

Climate change and global health: a new conceptual framework - Mini Review

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Abstract

Climate change's burden of disease seems orders of magnitude too low to justify claims that it is this century's greatest threat to health. However, such claims can be more easily understood by considering how climate change acts as a risk multiplier, compounding pre-existing socially and politically-mediated drivers of adverse health consequences including conflict.

Is Climate Change the Biggest Global Health Threat of Our Time?

A widely cited paper characterized climate change as this century's greatest threat to health [1]. However, the 29 authors of this paper, the longest ever published in *The Lancet*, are vague concerning their reasons for this strong claim. About a decade ago, the World Health Organization undertook a comprehensive study of the burden of disease of climate change, concluding that in 2000 it was about 160 000 deaths per annum, with 5.5 million lost disability-adjusted life years (DALYs). These were mainly due to climate change related undernutrition, with minor contributions from infectious diseases (especially malaria and diarrhoea), heatwaves and floods [2,3]. Such numbers, even if accurate, were insignificant as a proportion of the global burden of disease in 2000, which was almost 1.5 billion DALYs [4]. They would have to rise by orders of magnitude to justify the claim as the greatest threat to health we face. Nor do the health chapters in the Intergovernmental Panel on Climate Change (IPCC) reports [5] hint that this dire prediction might be valid.

Primary, Secondary and Tertiary Health Effects – an Emerging Classification

However, such claims may not only be justifiable but also more easily understood if the commonly used bi-modal categorization of the health effects of climate change is widened to include a separate category that explicitly recognizes the interaction between the environmental effects of climate change and the social and political 'milieu' in which they operate. A recent edited book, assembling a group of 56 authors from 19 countries, sympathetic to this broad conceptual framework attempts to consolidate this causal classification [6]. This third class concerns future adverse health effects arising from harm to the economic and social determinants of health occurring as a consequence of future climate change.

Discussion of these 'eco-social' effects is still limited in the health literature, particularly in comparison to their potential scale.

In the past, relevant literature (including a previous edited book on climate change and health) have focused mostly on pathways described as 'direct' (such as from heatwaves or injury due to a flood or storm) and 'indirect' [7]. The latter generally are dominated by changes in infectious diseases, but other less direct, climate change related mechanisms are known to impact health, such as via altered timing and concentrations of allergens or hypertension from increasingly saline ground water in coastal Bangladesh exacerbated by sea level rise [8].

If considered at all, the politically-mediated, *systemic* effects are also usually also considered 'indirect', but mostly as a footnote. Recognizing this conceptual gap, and at the same time wanting to promote recognition of the potential severity of the health consequences of climate change, Butler *et al.* [9] proposed a four-way classification of effects, which they called 'direct', 'mediated', 'modulated' and 'systems failure'. Later, this was simplified by merging the final two forms into a group was then called 'tertiary' [10]. This revision also changed the names of 'direct' and 'mediated' to 'primary' and 'secondary'.

'Primary' effects operate most directly on humans, such as through acute or prolonged heat stress, especially a problem for vulnerable people on hot nights, or emergency personnel engaged in strenuous exercise. Secondary effects include changes to the distribution of vectors that spread malaria and other vector-borne diseases.

Butler and his three co-authors held that the third category – whatever its name – warranted separate discussion for several reasons. All three categories arise from the interaction of anthropogenic climate change and 'eco-social' causes. However, causation becomes increasingly 'indirect', with each successive category. For example, there is less debate that a heatwave harms health, even though its health burden is mediated by non-climatic factors such as housing, air conditioning and the effectiveness of emergency services. Climate change

aggravated malaria [11], here grouped in the 'secondary' category, also arises through the interaction of climatic change, ecological factors (e.g. the distribution of vectors) and social and economic determinants.

The association of malaria (and other infectious diseases) with climate change has, in fact, been intensely contested [12]. But the third, tertiary, classification is distinguished by the greatest causal complexity and indirectness. Tertiary health consequences are modified by numerous cultural, political, economic, social and other effects such as poverty, inequality, population growth, resource scarcity and governance. But this complexity should not be used to argue there is no climatic component, which will become increasingly obvious (and accepted) with time. Butler *et al.* [9] also argued that the likely health impact of such effects, perhaps by as soon as 2050, could be orders of magnitude greater than from heatwaves, allergens or vector-borne diseases (even if combined). This scale difference constituted an additional justification for a separate category.

Late last century it was briefly fashionable to argue that humanity had finally solved its ancient problem of scarcity. This fantasy is slowly being replaced by a re-awakening that immense problems persist, and that the declining availability of essential resources, including because of climate change, will worsen hunger and increased under-nutrition in many populations [13]. However, it is still underrecognized that these consequences will have their own ramifications, generating cascading effects likely to include decreased health system capacity, reduced funding to improve other health determinants, and increased migration and conflict.

Discussion of the tertiary effects is unsettling territory for many within medicine and even some within public health, as some regard the causal pathways involved as too 'upstream' [14] or 'political' [15,16]. Partly as a result, these pathways have received grossly insufficient attention within the health literature, though there is growing concern about the consequences for society in some other disciplines (notably ecology) and within society more broadly [17].

This is not to say that tertiary effects (however classified) have been entirely ignored. The earliest editorial on climate change and health in *The Lancet* (and perhaps in the entire health literature) mentioned the possibility of conflict [18]. However, there has been little consolidation of this thinking, including in the most recent IPCC chapter (to which the author contributed) [5].

There are several exceptions not mentioned above. McMichael *et al.* [2] noted that "the conflicts and the migrant and refugee flows likely to result from these wider-ranging effects would, typically, increase infectious diseases, malnutrition, mental health problems, and injury and violent death. They commented that 'future assessments of the health effects of climate change should attempt order-of-magnitude estimates of these more diffuse risks to health.' Myers and Patz [19] wrote 'It may

be that scarcity of food and water combined with greater vulnerability to natural disasters and forced migration will lead to much higher morbidity and mortality than increased exposure to infectious disease.' A recent magazine article by one of these authors is even closer to the arguments presented here: 'we believe that there is another threat, one that is orders of magnitude more potent than those which have been emphasized to date. Here we argue that it is the *indirect* impacts of climate change – large-scale alterations to Earth's natural systems – that pose the greatest risk to human health'. This essay also notes the reticence of the IPCC health chapter to engage with these issues [20].

Conclusion: From Adaption Towards a Solution

For at least a generation the dominant *revealed* (as opposed to *stated*) global policy has been one of attempted 'adaptation' to climate change, but it can be argued that too often this has been at the expense of mitigation. In public health terms, a focus on adaptation at the cost of prevention is policy failure, especially where viable preventive policies exist, as has long-been argued to be the case for climate change (e.g. by accelerating the roll-out of clean energy). Instead, as many have observed, what is lacking to advance solutions for climate change is sufficient political will [17].

To change this, a deeper understanding (and indeed a degree of anxiety), especially among the educated masses in rich countries, and elites everywhere is required. Determination to act is finally emerging, for example as shown by leaders such as UN Secretary General Ban Ki Moon, Pope Francis, US Secretary of State John Kerry and former UN Commissioner for Human Rights, Mary Robinson. All have become leading, even outspoken, advocates for policies to address climate change. They may not be aware of the conceptualization of climate change and health described in this paper, but they are certainly motivated by concern over the tertiary effects.

Many developing countries, such as parts of Africa and South Asia, appear especially vulnerable to the threat multiplying spectre of climate change, as they are also infected by persistent underdevelopment, conflict, poverty, high population growth and other traps that afflict the 'bottom billion' [21]. Many other regions, including Syria and Yemen are also vulnerable to the risk-multiplying leaven of climate change in the near future (perhaps to 2050). But as and if the juggernaut of climate change becomes unstoppable its myriad harmful effects such as sea level rise, intensification of extreme weather events, ocean acidification, rising food prices and crop failure) place even parts of civilization appear that are currently privileged at risk [22].

Such a world of intensified haves and have-nots will inspire growing radicalism and desperation among the excluded, leading to both violence [23] and increasingly

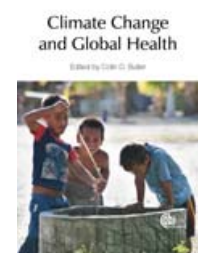
barbaric 'fend' strategies to try to deter aspiring immigrants [24]. Long before civilization collapses, quality of life within the shrinking fortresses of remaining order will plummet; unless something is done.

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