Climate change, health and infectious disease

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ONE PLANET, ONE HOME

The Greek term for home is ἐ̓κωσ which translates as the prefix eco and reminds that life on Earth is produced through complex relationships forged between organisms and environments. Biologically, 13.7 billion years of evolution has enabled humans, animals, and microbes to survive within a diverse array of biomes and ecosystems as well as enabled the cultivation of a range of dynamic relationships between peoples, cultures and climates. Since the industrial revolution, however, human activity has generated unprecedented changes to the geologic record and increasingly to the earth system, leading the current era to be named The Anthropocene. Ours is an age increasingly contoured by anthropogenically driven climate change which is in fact only one of a ‘syndrome of macroscopic environmental consequences’, which includes the impacts from stratospheric ozone depletion, biodiversity loss and widespread land degradation. Climate scientists assert that humanity now stands at a carbon crossroads and people must translate scientific knowledge and ethical concern into actions that will control the social drivers and prevent the ecological impacts of climate change.

Addressing the global health impacts of climate change also requires a ‘step-change in thinking’ as complex processes are altering “the rates, ranges, seasonality and patterns of injury, disease and death” for both humans and animals. Exactly how climate change is affecting health is an active arena of research. What many do agree upon is that while some causal pathways are direct, as in the case of natural disasters, many more are indirect as climate change acts as a “risk multiplier, compounding pre-existing socially and politically mediated drivers.” Clearly, addressing climate driven health problems requires thoughtful action and the forging of meaningful collaborations with unusual allies both within the public health arena and far beyond.

SUPER WICKED PROBLEMS

Anthropogenically driven climate change is a ‘super wicked problem’ (also known as a ‘social mess’), not only because it has thus far been impossible to stop but also because the actors who have intensified the problem – humans - are also those responsible for preventing further harms and resolving those that are already occurring. To add to the complexity, climate change is to some degree one of the unintended consequences of building healthier societies. For example, the pursuit of improving health has played a part in driving global environmental change whether it be from widespread land use modification and consumption (e.g. improving food production, housing, irrigation or disease prevention) through to waste generation (e.g., the ecological footprint of health care services). Unfortunately, the short term health benefits of climate change (e.g. less cold weather related deaths) pale in comparison to the overall the health effects which are “likely to be overwhelmingly negative” and are already significantly affecting the social and environmental determinants of health such as access to “clean air, safe drinking water, sufficient food and secure shelter”. This is also a ‘glocal’ issue as it is a global phenomenon with local expressions which are being expressed with great specificity at the scale of the households, neighborhoods, cities and regions.

The places already being directly impacted by climate change or which are most significantly at risk are Small Island developing states, mountainous regions, Polar Regions, water-stressed areas, megacities and coastal areas in developing countries - particularly the large urban agglomerations in delta regions in Asia. Research also shows that the people at greatest risk for climate-related health disorders and premature deaths – regardless of country of residence – are the poor, the very young and the very old, women and girls, Aboriginal peoples, people with disabilities and people with mental health illness. Furthermore, whether in rich or poor country contexts, a factor which further intensifies risk for certain groups is their lack of access to robust public health infrastructure.

RESPONDING TO THE HEALTH IMPACTS OF CLIMATE CHANGE

In concerted efforts to address the impacts of climate change, health practitioners are adapting existing frameworks to support their work. One model being used is derived from risk pathway thinking which uses the notion of primary, secondary and tertiary impacts which occur through direct, indirect and socially mediated pathways. For example, direct health impacts are linked to weather related deaths) pale in comparison to the overall the health effects which are “likely to be overwhelmingly negative” and are already significantly affecting the social and environmental determinants of health such as access to “clean air, safe drinking water, sufficient food and secure shelter”. This is also a ‘glocal’ issue as it is a global phenomenon with local expressions which are being expressed with great specificity at the scale of the households, neighborhoods, cities and regions.

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For many, the ethical and moral imperative to respond to climate change in a way that considers the impacts of political and economic activities translates into calls to strengthen methodological rigour and reflect on the role of the scientist in society. Some researchers are calling, for example, for attention to be paid to the ‘social and political lives’ of climate change modeling and policy development in order to make visible the social, cultural and political norms and values shaping research and the manners in which data are presented and used. Thus, researchers such as Leach and Scoones endorse the triangulation of data in order to ensure a range of models and modeling tools and technologies are used to build evidence based policy around climate change and health.22 While other scholars question the role of ethics and morality in research. For example, Butler has argued that excessive anxiety has been generated and resources have been diverted towards to pandemics which are either newly recognized infections emerging in developing countries and/or new strains of influenza arising from intensively farmed animals or wet markets and away from from research into the infectious diseases which are producing the greatest overall strife.10 Butler suggests these neglected diseases along with studies of the “changing milieu that is eroding the determinants of immunity and public health caused by adverse global environmental changes, including climate change and other components of stressed life and civilisation-supporting systems”10 be more fulsomely considered.23 One way to measure the value of such proposals is to consider real world examples.

LEARNING FROM EBOLA ABOUT THE LINKS BETWEEN THE SOCIAL AND THE ECOLOGICAL

The Latin derivative of virulent, virulentus, means ‘full of poison’ and points to the importance of understanding what forces are on the one hand damaging the resilience of peoples and places and on the other hand strengthening the pathogenicity and ranges of transmission of infectious diseases. Broadly, research to date on the links between climate change and newly emerging, re-emerging and surging infectious diseases is showing that an interplay between biophysical, social and ecological factors tends to drive up infectious disease morbidity and mortality rates.24 Recalling the framework of primary, secondary and tertiary impacts, the supposition posited within those frameworks is that the secondary impacts of climate change occur via ecosystem alteration and other interactions, including changes in the distribution and prevalence of diseases and vectors. This insight is relevant as the majority of diseases causing outbreaks are zoonotic and are often occurring in contexts of rapid socio-ecological change.25 For example, human activity, such as deforestation, agricultural expansion, habitat encroachment, hunting and trade are all mechanisms through which humans, livestock and wildlife enter into novel interactions which can amplify opportunities for transmission. Incidentally, the opposite is also true as improving public health and environmental sustainability tend to be mutually reinforcing. Research on the 2014 Ebola virus disease (EVD) outbreak in West Africa supports these observations.

The Zaire ebolavirus species, the most deadly of the 5 strains of Ebola (EVD) and the one responsible for the 2014 outbreak, was not previously thought to be in West Africa. Studies are now showing, however, evidence that it may have been endemic in some animal populations (especially fruit bats) and when the initial cases arose, it was likely misdiagnosed as one of the viral hemorrhagic fever already known to be present in the region. From a social-ecological perspective perspective, it is interesting to note that the Ebola outbreak occurred during a particularly arid and prolonged dry season were conditions generated by increasing temperatures were compounded by pre-existing issues of food insecurity, under nutrition, and poverty. Multiple years of civil conflict, an employment constrained economy and a significantly under resourced public health system were also factors that had led people to intensify their use of the forest. While human encroachment on bat and sylvan habitats are known to be important mediating factors in the emergence of EVD,26 in these contexts of social and economic stress people went deeper into the wooded areas to find wild food, harvest forest products for fuel and construction and repurpose land (e.g., through artisanal and small-scale mining). However, all of these activities are known to

Table 1. Categories of Climate-Change Risks to Health, According to Causal Pathway

| Risk Category | Causal Pathway |
|---------------|---------------|
| Primary       | Direct biologic consequences of heat waves, extreme weather events, and temperature-enhanced levels of urban air pollutants |
| Secondary     | Risks mediated by changes in biophysically and ecologically based processes and systems, particularly food yields, water flows, infectious-disease vectors, and (for zoonotic diseases) intermediate-host ecology |
| Tertiary      | More diffuse effects (e.g., mental health problems in failing farm communities, displaced groups, disadvantaged indigenous and minority ethnic groups) |

Consequences of tension and conflict owing to climate change-related declines in basic resources (water, food, timber, living space)
not only significantly alter local ecosystems but to also bring humans into novel interaction with chimpanzees, gorillas and fruit bats infected with the Ebola virus.26-28

It is also important to note that the index case of the 2014 Ebola outbreak was a young child. Now that the epidemic has been controlled attention has been placed on addressing the impacts and preventing future outbreaks. Research is showing that women and children have been disproportionately affected by the epidemic.29 The reasons are several and include the fact that women tend to be the primary care providers in communities and therefore face an increased risk of contracting the virus. Further, during the peak of the epidemic it is reported that resources were often diverted away from pregnant and birthing women either due to health worker deaths and health services collapse or due to a fear that health providers would come into contact with contaminated bodily fluids (e.g. during birth). These inequities were compounding in a region where artisan mining is an important source of income for women. During the epidemic the mines were closed as they were found to be contexts where higher rates of transmission were occurring yet the consequences of losing this source of income have also been detrimental to the health and wellbeing of affected women and children.29 What is becoming clear is that whether it is women and children suffering from Ebolat, stigma and fear surrounding the disease or the impacts of deforestation on humans and animals living in these altered landscapes, the drivers and follow on effects of climate change now has a face as so many lives have been impacted.

CONCLUSION: A NEW GENERATION OF RESPONSES TO CLIMATE CHANGE

A new movement is afoot to promote the cultivation of perspectives “which focus on ecosystems and on the recognition that the foundations of long-term good health in populations relies in great part on the continued stability and functioning of the biosphere’s life-supporting systems.”30 Planetary Health33 is emerging as a concept to embody this thinking while more established concepts such as Ecohealth,34 One Health35 and Aboriginal perspectives on wellness35 are also providing frameworks for conducting this integrative social-ecological thinking.

2015 has been dubbed the ‘year to make climate change history’. The United Nations Framework Convention on Climate Change (UNFCCC) holds that the goal of the 21st session of the Conference of the Parties (COP 21) in Paris in December 2015 is to secure an universal global climate agreement to curb carbon emissions.36 Large scale social movements, embodied by events like the 2014 People’s Climate March movement which took place in 162 countries, are now calling for action. Concurrency, scientific research is producing an increased set of certainties about the anthropogenic drivers of climate change and calling for attention to the causes of the causes of climate change (for example extreme fossil fuel dependence) to be treated as threats to planetary survival as well as to human, animal and environmental health and well-being8.

This paper began by framing climate driven health harms as social-ecological phenomena and arguing that public health must not only control and contain but also seek to prevent climate driven disease emergences by looking upstream at real places, people and practices. This approach to research considers utilizes both ‘hard’ and ‘soft’ scientific methods including considerations of the narratives and values that inform the development of models used to study climate change and health and the awareness of the health inequalities at play, as has been the case with Ebola. Such an orientation underscores the need for both discipline specific expertise and interdisciplinary collaboration and the importance of collaborating with ‘unusual allies’ including researchers within as well as beyond the health sciences. These are all elements of public health research and practice capable of creating a healthy, just and sustainable world for all.

Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

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