

The impact of climate change on maternal and child health

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Introduction

It can be argued that there are three colliding pandemics that are currently affecting the planet and its people: COVID-19, global inequities and climate change. Regrettably, these are all the result of human action or inaction and are preventable. The United Nations Conference of the Parties (COP26), held in November 2021 in Glasgow, addressed some of these issues.¹ Prince Charles called this meeting the 'last chance saloon to save the planet.' The main objective of COP26 was to reduce global heating and limit global warming to the target maximum temperature of 1.5-degree Celsius above pre-industrial levels. According to the National Aeronautics and Space Administration (NASA), since the late 19th century, the earth surface temperature rose by 1.18 degrees Celsius, caused by increased carbon dioxide and other emissions into the atmosphere, with the years 2016 and 2020 being tied as the warmest years on record.² However, many, including a group of scientists called 'Scientist Rebellion' were not convinced that COP26 would make any difference to the warming of the planet.³ President of COP26, Alok Sharma admitted that the objective of the conference was not reached but remained cautiously optimistic: "We can now say with credibility that we have kept 1.5 degrees alive. But its pulse is weak and it will only survive if we keep our promises and translate commitments into rapid action".⁴

In this paper we consider how climate change can potentially impact pregnancy and its outcomes and how it will interact with inequality to affect especially the most vulnerable, namely women and children in low-and-middle-income countries (LMICs).

Scope of the problem and why pregnant women and LMICs are affected disproportionately

Climate change refers to a change in global or regional climate patterns, in particular a change apparent from the mid to late 20th century and is largely attributed to increased levels of atmospheric carbon dioxide produced by use of fossil fuels. The global north (typically high-income countries) are the world's largest emitters of carbon dioxide. According to Hickel (2020) the global north is responsible for 92% of excess carbon dioxide emission while African countries, cumulatively contribute around 3% greenhouse emissions.⁵

Changes in climate are certain to impact human health in a variety of ways. Increasing heat, flooding, droughts, wildfires, nutrition insecurity and an increase in infectious diseases are the main areas of concern. Low-and-middle-income countries are particularly vulnerable to these outcomes of climate change. With rising seas because of polar caps melting, island states are likely to

disappear over time – 80 % of the Maldives, for example, is only 3.3 feet (about 1 metre) above sea level and is under serious threat. The United Nations Department of Economic and Social Affairs estimates that over 1 billion people are living in informal settlements with poor access to water and sanitation. Of these 238 million are in sub-Saharan Africa (SSA). This situation is predicted to get worse with 3 billion people needing housing by 2030. This group includes poor pregnant women who do a variety of outdoor work and are continuously exposed to the elements.⁶

Pregnancy outcomes are likely to be significantly affected by global warming. Many low-and-middle income countries already have unacceptably high maternal and neonatal mortality rates. According to the World Health Organisation, SSA accounts for roughly two-thirds or 196 000 maternal deaths, with South Asia accounting for nearly one-fifth or 58 000 annually.⁷ The maternity mortality ratio in low-income countries is 462 per 100 000 live births while it is 11 per 100 000 in high-income countries. Similarly, according to the United Nations Children's Fund (2020) neonatal mortality is 27 per 1000 live births in SSA and 25 per 1000 in South Asia.⁸ A child born in SSA is 10 times more likely to die in the first month of life than a child born in a high-income country, while a child born in South Asia is nine times more likely to die. It is clear that mothers and newborns in low-income countries are already extremely vulnerable and this situation is likely to get worse. Unless we act now, the existing inequity in mortality between the global north and the global south and the rich and the poor will only get wider.

Low-and-middle-income countries will struggle to cope with the impact of climate change for the following reasons: inadequate expertise and resources, inability to rapidly reduce the use of fossil fuels; poor health and social systems, significant number of people living in informal settlements that are subjected to the elements. This means that the poor, including pregnant women, are likely to be the most adversely affected by climate change.

Food (In)security

The term food security encompasses the availability (production, distribution and exchange), access (affordability and preference) and utilisation (food safety, nutrition and social value) of food. The impact of climate change on food security, particularly in sub-Saharan Africa (SSA), is increasingly being recognised. It is estimated that two-thirds of arable land in Africa is expected to be lost by 2025 due to drought.⁹ Pregnant women in low-resource settings are particularly vulnerable to food insecurity. United Nations Climate quotes the Food and Agricultural Organisation (FAO) as suggesting that since 2012 the number of undernourished people in SSA has increased by 45.6%.¹⁰ Food insecurity and undernutrition in pregnancy are associated with maternal micronutrient deficiencies, depression, anxiety, gestational diabetes, hypertension and maternal

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morbidity and mortality. Bryson et al reported a cyclic interaction between physical health during pregnancy and food security amongst Ugandan women: illness during pregnancy decreased food procurement and consequent undernutrition intensified illness, making it even harder for women to access food.¹¹ Extreme weather events are expected to increase health risks for pregnant women in rural areas making it easier to enter and harder to exit the cycle of ill health and poor food security.

The world's freshwater resources, particularly natural drinking sources, are believed to be threatened by the effects of climate change. Groundwater, crop soils and many rivers are likely to become increasingly saline from higher tidal waves and storm surges. High salinity levels in drinking water impact the health of populations. Khan et al (2011) reported higher rates of preeclampsia and gestational hypertension in women living in the southwest coast of Bangladesh compared with non-coastal pregnant women due to saline contamination of drinking water.¹²

Air Pollution

Air pollution is among the top 10 threats to global health as listed by the WHO and the fourth leading risk factor for early death worldwide in 2019.^{13,14} Ambient air pollution is a dynamic mixture of ultrafine, fine and coarse particles as well as various gases, which results from fossil fuel combustion, industrial processes and waste incineration. Household air pollution is generated from cooking with low quality fuels and technologies. The World Health Organisation (WHO) recommended that safe level for particulate matter (PM) 2.5 is 5 micrograms per cubic of air as an annual average.¹⁵ Approximately 93% of children live in environments with air pollution levels above the WHO guidelines. Residential cooking contributes as much as 12% of global PM 2.5. There is mounting evidence that several aspects of reproduction are impacted by air pollution. These include decreased live birth rates, increased rates of miscarriage and fertility problems. While the mechanism of action is not well understood, an association has been drawn between exposure to PM 2.5 and decreased human fecundity with possible explanations include reduced sperm quality and an inverse relationship between oocyte numbers, maturation and even fertilisation rates.¹⁶

A recent systematic review specifically focusing on a US population noted a significant association between increased PM 2.5 and heat exposure with worse birth outcomes.¹⁷ Exposure to PM 2.5 is associated with an increased risk in preterm birth and low birth weight in 79% and 86% of the studies respectively. Additionally air pollution has significant negative effects on the cardiovascular system. Meta-analyses have shown significant positive associations between the incidence of preeclampsia and exposure to PM 2.5 and nitrogen dioxide.¹⁸ Pollutants are believed to adversely affect trophoblast invasion and placental vascularisation resulting in placental dysfunction.

Heat-related impact

Physiological changes associated with pregnancy creates a specific vulnerability to climate change. Pregnant women are at greater risk for heat-related illnesses than their non-pregnant counterparts as they are less able to thermoregulate. Increased fat deposition and the decreased body-surface-area to body-mass ratio reduces the pregnant mother's ability to lose heat to the environment. Mothers exposed to extreme heat during pregnancy are at higher risk of stillbirths, preterm births and delivering low birth weight infants.¹⁹ Moodley et al (2021) found a 4% increase in pregnancy loss for every 1 degree

increase in temperature in a rural setting in South Africa.²⁰ Maternal exposure to heat stress also increases one's risk for dehydration and renal failure. Dehydration in early pregnancy adversely affects fetal growth while it is associated with preterm birth in later gestations. In a systemic review by Bekkar et al, the risk of pre-term birth was increased by 11.6% per 5.6°C increase in temperature.¹⁷ Term birth weight decreased by 16g per IQR temperature increase, and the risk for stillbirth increased by 6% per 1°C increase the week before delivery during summer. Maternal hyperthermia in early pregnancy is associated with increased risk of congenital malformations such as neural tube and cardiac defects in the fetus. Increased heat is already a reality for many – including people living in informal settlements where houses are often built of corrugated iron with little or no ventilation.

Flooding and droughts

Droughts and floods reduces access to reliable water sources resulting in dehydration. Additionally, droughts and floods decrease food security, which impacts on maternal nutrition. Increased rates of preterm birth and low birth weight babies were reported following the Hurricane Katrina in 1997. Evidence from the Iowa flood, the El Nino flood as well as the Yangtze River Flood indicate that prenatal maternal stress caused by a natural disaster such as flooding are associated with a higher risk of cognitive impairment in childhood.²¹ The severity and effect is proportional to the duration of exposure and the severity of flooding.

Vector borne illnesses

Increasing temperature is also associated with increases in the rates of malaria, dengue and Zika which are more harmful to pregnant compared to non-pregnant women as well as their fetuses. Malaria, Dengue fever and Lyme disease are of the most common vector-borne illnesses, where pregnant women are at an increased risk of developing severe malaria. Vectors, which are all ectotherms (cold-blooded) breed easier in warmer climates, as seen in SSA. Predicting the spread and effect of vector-borne disease is a very difficult predict as it has many variables including aggressiveness of climate control, and vaccination rollout and usage. Spread of mosquitos such as *A. aegypti* is limited by cool ambient temperatures in higher altitudes. There is fear that as the earth warms, these limits will shift enabling flourishing of these mosquitos, and Dengue fever in previously unaffected areas. Furthermore, there is a possibility that as ambient temperatures rise, the lifecycle of the malaria parasite will accelerate, thereby increasing the rate of spread of malaria.²²

Role of the physician

The “pledge for planetary health to unite health professionals in the Anthropocene” encourages physicians to strive to uplift our planet. Physicians should actively address environmental, social, and structural determinants of health and protect the natural systems that support a viable planet for future generations. We should share and expand our knowledge for the benefit of society and the planet.²³

Physicians caring for pregnant women should try to ensure that their patients have access to clean drinking water, shade and cooling centres during periods of extreme heat. Women should be informed about the risk of illness from food, water and vector-borne pathogens. All food must be prepared with safe clean water.

Actions needed by the health-sector

Health professionals, health associations, academics and researchers

have a number of roles that they can play in responding to the impact of climate change on pregnancy and pregnancy outcomes. These include:

- Researching the impact of climate change on women living in informal settlements in homes with poor ventilation and inadequate access to clean water
- Advocating for decent housing especially for women and children – simple measures like cool roof technologies can decrease indoor temperature.
- Advocating for a reduction in greenhouse gas emissions, including reduction in dependence on fossil fuels
- Providing information and increasing awareness to front line health workers and to local communities about the impact of excessive heat on pregnancy and its outcomes – including in antenatal clinics and through community health workers
- Advocating to municipalities to provide sufficient clean water for hydration and the establishment of community gardens to strengthen food security and maternal nutrition
- Advocating for the use of cash transfers for indigent pregnant women to enable them to protect themselves during their pregnancy and improving access to child care grants
- Working with municipalities to monitor heat levels especially in poorly constructed and poorly ventilated homes including in informal settlements
- Advocating with employers to protect pregnant women from working in environments with excessive heat

Conclusion

The impact of climate change on the health of our future generations should not be underestimated. Furthermore, the effects of climate change are likely to widen existing gender-based health disparities, particularly in low-and middle-income countries. Pregnant women and neonates represent a vulnerable group across a range of social and cultural contexts. There is an emerging need for adequate policy and public health responses to mitigate the risk of climate effects on adverse pregnancy and neonatal outcomes. Global health and climate change communities need to galvanise efforts to raise awareness among policy makers. There is also a need to improve the availability of high-quality data on the impact of climate change on maternal and new-born health as we can only plan for the future if we understand the true burden of the challenges we face.

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