



COMMENTARY

Climate change threatens the achievement of the millennium development goal for maternal health

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Introduction

In September 2000, leaders from 189 nations agreed on a vision for the future: a world with less poverty, hunger and disease, greater survival prospects for mothers and their infants, better-educated children, equal opportunities for women, and a healthier environment; a world in which developed and developing countries worked in partnership for the betterment of all (United Nations, 2000). The eight millennium development goals (MDGs) were established from the Millennium Declaration, with 2015 being the date for achievement. The goal of MDG 5 is to improve maternal health, the target being to reduce the maternal mortality ratio by three-quarters between 1990 and 2015. The MDGs provide a framework with specific targets by which progress can be measured (UN Millennium Project, 2005). The MDGs established quantifiable benchmarks to halve extreme poverty in all its forms, and hence make significant improvements to the lives of the world's people.

As 2015 approaches, it seems unlikely that the targets for a number of MDGs, especially MDG 5—improving maternal health—will be met. Avail-

able data indicate that there has been little progress in the developing world as a whole towards meeting MDG 5, with 480 maternal deaths per 100,000 births in 1990 compared with 450 deaths in 2005 (United Nations, 2009). Every year, an estimated 536,000 women and girls die as a result of complications during pregnancy, childbirth or the six weeks following birth. Almost all of these deaths (99%) occur in developing countries. Maternal mortality is one of the health indicators that shows the greatest gap between the rich and the poor. Developed regions report nine maternal deaths per 100,000 live births compared with 450 per 100,000 in developing regions, where 14 countries have maternal mortality ratios of at least 1000 per 100,000 live births. Half of all maternal deaths (265,000) occur in sub-Saharan Africa and another third (187,000) occur in southern Asia. Together, these two regions account for 85% of all maternal deaths (United Nations, 2009).

The most recent MDG report highlighted that 'greater political will must be mustered to reduce maternal mortality, especially in sub-Saharan Africa and southern Asia, where negligible progress has been made so far' (United Nations, 2009, p. 5). The

report went on to say that 'Achieving the MDGs will require the development agenda be fully integrated into efforts to jumpstart growth and rebuild the global economy. At the top of the agenda is the climate change problem, which will have to be regarded as an opportunity to develop more efficient 'green' technologies and make the structural changes needed that will contribute to sustainable growth' (p. 5).

There is political will to reduce maternal mortality. In 2008, the G8 leaders addressed maternal, newborn and child health, releasing the Toyako Framework for Action on Global Health, which highlighted specific actions to be taken to improve progress in reducing maternal mortality (G8 Health Experts Group, 2008). In 2009, the G8 Leaders Declaration Document went further, calling for the building of 'a global consensus on maternal, newborn and child health as a way to accelerate progress on the Millennium Development Goals for both maternal and child health' (G8 Leaders Summit, 2009). The means to achieve this included the removal of barriers to access to skilled health workers for all women and children. The White Ribbon Alliance (WRA) for Safe Motherhood (White Ribbon Alliance, 2009) has been instrumental in highlighting maternal health as a major issue. The WRA was established in 1999 as an international coalition of individuals and organisations to promote increased public awareness of maternal and infant health issues, and has a number of high-profile supporters, including the Global Patron Sarah Brown (the wife of the current British Prime Minister).

High-level political will and commitment while necessary, is not sufficient. Climate change poses a threat to the achievement of the MDGs and related national poverty eradication and sustainable development objectives (Global Humanitarian Forum, 2009; United Nations, 2009). Achieving the MDGs, especially in relation to maternal health, looks improbable unless the amplifying impacts of environmental changes upon human health outcomes are averted (McMichael et al., 2008).

This commentary aims to highlight some of the main maternal health issues in relation to climate change and to show how climate change will, increasingly, jeopardise our efforts to improve maternal health and achieve the MDG goals. It is important to consider these issues as the world prepares for the next and extremely important phase of the international climate change negotiations—the 15th 'Conference of the Parties' (COP15) convened under the United Nations Convention on Climate Change, to be held in Denmark in December 2009 (United Nations Climate Change Confer-

ence, 2009). As a key role of the midwife is health advocacy to reduce maternal and neonatal deaths, midwives have a responsibility to understand the threats posed by climate change, and to thus be able to contribute information (perhaps along with active participation) to global efforts of mitigation and adaptation.

Climate change

Climate change has received growing attention in the past two decades. Climate change is now well understood to be a real and significant threat to the environment and subsequently to global human health. There is international scientific consensus that human actions, particularly since the onset of the industrial revolution, have initiated global climate change—a rapid process that is being superimposed on other slower natural changes (McMichael, 2009). The most recent Fourth Assessment Report from the Intergovernmental Panel on Climate Change (IPCC, 2007) left little doubt that climate change is real, underway and accelerating, with statements that include the following:

Warming of the climate system is unequivocal, as is now evident from observations of increases in global average air and ocean temperatures, widespread melting of snow and ice and rising global average sea level (p. 2).

While many factors continue to influence climate, scientists have determined that human activities have become a dominant force, and are responsible for most of the warming observed over the past 50 years (p. 97).

The latter statement highlights the human-driven factors and the need for changes in human behaviour.

The most important observed changes in the climate are increases in the Earth's surface temperature, widespread over the globe but greater at higher northern latitudes; rising sea levels consistent with thermal expansion of the oceans (warming); decreases in snow and ice extent, with mountain glaciers and snow cover declining in both hemispheres; and changes in rainfall—precipitation has increased significantly in eastern parts of North and South America, northern Europe and northern and central Asia, and decreased in the Mediterranean, southern Africa and parts of southern Asia. The combined effect of temperature rise and lower rainfall in the worlds' major food producing regions is likely to be a reduction in yields, which will create food shortages and increase prices beyond

Table 1 Projected impacts of climate change on two regions (Intergovernmental Panel on Climate Change, 2007).

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- Africa
- By 2020, between 75 and 250 million people are projected to be exposed to increased water stress due to climate change.
 - By 2020, in some countries, yields from rain-fed agriculture could be reduced by up to 50%. Agricultural production, including access to food, in many African countries is projected to be severely compromised. This would further adversely affect food security and exacerbate malnutrition.
 - Towards the end of the 21st Century, the projected sea-level rise will affect low-lying coastal areas with large populations. The cost of adaptation could amount to at least 5–10% of gross domestic product.
 - By 2080, an increase of 5–8% of arid and semi-arid land in Africa is projected under a range of climate scenarios.
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- Europe
- Climate change is expected to magnify regional differences in Europe's natural resources and assets.
 - Negative impacts will include increased risk of inland flash floods and more frequent coastal flooding and increased erosion (due to storminess and a rise in sea level).
 - Mountainous areas will face glacier retreat, reduced snow cover and winter tourism, and extensive species losses (in some areas, up to 60% by 2080 under high emissions scenarios).
 - In southern Europe, climate change is projected to worsen conditions (high temperatures and drought) in a region already vulnerable to climate variability, and to reduce water availability, hydropower potential, summer tourism and, in general, crop productivity.
 - Climate change is also projected to increase the health risks due to heatwaves and the frequency of wildfires.
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the reach of many of the world's poor. The global food crisis of 2008 may indeed be a foretaste of future climate change impacts on food security and, importantly, the nutritional status of child-bearing women in developing countries. There will also be impacts of a more direct kind on human health, including heat-related mortality in rich, as well as poor countries, and changes in the pattern and range of occurrence of various infectious diseases.

The projected regional impacts (see Table 1 for two examples) highlight the diverse range of effects, both to 2020 and 2080. The most significant impacts on food production, food security and access to fresh water will be in the poorer regions of the world; the regions where the most difficulty in meeting MDG goals have been seen.

The major international Scientific Congress on Climate Change, held in Copenhagen in March 2009 (Richardson et al., 2009), concluded that even the worst-case scenarios of change, as published by the IPCC (2007), are now being realised. Parameters such as global mean surface temperature, sea-level rise, ocean and ice sheet dynamics, ocean acidification, and frequency of extreme climatic events risk appear to be accelerating, posing an increasing risk of abrupt or irreversible climatic shifts. The Congress's formal conclusion also warned that 'temperature rises above 2 °C will be very difficult for contemporary societies to cope with, and will

increase the level of climate disruption through the rest of the century' (p. 6).

The health effects of climate change

The opening sentence of a comprehensive review of the health effects of climate change, commissioned by *The Lancet* in 2009, states: 'The effects of climate change on health will affect most populations in the next decades and will put the lives and well-being of billions of people at increased risk' (Costello et al., 2009, p. 1693). Climate change will affect health, directly and indirectly, through complex interdependent interactions. Women and children are high on the list of adverse impacts. The review from *The Lancet* (known as the *UCL Lancet Commission*) highlights how climate change will also exacerbate inequities between rich and poor as it will have disproportionate impact on the world's poorest nations; ironically, those who have contributed least to its cause. Maternal mortality, by virtue of its highest prevalence in poorer nations, is likely to be heavily affected, and to contribute significantly to the widening of the inequality gap.

The *UCL Lancet Commission* focused on the six aspects that link climate change to adverse health outcomes: changing patterns of disease and mortality; food; water and sanitation; shelter

Table 2 Six aspects that link climate change to adverse health outcomes (Costello et al., 2009).

Focus areas	Impact on health
<i>Changing patterns of disease and mortality</i>	<ul style="list-style-type: none"> • Heat-related stress • Increased frequency of vector-borne diseases (e.g. malaria) • Cholera outbreaks due to rising ocean temperatures • Strain on public health resources
<i>Food</i>	<ul style="list-style-type: none"> • Adverse impacts on crops, fisheries, livestock, forestry • Drought and changing patterns of pest infestation and livestock diseases • Reduced income from primary production • Existing food insecurity compounded • Increased malnutrition, low birth weight and suboptimal breast feeding
<i>Water and sanitation</i>	<ul style="list-style-type: none"> • Lack of access to clean water and sanitation • Increased diarrhoeal diseases from biological/chemical contaminants • Changes in water availability in areas impacted by glacial-fed catchments
<i>Shelter and human settlements</i>	<ul style="list-style-type: none"> • Increased urbanisation causing over-crowding and increased poverty • Increased need to use polluting fuels for cooking and heating • Increased exposure to health risks (e.g. smoke)
<i>Extreme events (e.g. heatwaves, coldwaves, floods, droughts and cyclones)</i>	<ul style="list-style-type: none"> • Water contamination, crop destruction, infrastructure breakdown after disasters affecting health-care services, sanitation and drainage, and mental health problems
<i>Population and migration</i>	<ul style="list-style-type: none"> • Increased competition for scarce resources (food, water, land) • Rising sea levels—displacement of populations will mean increased strain on health infrastructure resources

and human settlements; extreme events; and population and migration. These aspects are important to consider in the overall context of global health and, more specifically, in relation to maternal health. These aspects are summarised briefly in [Table 2](#).

Climate change and maternal health

Climate change is expected to have its most adverse effects on health in the poorest nations, where maternal mortality is the highest and where the smallest gains towards the MDGs have been achieved.

Weather-related disasters disproportionately affect poor countries (UNISDR, 2009). Low-lying communities and those living in the world's major

delta zones are at heightened risk of sea-level-rise-associated inundation and salt contamination of freshwater supplies. For example, it is estimated that Bangladesh currently has about 2.8 million hectares of land affected by salinity, amounting to one-third of the 9 million hectares of total national cultivated area, and about one-fifth of the total area of Bangladesh. Adverse effects of salinity on ecosystems and crop productivity are well documented. Health effects are also emerging, in particular, pre-eclampsia, eclampsia and hypertension. Records from an antenatal clinic located in a port region in Bangladesh reveal that 21% of women between the ages of 16 and 40 years have been diagnosed with at least one hypertensive disorder. This rate is strikingly higher than the figures of 2.65%, 6.8% and 5.4% seen in non-coastal rural communities of Bangladesh (Khan et al., 2008).

Box 1 Case study of Josefina and her family.

Josefina is a 25-year-old woman who lives in India in the world's largest delta, where the Brahmaputra and Ganges rivers meet and flow into the Bay of Bengal. Her husband is a fisherman but recently the seas have been stormy and he has been unable to fish every day. After recent floods, they lost their livelihood as all of their belongings and cattle were swept away by the water. The floods also meant that salty water has got into the fields, making many of them useless for crops, and food has been in short supply.

Josefina and her husband have three children who have all been unwell recently with malaria, and she has been caring for them. The children are also underweight due to malnutrition. None of them have attended school this last year. She has not been able to go out to work because of caring for the children, and this has added to her family's financial and food stressors. Many of her family moved away from the area as their homes were destroyed. She misses them, especially her mother and sister, and has been experiencing anxiety, sleeplessness and feelings of helplessness.

Josefina is pregnant with her fourth baby. The road to the health service was recently flooded and part of the health clinic was damaged. The staff from the district hospital cannot travel to the community at the moment because of the road so there is no antenatal care. She will have this baby at home but the village midwife left after the last big floods. She was anaemic in her last pregnancy, and had a postpartum haemorrhage after the baby was born.

Human ecosystems and social structures are complex and interlinked. Due to this integration, environmental changes act at multiple levels, and each may overlay with compounding negative effect. **Box 1** presents a hypothetical case to illustrate how climate change is affecting maternal health. The story is an amalgamation of a number of actual cases presented in recent international reports on climate change and health ([Global Humanitarian Forum, 2009](#); [Renton, 2009](#)). This scenario demonstrates the precarious situation experienced by disadvantaged communities, where additional burdens arising from climate change further exacerbate disadvantage and the loss of livelihoods and social support networks.

A lack of access to health care is part of the wider socio-economic situation that particularly affects women and children. Climate change is likely to further jeopardise economic viability by disrupting rainfall patterns, affecting food production and distribution, and poverty and hunger. Women and children, commonly the most vulnerable in societies, will bear the brunt of many of these burdens from climate change. Thus, gender equality will be further threatened ([Poverty-Environment Partnership, 2003](#)). Maternal health is strongly linked to these broader social issues of access to education, gender equity and empowerment.

Women and children are particularly vulnerable to extreme weather events ([Poverty-Environment Partnership, 2003](#)). For example, 90% of victims in the cyclone in Bangladesh in 1991 were women and children ([Global Humanitarian Forum, 2009](#)). Dis-

placement and migration will also affect maternal health, as delivery of food, water, sanitation and health care poses additional health risks to these vulnerable communities ([Parry et al., 2007](#); [Carballo et al., 2008](#)).

The IPCC Fourth Assessment Report defines vulnerability as the 'degree to which a system is susceptible to, and unable to cope with, adverse effects of *climate change*, including *climate variability* and extremes' ([Parry et al., 2007](#)). Sensitivity in this context is defined as the 'degree to which a system is affected, either adversely or beneficially, by *climate variability* or change'. Sensitivity can be moderated by the system's ability to adjust to *climate change* (including *climate variability* and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences, is called 'adaptive capacity'. A critical component of adaptive capacity is a stable infrastructure that can deliver clean water and sanitation, food security and an effective health-care system. The heightened vulnerability of poor nations to climate change therefore derives from high levels of exposure to extreme weather events and diminished adaptive capacity. Amplification of effort is required from rich nations to assist the global poor to adapt.

What to do about it?

Climate change is a global phenomenon and requires a collective response in the form of global

partnerships (*Poverty-Environment Partnership, 2003*). Those of us who live in the developed world have a particular responsibility to understand climate change, to make changes and lobby for action. On a per capita basis, we have generated most of the problem of climate change, while the poorer countries are more likely to face the adverse impacts. We must therefore adopt 'mitigation' and 'adaptation' strategies.

Mitigation involves taking actions to reduce greenhouse gas emissions and reduce the extent of global warming, while adaptation involves taking action to minimise the impacts of global warming (*Verbruggen, 2007*). Mitigation means making changes to energy sources, urban design, transportation and increasing carbon bio-sequestration (the uptake and storage of carbon by forests, other vegetation and soils) (*McMichael et al., 2008*).

Adaptation includes public education activities to help others understand the health risks, enhanced infectious disease control programmes, improved surveillance of risk factors and health outcomes, and capacity building of the health workforce to deal with climate change health effects in the future. Practical strategies include better data and assessments of risk to inform action and monitor progress.

Many countries are now undertaking risk assessments for health that will inform current and future policy direction and resource allocation (*McMichael et al., 2008; Campbell-Lendrum et al., 2009a,b*). Improved data will help to generate better evidence and robust projections on the health effects of climate change which, in turn, will support increased advocacy, informed lobbying and more efficient use of resources (*Costello et al., 2009*).

An ongoing commitment by governments worldwide to address poverty and inequities in health is required to achieve the MDGs. Investment to achieve the MDGs will reduce vulnerability in relation to climate change. Investments in food security, safe water supply, improved design of buildings, disaster risk assessments, community mobilisation and capacity building will all produce dividends in adaptation to climate change. Significantly, the *UCL Lancet Commission* highlighted that investments in essential maternal and child health and family planning services would be an important component of adaptation to climate change (*Costello et al., 2009*). Family planning is a broad strategy that includes literacy and education for girls and young women. It affords a unique solution, as, first, it reduces poverty and maternal and child mortality, while increasing women's education and empowerment; and, second, it helps

to mitigate the process of climate change by constraining the global population size.

Addressing climate change requires behavioural change; something that has never been easy to achieve. Changing behaviour in high-income countries is particularly challenging. Simple measures are possible at a local level. For example, low carbon living through increased use of public transport, cycling and walking will also increase physical activity, reduce obesity and stimulate social contacts (*McMichael et al., 2008*). Reducing our consumption of red meat would confer benefits in terms of reducing methane which has significant warming effects in the atmosphere (*McMichael et al., 2007*). The 10:10 Campaign, launched in London in September 2009, is another example of a strategy that aims to bolster grassroots support for tough action against global warming ahead of the key global summit in Copenhagen in December (*The Guardian, 2009*).

The *UCL Lancet Commission* calls for a new public health movement that frames the threats from climate change as a major health issue for all (*Costello et al., 2009*). For the most part, the issue of the risks to health from climate change has been addressed by only a few health professionals and, even then, with little attention to maternal health and mortality. It is time for all health professionals to understand the issues and to take action. Climate change is not a sideshow to health issues—it is an essential element of the debate.

Conclusion

Climate change will significantly slow any efforts at achieving MDGs. In particular, MDG 5—improving maternal health—will not be achieved in the foreseeable future. Considerable efforts are being made; however, they will be limited if the broader issues of climate change are not addressed locally, nationally and at a global level. Professionals working in maternal health have a responsibility to understand the linkages and the effects of climate change on mothers and infants, and to support advocacy for change and investments to secure a better future for the mothers of the world.

The evidence that climate change is real, is already with us and is accelerating is now very strong. What lies ahead in terms of specific local changes, and the exact timeframes depends largely upon the global policies adopted, holds uncertainties. This inexactitude should not prevent strong and urgent mitigation actions to avert further warming. Meanwhile, many adaptive actions can

be initiated almost immediately, including the introduction of various 'no-regrets' policies that confer local health benefits anyway, in addition to providing protection of the public's health against climate change. Examples include assisting the development and deployment of renewable energies in developing countries to reduce their dependence upon polluting fossil fuel use and health-damaging biomass combustion, and, in wealthy countries, enacting policies that promote the shift from cars to active transport options such as of cycling and walking.

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