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# Climate Change and Maternal and Newborn Health Outcomes

## OVERVIEW

The growing climate crisis presents one of the largest public health threats of the century. However, its countless impacts on maternal and newborn health outcomes (as well as health disparities worldwide) have only recently gained global attention.<sup>1</sup>

Climate change refers to long-term shifts in temperatures and weather patterns. While such changes may have natural causes, human activity such as the burning of fossil fuels like coal, oil and gas has been the main driver of climate change since the 1800s.<sup>2</sup> Over the last century, the average temperature of the planet has risen rapidly, with surface temperatures in 2022 measuring 1.90 degrees F (1.06 degrees C) higher than pre-industrial periods.<sup>3</sup> Increasing heat levels drives regional and seasonal extremes in temperature and increases the severity of weather events such as floods, droughts, wildfires, and cyclones.<sup>4</sup>

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This brief was prepared by Deekshita Ramanarayanan, Sarah B. Barnes, and Rhea Kartha through the generous support of EMD Serono, the healthcare business of Merck KGaA, Darmstadt, Germany.

While climate change affects all aspects of life in all areas of the world, existing inequities exacerbate the stress felt by its impacts across underserved groups. Often the populations who experience the highest exposure to hazards, have the least access to resources to successfully adapt.<sup>5</sup> Women and girls often face increased risks and strains from the impacts of climate change due to existing gender roles and cultural norms that make them responsible for household energy, water, food, and caregiving.<sup>6</sup> There is strong evidence that climate change impacts affect pregnancy and newborn health directly, as well as indirectly due to structural or infrastructure changes where pregnant people and their newborns live.<sup>7</sup>

The ways in which these direct and indirect impacts occur are manifold. Climate-related disasters are linked to increased gestational complications, like high blood pressure, dehydration, and kidney failure, as well as pregnancy loss, low birthweight, preterm birth, and delivery or newborn complications.<sup>8</sup> Exposure to extreme heat can result in obstetric complications for women and pregnant people such as placental abruption, gestational hypertension, gestational diabetes, cardiovascular events, preterm birth, miscarriage, stillbirth, and adverse perinatal mental health.<sup>9</sup> Such exposure may also cause neonatal complications such as fetal distress, neonatal intensive care unit (NICU) admissions, fetal growth restriction or low birth weight, congenital birth defects, diarrheal disease, vector-borne diseases (VBDs), and sudden infant death syndrome.<sup>10</sup>

Exposure to wildfire smoke, which contains dangerous particulate matter, can increase the severity of cardiovascular and respiratory disease,<sup>11</sup> which in turn increases the risk of obstetric complications during pregnancy. Increased severity of floods may lead to standing water, which can increase infection and disease, and creates barriers to accessing maternal health services.<sup>12</sup> And as the geographic spread of mosquitoes and

ticks expands due to increasing heat, so does the geographic spread of related diseases.<sup>13</sup>

This policy brief will explore the direct and indirect impacts of climate change on maternal and newborn health outcomes; highlight existing policies working to prevent or mitigate these impacts; and offer recommendations to improve resiliency to the growing impacts of the climate crisis.

## DIRECT IMPACTS OF CLIMATE-RELATED EVENTS

Exposure to extreme heat is associated with numerous pregnancy and newborn health outcomes. Preterm birth, which impacts approximately 13.4 million babies globally each year,<sup>14</sup> carries a 16% higher risk of occurrence globally during heatwave days as compared to non-heatwave days.<sup>15</sup> Global evidence has also found an increased risk of preterm birth, low birthweight, and stillbirth on higher temperature days, which rises progressively with increasing temperatures or with longer periods of heat exposure.<sup>16</sup> In low- and middle-income countries, pregnant people who experienced hot temperatures within seven days of giving birth have an elevated risk of experiencing a stillbirth.<sup>17</sup> Studies focused on extreme heat in the United States have also revealed an increased risk of stillbirth, particularly among Black and Hispanic women.<sup>18</sup> These findings, though from diverse contexts, demonstrate the risk of extreme heat on pregnancy and newborn health outcomes.

Pregnant people are particularly susceptible to adverse reactions to wildfire smoke, which contains high levels of carbon monoxide, carbon dioxide, and particulate matter, though the discrete effects of wildfire smoke on pregnancy are unknown.<sup>19</sup> However, analysis of wildfires in the United States over the last 20 years have found associations between exposure to wildfire smoke and preterm birth and low birthweight.<sup>20</sup> In Colorado, a five-year study of wildfires found that 3.7% of all births





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(6,974 births) were premature and attributable to wildfire smoke exposure during pregnancy.<sup>21</sup>

Exposure to cyclones or hurricanes may also contribute to increased pregnancy complications, preterm birth, low birthweight, and cesarean births.<sup>22</sup> During Hurricane Sandy in New York in 2012, the city saw a 4.1% increase in emergency department visits for major pregnancy complications within one week of the hurricane.<sup>23</sup> Such weather events often are associated with heavy rainfall and flooding, which may lead to increased risk of low birthweight, gestational hypertension, postpartum hemorrhage, and sepsis.<sup>24</sup>

In the midst of extreme flooding or other natural hazards, access to maternal, reproductive, and newborn health care is often excluded from emergency responses. For instance, 75% of deaths associated with flooding are caused by drowning, a circumstance which disproportionately impacts children under five globally.<sup>25</sup> Reports following recent flooding in Libya indicate that access to quality prenatal and postnatal care is limited due

to the damaged health infrastructure and the prioritization of the other healthcare needs of survivors.<sup>26</sup> And after the 2019 floods in Pakistan, maternal mortality rose dramatically in flood-hit areas, with 41% of deaths occurring due to post-partum hemorrhage.<sup>27</sup> Oxytocin, a drug typically used to prevent hemorrhage during childbirth, must be stored under strict temperature controlled settings for it to be effective. This was not possible due to damaged infrastructure as a result of the floods.

Flooding and other natural disasters may also disrupt access to prenatal, labor, and post-partum care provided by midwives, nurses, or physicians due to both damaged transportation infrastructure and a lack of access to water and nutrition.<sup>28</sup> However, some studies suggest that areas in which a strong infrastructure for prenatal care already exists experience only minor increases to adverse maternal and newborn health outcomes. In turn, such impacts are exacerbated in places where prenatal care is not universally available and health facilities prove difficult to access.<sup>29,30</sup>





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## INDIRECT IMPACTS OF CLIMATE-RELATED EVENTS

Climate change can impact environmental issues such as air quality. Increasing wildfires release hazardous air pollutants into the atmosphere, and warmer temperatures globally can facilitate the formation of ozone and other particles contributing to air pollution.<sup>31</sup> Exposure to both indoor and outdoor air pollution contributes to adverse pregnancy and newborn health outcomes. Research indicates that 41% of households, particularly in the Global South, rely on solid fuels for cooking, which contributes to indoor or household air pollution. Solid fuel use is associated with a 35% increase in risk for experiencing low birthweight globally.<sup>32</sup> Exposure to air pollution in the first 1,000 days post-conception may contribute to impaired lung function in infants and children, as well as childhood asthma.<sup>33</sup>

Shifting weather patterns and extreme weather events may also severely affect access to safe

food and water. In particular, land-locked and low-income countries experience rapidly shifting supplies of food and water depending on local weather conditions.<sup>34</sup> Food shortages can lead to poor maternal nutrition, which increases the risk of low birthweight—and even infant mortality.<sup>35</sup>

Additionally, lack of access to safe drinking water contributes to adverse pregnancy outcomes, particularly in regions with fewer resources.<sup>36</sup> Unsafe water can transmit bacterial, viral, or parasitic infections which increases the risk of maternal mortality or obstetric complications for pregnant people contracting these infections.<sup>37</sup> Access to clean water is also critical during labor, delivery, and newborn care. Globally, 9% of maternal deaths and 16% of newborn deaths can be attributed to infection or sepsis.<sup>38</sup>

Increasing access to safe water sources is associated with a decrease in under-five, newborn, and maternal mortality.<sup>39</sup> Breastfeeding is protective against illnesses caused by





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contaminated water, like diarrhea and vomiting; and infants who are not breastfed can be impacted by interrupted formula supply, lack of refrigeration, and limited access to cleaning supplies or hygienic areas to prepare formula.<sup>40</sup> Further, rising sea level in countries such as Indonesia can increase the salinity of groundwater and surface water sources of drinking water, which increases a person's salt intake.<sup>41</sup> Excess salt consumption during pregnancy contributes to gestational hypertension and the development of preeclampsia.<sup>42</sup>

Warmer temperatures and increased rainfall also increase the prevalence of mosquito- and tick-borne disease, including the Zika virus and malaria. Studies have highlighted the risk of Zika infection to pregnancy outcomes, including brain defects such as microcephaly.<sup>43</sup> Malaria, which impacts approximately 125 million pregnant people yearly, causes up to 200,000 annual infant deaths in sub-Saharan Africa.<sup>44</sup> Also in the region, 24-37% of maternal deaths can be attributed to complications related to malaria.<sup>45</sup> Additionally, malaria-induced

anemia may increase the risk of preterm birth and low birthweight.<sup>46</sup>

Stress related to climate change also has significant impacts on mental health, particularly during pregnancy. Areas impacted by hurricanes and cyclones experience reduced economic opportunities, unstable housing, reduced agricultural capacity, and reduced income—all of which are determinants of poor mental health.<sup>47</sup> Children who reported that their homes flooded due to natural disasters were three times more likely to report symptoms of post-traumatic stress disorder (PTSD) or behavioral and emotional disorders than children whose homes did not flood.<sup>48</sup> Pregnant people exposed to floods during pregnancy also reported higher levels of prenatal stress, which is associated with preterm birth and low birthweight.<sup>49</sup>

Today, more than half of the global population of internally displaced people are women and girls. Women and children are 80% more likely to be displaced due to climate impacts.<sup>50</sup> In fragile



settings, women and children are 14 times more likely to die than men.<sup>51</sup> They also face a heightened risk of gender-based and sexual violence which impacts their physical and mental health, increases the risk of unwanted and unplanned pregnancies, and their risk of infection. Additionally, those who remain in disaster-impacted regions may be faced with increased power outages, which impacts both a pregnant person's ability to travel to a healthcare facility and their access to a safe delivery in that facility or in their home.<sup>52</sup>

## EXISTING GLOBAL AND US POLICIES

Attempts have been made to address these climate-related challenges, including the following policy responses and legislative proposals:

### United States Global Strategy to Respond to the Effects of Climate Change on Women 2023

- This framework was published in 2023 by the United States Department of State Office of Global Women's Issues. It offers details about the impacts of climate change on women and girls, including scarcity of natural resources, gender-based violence, and economic participation. While this strategy and others released by the White House and other federal agencies do not directly address the impacts of climate change on maternal and newborn health, the framework does aim to address the disproportionate impact of climate change on women and girls, and empower them to become leaders in addressing these impacts, including those related to health.

### S.1601 – Protecting Moms and Babies Against Climate Change Act

- This US domestic bill was re-introduced by Representative Lauren Underwood and Senator Ed Markey in May 2023. Its aim is to invest in initiatives to reduce exposure to extreme heat, air pollution, and other climate-related threats to maternal and newborn health.

- The proposed legislation details four major actions to achieve its goals: invest in community-based programs to identify and address climate change-related risks to maternal and infant health; provide funding to prepare future nurses, doctors, and other health professionals to address these risks; establish a consortium at the National Institutes of Health to advance research on the impacts of climate change on maternal and infant health; and develop a strategy to identify and designate zones of increased risk to pregnant and post-partum people and their newborns due to climate change.

## RECOMMENDATIONS

What steps should be taken to address the urgent public health crisis caused to pregnant people and newborn children by climate change? We present the following policy and programmatic recommendations to address these impacts:

- 1. Close the knowledge gap on the direct and indirect impacts of climate change on maternal and newborn health.** As climate change increases the frequency and intensity of extreme weather events, it is critical to understand the direct impacts that these events have on health outcomes, as well as to access to safe and quality health services. Efforts such as the Climate, Heat, and Maternal and Neonatal Health in Africa project (CHAMNHA) aim to assess and quantify the impact of heat stress on health outcomes, including outcomes related to maternal and newborn health.<sup>53</sup> Understanding the indirect impacts of climate change, such as increased food and water insecurity, can better inform policy solutions aimed at reducing the severity of or exposure to these impacts.
- 2. Create and implement policies in the United States and globally to address the impact of climate change on maternal and newborn health.** Climate change has drawn significant



global attention in recent years, resulting in national action plans, efforts to reduce emissions, and investments in clean energy sources. Yet country-level and global policies centered on climate change offered to date do not address the impact of climate change on maternal and newborn health, despite the fact that these impacts have been demonstrated in the evidence obtained by research and analysis. Some frameworks, such as the United States Strategy to Respond to the Effects of Climate Change on Women 2023, do note the impact of climate change on public health as well as its impact on women and girls. However, in order to mitigate and prevent the impact of climate change and extreme weather events on maternal and newborn health, explicit policy guidance is needed. Legislation such as the Protecting Moms and Babies Against Climate Change Act provides a framework for reducing exposure to global climate-related threats which can be adapted for global implementation.

### **3. Strengthen infrastructure related to prenatal, labor, and delivery care and improve the resilience of health systems.**

This recommendation envisions steps that include ensuring that roads and other modes of transportation are resistant to impacts of floods or heat, as well as ensuring that pregnant people can use these modes of transportation safely during disasters. Research shows that in countries and settings where prenatal care is already widely accessible and utilized, the interruption of service provision is not experienced as acutely as it is in low-resource settings. This disparity points to the need for targeted investment in prenatal care. Ensuring that healthcare workers are educated on climate-related risks, as well as trained to treat pregnant people and newborns faced with direct and indirect health complications due to climate change can help mitigate these risks as they happen.

### **4. Invest in low-cost innovations to build resilience to climate impacts.**

Traditional practices can inform safe and low-cost tools for addressing climate-related risks. For example, in several parts of India, earthen pots are used to keep drinking water cool and could be used to ensure that pregnant people, newborns, and children have safe drinking water. Their use can also create hygienic settings for providing health services.<sup>54</sup> Improving health facilities' resilience to extreme weather conditions and resulting power outages is another step to make certain that essential health services are maintained even during extreme weather events. Innovations such as *We Care Solar Suitcases* provide medical-grade equipment that midwives and other health professionals can use to treat pregnant people and diagnose any obstetric or neonatal complications—even in adverse conditions.<sup>55</sup>

### **5. Improve education at the community level on strategies to increase adaptation and resilience during climate-related events or stress.**

Health promotion education campaigns must include information on managing climate impacts such as heat, air pollution, wildfire smoke, and heavy rains on health. Information on managing mental health is also critical to minimizing prenatal stress, PTSD, and other perinatal mental health conditions.<sup>56</sup> Encouraging those who are able to breastfeed to do so, especially when safe water is scarce, may protect newborns and infants from infection and disease stemming from unhygienic food and water supply. The Community Resilience Education Theory of Change developed by the National Oceanic and Atmospheric Administration details strategies to incorporate resilience to extreme weather and other climate impacts in both formal and informal education projects.<sup>57</sup> This educational initiative—and others like it—could be adapted and implemented globally to address the impacts of climate change on maternal and newborn health outcomes.



## ENDNOTES

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Woodrow Wilson International Center for Scholars  
One Woodrow Wilson Plaza  
1300 Pennsylvania Avenue NW  
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## Maternal Health Initiative

Sarah B. Barnes | Director  
Deekshita Ramanarayanan | Program Associate  
Rhea Kartha | Program Intern

 [wilsoncenter.org/maternalhealth](https://wilsoncenter.org/maternalhealth)  
 [mhi@wilsoncenter.org](mailto:mhi@wilsoncenter.org)  
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