is the increasingly frequent extreme weather phenomena.[1] Heat waves, cold waves, hurricanes, tropical cyclones, floods, droughts, heavy rain, and snowfalls are some examples of extreme weather events. Anthropogenic climate change is not only linked to a single extreme weather event. However, scientists argue that climate change is a growing factor for changing the odds of occurrence and the intensity of these phenomena.[2]

Extreme weather brought on by climate change can have a variety of direct and indirect effects on health, such as: The life cycles of the organisms that cause the disease or those of other species that spread those diseases to humans may be impacted by variations in rainfall and temperature. There could be a variety of these effects.

- Variations in rainfall and temperature will impact agricultural productivity, raising the possibility of malnutrition, harvest failure, and a variety of other health issues.

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- The changes in hydrology and rainfall may possess an impact on sanitation and water availability, raising the possibility of water-borne illnesses.
- Extreme weather events may destroy settlements or income-generating resources and facilities, leading to direct physical harm, loss of income and consequent well-being, psychological stress, and other direct and indirect human health consequences.[3]

In the Climate Risk Profile report, Indonesia is ranked in the top third of countries regarding the severity of climate risk, with high vulnerability to all types of flooding and extreme heat.[4] Extreme weather is a key factor in this tragedy. For example, heavy rains can lead to flash floods, which result in a variety of diseases. It cannot be denied that Indonesia as a tropical country has a high risk of vector-borne diseases. In addition to high rainfall, air temperature also plays an indirect role in the dynamics of malaria and dengue transmission. Temperature greatly affects various biological processes of mosquitoes.[5] The transmission of vector diseases faced by Indonesia is a major challenge for Indonesia's resilience in terms of climate change, this is evidenced in the ASEAN State of Climate Change Report document, Indonesia has reported that the increase in dengue fever is one of the impacts of environmental changes faced by Indonesia in the health sector.[6]

Furthermore, in 2023, Indonesia experienced extreme heat events with temperatures reaching 38 degrees Celsius.[7] Indonesia found an increase in the number of warm days during the daytime while decreasing the number of colder days at night. [5] This shows that in Indonesia there has been a rise in global temperatures. Although the heat wave that occurred in Indonesia is not as severe as that in other southeast Asia, however, the Indonesian government must be aware of the health impacts caused by these weather anomalies as explained in the 2019-2020 RPJMN report that efforts to deal with rising temperatures due to the effects of climate change must be prioritised in the 2020-2024 RPJMN period.[8]

The connection between health and global climate change is complex, involving interrelated causal factors and intersecting responsibilities. Indonesia has made important commitments to climate adaptation and mitigation strategies, one form of Indonesia's commitment to strengthening climate resilience is developing the National Action Plan for Climate Change Adaptation (RAN-API), which recognizes the health sector as an important subject to adapt to climate change. Therefore, this study will analyze existing national policies, and mitigation and adaptation programs designed to address the impacts of climate change and provide recommendations to strengthen adaptation and mitigation strategies to reduce the harmful impacts of extreme weather phenomena on public health in Indonesia.

## **2 Research and Method**

This study's methodology combines a review of the literature with an analysis of state practices. In order to obtain a comprehensive understanding of the adaptation and mitigation strategies of extreme weather on public health in Indonesia, a thorough review of pertinent academic publications, scholarly articles, reports, and legal documents were conducted.

Through descriptive analysis, the literature review focuses on national legal frameworks and policies pertaining to adaptation and mitigation from a normative perspective. Additionally, it examines scientific studies on the effects of severe weather. The analysis of the study includes the challenges and solutions in accordance with state practice in developing and committing mitigation and adaptation plans.

### 3 Results and discussions

#### 3.1 Indonesia national policies, and mitigation and adaptation programs for health system resilience due to extreme event

The World Health Organization (WHO) determines health system resilience as the capability of medical personnel, institutions, Stakeholders, and communities to prepare for, respond to, and recover from crises while performing critical functions. Therefore, adaptive healthcare systems are essential to protect lives and ensure positive health outcomes due to climate change.[7] In response to the impact of extreme weather in health resilience, Indonesia has adopted a climate change action plan into various policies.

For directive policies, Indonesia had confirmed the ratification of the Paris Agreement through the Law No. 16/2016, this act mandated the parties should take action to address climate change, respect, promote, and consider their state obligation on right to health.[9] additional legal framework, such as Law No. 36/2009 which mandates that everyone is obliged to respect the rights of others in an effort to obtain a healthy environment, both physical, biological and social.[10] Furthermore, strengthened by Government Regulation No. 66/2014 which address national policies on climate change mitigation and adaptation related to health as well as coordination and supervision at the national or regional level[11].

##### 3.1.1 *Indonesia Climate Change Sectoral Roadmap (ICCSR)*

The development of health-related adaptation to climate change in ICCSR should specifically concentrate on the following areas:

- Increasing infrastructure facilities and basic health services and improving access, equality, affordability, and quality of health services, particularly for the poor, by providing services for those with limited finances in class III hospitals and public health centres (PUSKESMAS);
- Increasing the accessibility of medical staff, particularly for basic health services in remote areas
- Prevention and eradication of infectious diseases through the use of appropriate case treatment methodology, enhanced surveillance, and proper infectious disease treatment.

ICCSR has recognized the threat to health due to extreme weather, but the form of adaptation/mitigation strategies provided at this time is still a general direction to the health sector caused by climate change. Although it is still a recommendation, ICCSR has become Indonesia's main reference in designing the RAN-API and also the Medium-Term Development Plan Development Plan 2020-2024 [12].

##### 3.1.2 *National Action Plan for Climate Change Adaptation (RAN-API)*

In terms of national development planning, RAN-API is a more specific plan for cross-sectoral development in preparing development plans for climate proof/resilient development at the national level. RAN-API is also a reference for local governments in preparing Regional Action Plans/Strategies for Climate Change Adaptation. RAN-API strategies in the health sector mandates 4 main targets:

- Strengthening the identification and control of risk factors in public health caused by climate change. The goals indicator of this target is the updated database and information related to the level of danger, vulnerability, and risk of the emergence or spread of diseases related to climate variables in district / city areas, and further indicators are the creation of vector disease control activities specifically for vulnerable

- groups, such as women, children, the elderly and low-income communities.
- Strengthening the alert system and creating an early warning system against the spread of infectious or non-communicable diseases caused by climate. The indicators of achievement of this target are the implementation of emergency response capabilities in disaster management carried out by districts / cities, the availability of health crisis management information products, and the achievement of organisational cooperation in the field of disaster management.
  - Strengthening regulations, and institutional capacity at the local levels towards the risk to public health caused by climate change. The target indicators are the number of legal products in the health sector and the strengthening of planning and utilisation of health human resources such as the division of tasks, authority, and resources between the central government provincial governments.
  - strengthening Science, Technological Innovation, and Public Participation Related to Health Adaptation to Climate Change. The target indicators of this target are the number of research products on health, increased public advocacy on climate- induced health info, adequate health service facilities, and an increase in the number of health human resources that have been upgraded through continuing education.[13]

### 3.1.3 *Presidential Regulation Number 18/ 2020 on The Medium-Term Development Plan Development Plan 2020-2024*

Through Article 2 of Presidential Regulation Number 18 of 2020 concerning the Medium-Term Development Plan 2020-2024, it is stipulated that the RPJMN is a strategic priority project across ministries/agencies and serves as a guideline for each ministry to develop its strategic steps. [14] The adaptation policy in the health sector includes controlling arbovirolosis (insect-borne diseases, such as Dengue Fever), fostering the implementation of healthy districts/cities, early warning response to extreme events, and early awareness of disease events. Funding allocations are also provided to fund these programs.[8] However, these priority activities or projects are not in line with protecting public health and the environment from the impacts of climate change, as four years on, how the country practices in implementing adaptation policies in climate change will be explained in sub 3.2.

### 3.1.4 *Regulation Of The Minister of Health Of The Republic of Indonesia No. 2/2023 Regarding Implementing Regulations of Government Regulation Number 66 of 2014 Concerning Environmental Health*

This Ministerial Regulation is realised as an effort to prevent diseases / health problems due to environmental risks. in the guidelines for organising environmental health stipulated in Ministerial Regulation No. 2/2023, several climate change mitigation / adaptation efforts in the health sector are offered as follows

- Development of early warning systems for relevant extreme weather events and climate-induced diseases, such as heat stress, vector-borne diseases and malnutrition.
- Developing and implementing communication strategies on climate risks to health for various target audiences such as mass media, communities and health workers.
- Preparedness and response management for extreme climate or hydrometeorological disaster, for example, by developing emergency response plans for health facilities through the placement of health facilities in appropriate locations that are sufficiently strong to be safe and remain functional during extreme weather events, and mitigation can also be done by conducting regular risk assessments for current and projected future exposure to extreme weather events as a basis for strategic development plans for the health sector.

### **3.2 Recommendations to strengthen adaptation and mitigation strategies**

Indonesia is one of the middle-income countries that has a higher level of support for climate action plans, and that support is almost consistently higher than that of other ASIAN countries such as China and India.[9] Therefore, stakeholders in Indonesia generally view current health policies positively, but recognize that the effectiveness of these policies is often limited. This problem is not only faced by Indonesia but also by all countries in Asia, furthermore in the ASEAN State of Climate Change Report it is stated that ASEAN countries show a large gap in implementation and ambition compared to their global goals for both adaptation and mitigation strategies.

Based on a report, diseases caused by climate change are not limited to arbovirolosis. This was proven in the RAN-API Review in 2018 by BAPPENAS. In the report, climate change contributes to rising temperatures in Indonesia, which has the potential to cause inflammation which is bad for the heart.[15] To support the program in dealing with the risks and mechanisms of extreme heat stress, and its impacts, there are various activities programmed by the Ministry of Health. The activities based on Ministry of Health Regulation No. 2 of 2023 on the Implementation Regulation of Government Regulation No. 66 of 2014 on Environmental Health specifically regulates climate-related health programs consisting of:

1. Communicable disease control
2. Non-communicable diseases
3. Water and sanitation
4. Nutrition, hygiene, and food safety
5. Occupational health
6. Environmental health
7. Maternal and child health
8. Geriatrics
9. Mental health
10. Disaster and emergency management
11. Facility management
12. Health statistics and information
13. Medicine

However, these activities are only centred on adaptation efforts. This is seen from the establishment of policies that focus on the risks of climate change, while mitigation remains important to establish. Mitigation is defined as an action to prevent and reduce future impacts of climate change. Adaptation is to reduce risk correlated with the impact of climate change. Therefore, it is necessary to focus more on mitigation than adaptation.

In 2012, the National Climate Change Secretariat of Singapore established a mitigation strategy to reduce carbon emissions.[16] The mitigation can be summarised as, firstly reducing fossil fuels with natural gases, and secondly, the use of energy-efficient measures and technology. The main consideration is trying to build Singapore to achieve sustainable energy efficiency, increasing the knowledge in energy management, and developing public awareness. Here, Singapore's policy in mitigating based on the source of the highest contributor to household gas, which is the energy sector.

Furthermore, working with companies, Singapore provides rules where companies must appoint energy managers, conduct monitoring and reporting, have plans for energy efficiency, and also make buildings with environmentally friendly designs. As for the transportation sector, the Singapore government created mass rapid transit (MRT) by building new rail lines and adding bus stops, including increasing the number of buses. Finally, Singapore has created a strict vehicle ownership system where the number of new vehicles that can be registered each year is limited.

In Sweden, the government cooperates with companies or the private sector, for example by creating guidelines for mitigation and adaptation measures in the form of e-services and

digital information for forest owners. In addition, the Swedish government also allocates funds for an eco-bonus system to stimulate the shift of goods from land transportation to sea transportation. In shaping climate change mitigation policies, the Swedish government has taken into account reports that if it does not act preventively, the total long-term costs and risks of climate change will be far greater than the costs of acting. [17]

As an archipelago state, mitigating climate change is divided based on the focus of the sector, which includes industry, building, transportation, energy supply, land use, and waste sector. Here, climate change adaptation is a complex policy as Indonesia is an archipelago state. However, the data concerning the highest emitting sources is enough to illustrate the preventive efforts that must be made to reduce the growth of greenhouse gas emissions.

The strategy used by Singapore and Sweden is through a problem approach. The application can be applied also by Indonesia by knowing the biggest contributors, thus, the best efforts can be made. Indonesia has also enacted several regulations to support climate change mitigation, such as protection against deforestation, energy transition, and waste management. However, these efforts have not been fully maximized due to several factors. These factors include:

1. Policies that focus on climate change mitigation efforts
2. Public participation in suppressing GHG emissions
3. Private sector involvement such as companies
4. Analysis of the impact of GHGs on the health sector

## 4 Conclusion

To strengthen adaptation and mitigation of climate change in Indonesia, the RAN- API remains ineffective in making a strategy to anticipate the threat from environment, society, and economy. Accordingly, RAN-API have two adaptations to climate change in Indonesia, which are:

- a. Adjustment effort in making strategy, policy, management, technology and attitudes
- b. Efforts to reduce the impact caused by direct and indirect, continuous and discontinuous permanent as well as impacts by level.

In achieving the RAN-API targets, several regulations complement Indonesia's strategy. These regulations consist of the RPJMN and ministerial regulations. However, several of these policies and regulations only focus on adaptation strategies to reduce the impact of climate change while mitigation programs to prevent climate change remain limited. One example of best practice in designing a climate mitigation program can be found in countries such as Singapore and Sweden which design programs through a problem-based approach by only focusing on the largest sources of GHG contributions. Thus, the government can anticipate the impact of GHGs that have a significant effect on various sectors including the public health sector and not just adapt to the impacts of climate change.

## References

1. UNICEF (2021). Ringkasa Kebijakan. Kesiapan Sektor Kesehatan dalam Mendukung Komitmen Nasional pada Adaptasi Perubahan Iklim: Akses dan Ketersediaan Data
2. J. H.Hashim, & Z. Hashim, Climate change, extreme weather events, and human health implications in the Asia Pacific region. *As. Pac. J. of Pub. Health.* **28**, 4 (2016).
3. Haryanto, B., Lestari, F., & Nurlambang, T. Extreme events, disasters, and health impacts in Indonesia. *Extreme Weather Events and Human Health: International Case Studies.* Springer International publish. AG. **227**, 245 (2020)
4. Climate Risk Profile: Indonesia (2021): The World Bank Group and Asian Development

## Bank

5. Kementerian Kesehatan RI. Badan Penelitian dan pengembangan Kesehatan (2021). Data dan Informasi Dampak Perubahan Iklim Sektor Kesehatan Berbasis Bukti di Indonesia
6. ASEAN State of Climate Change Report (2021): The Association of Southeast Asian Nations (ASEAN)
7. Sulistiadi, W., Wasir, R., Thalib, W., Ayuningtyas, D., Bawazier, N., & Buskens, E. Building health systems resilience: understanding the social, economic, and cultural impacts of climate change from stakeholders' perspectives in Indonesia. *Archives of Public Health*, 82(1), 1-11 (2024).
8. Pemerintah Indonesia. Peraturan Presiden (Perpres) Nomor 18 Tahun 2020 tentang Rencana Pembangunan Jangka Menengah Nasional Tahun 2020-2024
9. Pemerintah Indonesia. Undang-undang (UU) Nomor 16 Tahun 2016 tentang Pengesahan Paris Agreement To The United Nations Framework Convention On Climate Change (Persetujuan Paris Atas Konvensi Kerangka Kerja Perserikatan Bangsa-Bangsa mengenai Perubahan Iklim).
10. Pemerintah Indonesia. Undang-undang (UU) Nomor 36 Tahun 2009 tentang Kesehatan.
11. Pemerintah Indonesia. Peraturan Pemerintah (PP) Nomor 66 Tahun 2014 tentang Kesehatan Lingkungan.
12. Kementerian Perencanaan Pembangunan Nasional/Badan Perencanaan Pembangunan Nasional Republik Indonesia. Indonesia Climate Change Sectoral Roadmap (ICCSR). (2010).
13. Menteri Perencanaan Pembangunan Nasional / Kepala Badan Perencanaan Pembangunan Nasional (Bappenas). Rencana Aksi Nasional Adaptasi Perubahan Iklim (RAN-API). (2014).
14. Pemerintah Indonesia. Lampiran III Peraturan Presiden (Perpres) Nomor 18 Tahun 2020 tentang Rencana Pembangunan Jangka Menengah Nasional Tahun 2020-2024.
15. Loso Judijanto; I Wayan Gede Suacana; Eksa Rusdiyana. Facing Climate Change Challenges: Adaptation and Mitigation Policies for a Better Future. *International Journal of Society Reviews*, *Vol. 2(5)*. pp. 1194-1207. (2024)
16. Ho, S. S., & Chuah, A. S. F. Climate change communication in Singapore. In M. C. Nisbet, S. S. Ho, E. Markowitz, S. O'Neill, M. S. Schäfer, & J. Thaker (Eds.), *The Oxford Encyclopedia of Climate Change Communication* (pp. 500-514). doi:10.1093/acrefore/9780190228620.013.473. (2017).
17. Government offices of Sweden, Ministry of the Environment. Sweden's long term strategy for reducing greenhouse gas emissions. (2020)