

## RESEARCH ARTICLE

# Climate Change Implications on Maternal and Infant Health Outcomes in Japan and Southeast Asia: A Comparative Scoping Review

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## ABSTRACT

Climate change is noted as the biggest challenge of the 21st century, due to its complexity and widespread impacts on every aspect of human life. Climate predictions in Asia are particularly daunting as they have grave implications on public health, especially for pregnant women and infants. The following scoping review identifies climate-related challenges currently faced by this subgroup, along with future complications predicted through meteorological modelling. First, the impacts of climate change in Japan were examined, accompanied by a cross-comparison with Southeast (SE) Asia to understand how similar predictions could have varying implications on health outcomes.

Climate modelling across East and SE Asia has indicated a rise in extreme weather events, pollution, precipitation, heat, and disease transmission. These predictions will fuel health complications for pregnant women and infants, notably increasing morbidity and mortality rates. The brunt of these climate consequences will be felt by the countries of SE Asia, due to underdeveloped infrastructure, governance, and public health systems. Nevertheless, current research emphasizes that neither Japan nor SE Asia are prepared to protect this vulnerable subgroup. Existing emergency-response strategies and medical resource allocation is limited in scope, and widespread disaster contingency plans are yet to be developed. To address these gaps, scientists have recommended the necessity of multidimensional, whole-of-government climate-adaptation strategies

## INTRODUCTION

While the impacts of climate change affect the entire world, certain populations are particularly vulnerable to its consequences due to geographical location, country-level development, poverty rates and other socioeconomic factors. Pregnant women and infants (ages 0-2) are susceptible to many climate-induced complications, such as spontaneous abortion, malnutrition, renal failure, and premature contractions [1]. Although this

subgroup is extremely vulnerable to climate consequences, extensive research on this topic is limited. The above consequences also have grave implications on the overarching healthcare system and governments. Therefore, it is important to understand the breadth of impact on this subgroup to better prepare nations for upcoming challenges. This scoping review aims to explore the impacts of climate predictions within the context of Japan and SE Asia (Figure 1).

Study Characteristics	Number of Eligible Studies
Region	
Japan	22
Southeast Asia	
Multiple	12
Cambodia	
Specific to: Thailand	2
Indonesia	
Lao People's Democratic Republic	
Malaysia	
Philippines	
Singapore	
Timor-Leste	
Brunei	
Specific to: Vietnam	1
Papua New Guinea	
Myanmar	

**Figure 1.** List of countries reviewed.

## METHODOLOGY

The Arksey & O'Malley methodological framework for scoping reviews was implemented to review existing literature. The electronic databases JSTOR, Web of Science and PubMed, along with Intergovernmental Reports and United Nations Progress Reports were searched. A total of 30 studies were included based on the eligibility criteria (Figure 2). Studies that fit the inclusion criteria were filtered and charted according to the aim of the study, location, target population, methodology and important findings.

## RESULTS

Climate change implications for Japan were noted to include rising water levels within the Sea of Japan, rising winter precipitation, land erosion, dust storms, rising sea and air surface temperatures and greater flooding [2]. In comparison, SE Asia faces a combination of reduced rainfall in some regions and longer monsoons in others. Apart from changing precipitation, SE Asia is experiencing prolonged droughts, greater frequency of tropical storms and greater surface air temperatures [2]. Tropical typhoons and cyclones have also grown in

Study Focus	
Healthcare Systems and Maternal/Infant Health	Inclusion
Direct Climate Impacts on Maternal/Infant Health in Japan and/or Southeast Asia (Current and/or Future)	Inclusion
Extreme Weather	Inclusion
Increased Precipitation & Flooding	Inclusion
Pollution	Inclusion
Indirect Climate Impacts on Maternal/Infant Health in Japan and/or Southeast Asia (Current and/or Future)	Inclusion
Food Insecurity	Inclusion
Water Insecurity	Inclusion
Poverty	Inclusion
Climate Predictions in Japan and/or Southeast Asia	Inclusion
Impact of Climate trends on life in Japan and/or Southeast Asia	Inclusion
Global Implications of Climate Change on Maternal/Infant Health	Exclusion: too broad
Reviewing small-scale program impacts on improving maternal/infant health outcomes	Exclusion: interventions and/or location of intervention too specific
Global-level proposals and recommendations for addressing climate change	Exclusion: too broad; doesn't address Japan and/or Southeast Asia specific problems

**Figure 2.** Eligibility criteria.

frequency and intensity due to the warming of sea water and changing wind patterns [3].

The increasing frequency of extreme weather events has caused massive destruction of homes, local infrastructure and livelihoods. Apart from immediate deaths and disabilities, many downstream effects are also observed, such as spikes in infectious diseases and mental disorders [2]. There are also rising cases of vector-borne diseases, especially dengue fever and malaria, with countries such as Malaysia and Singapore experiencing more than a 10-fold increase over the past few decades [4]. Vector-borne infections such as malaria during pregnancy can increase the risk of spontaneous abortions, premature delivery, stillbirth, and fetal underdevelopment [4]. Diarrheal disease outbreaks are also increasing across coastal East and SE Asia, where warmer coastal water temperatures are influencing waterborne pathogen toxicity [4]. Diarrhea is one of the leading causes of death for children under the age of 5 in SE Asia, as infant susceptibility to diarrheal outbreaks is greater due to compromised immune systems [4].

Water shortages are not only fueled by rising heat

levels, but also changes in the water cycle, continuous hydropower construction and overconsumption of groundwater without allowing the water-table to replenish [3]. The lack of water significantly affects sanitation and hygiene practices and has increased the frequency of infectious disease outbreaks mentioned above. Changing weather patterns and water cycles also affect staple crop production such as rice and wheat, along with inland fish reproduction within the lakes and rivers of Eastern Asia [3]. Persistent water and food insecurity are affecting women and infants disproportionately by reducing family earnings, food intake and diet quality, which affects healthy pregnancies and infant growth [4]. Common nutritional deficiencies within this sub-population include low iron, Vitamin B-12 and protein. Iron deficiency anemia is a common cause for maternal mortality and birth complications within the region. Infants also face numerous complications due to malnutrition after weaning, such as being more susceptible to disease outbreaks, stunting and wasting [4].

Torrential rain and flash flooding events have also increased in frequency across this region, inducing PTSD and depressive symptoms in pregnant women, along with reduced birth weights of infants [5]. Alternately, growing urbanization and atmospheric factors that enable cross-border pollution continue to reduce air quality across East and SE Asia. Prolonged exposure to pollutants during pregnancy is affecting fetal neurodevelopment, causing preeclampsia and preterm birth. Rising levels of heavy metal pollution, particularly in SE Asia, have induced oxidative stress and neural cell death within pregnant women [6].

## DISCUSSION

Although climate trends in Japan and SE Asia are similar, these trends are predicted to have graver implications on the SE Asian population due to limited infrastructure development, government capacity and resources to support growing population needs. While Japan is better prepared for climate consequences through government policies, safety standards and resource allocation,

more interventions are required to provide well-rounded support for pregnant women and infants. Current emergency-response strategies and medical resources are limited to certain climate consequences, such as natural disasters. However, a wider range of consequences are expected to impact Japan in the coming years, including a rise in vector-borne diseases, flash flooding and varying temperature levels, for which plans of action are yet to be developed. To reduce disease burdens within both regions, many scientists have proposed climate-adaptability interventions that target healthcare infrastructure, industrial practices and emergency-preparedness plans.

Broader climate-adaptability interventions that are applicable to both SE Asia and Japan include early disaster detection and prevention, supporting breastfeeding practices, providing monetary support, educating pregnant women on coping with post-disaster stressors and providing post-disaster prenatal care, including both mental and physical health evaluations [2,5,7]. Reports from rural Japan and SE Asia have indicated the drawbacks of emergency obstetric services, which usually only cover basic physiological complications. Therefore, improvements in obstetric service delivery and resource allocation need to occur to reduce infant and maternal mortality rates following natural disasters [8]. Although climate-modelling indicates a rise in disaster incidences, more data collection on morbidity and mortality rates within this subgroup is necessary to understand problem-specific implications. Apart from governmental support, at-risk communities can be better prepared for climate calamities through development of evacuation procedures and engaging in small-scale mitigation practices, such as planting flood resistant crops, development of flood shelters and emergency food storage. If adaptation practices are multidimensional, they have the possibility of addressing physical, mental and socioeconomic vulnerabilities of the target population [2]. Multidimensional practices, such as climate-smart agriculture or livelihood diversification, should be combined with data from geographical information stems to identify town-specific vulnerabilities and better manage climate risks [2].

## CONCLUSIONS

Climate modelling in East and SE Asia has revealed complications such as flooding, increased heat, precipitation, pollution, and extreme weather events, which will have downstream effects on maternal and infant health outcomes. Inequitable rates of infant and maternal mortality are expected across Asia compared to the rest of the world due to its population density, geographical location, and economic conditions [9]. Without proper resource allocation, infrastructural development, poverty reduction initiatives and governance systems in place, it is impossible to tackle rising maternal and infant health concerns associated with climate change [8]. Governments across SE Asia and Japan will need to work at the national level to develop targeted and inclusive plans of action. Collaborative efforts between Asian countries will also be required to improve adaptability of its populations and be better prepared for climate-calamities.

## ACKNOWLEDGEMENTS

*I thank Dr. Kayoko Sekijima from Niigata University for providing the opportunity to conduct this research under her supervision.*

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