OPINION ARTICLE

Climate change, migration and health systems resilience: Need for interdisciplinary research [version 1; referees: awaiting peer review]

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Abstract
Climate change is one of today's major challenges, among the causes of population movements and international migration. Climate migrants impact health systems and how they respond and adapt to their needs and patterns. But to date, the resilience of health systems in the context of climate change has been little explored.

The purpose of this article is to show the importance of studying, from an interdisciplinary perspective, the relationships between climate change, migration, and the resilience of health systems.

Resilience is an old concept, notably in the field of psychology, and is increasingly applied to the study of health systems. Yet, no research has analysed the resilience of health systems in the context of climate change. While universal health coverage is a major international goal, little research has to date focused on the existing links between climate, migration, health systems and resilience.

We propose an interdisciplinary approach relying on the concept of health system resilience to study adaptive and transformative strategies to articulate climate change, migration and health systems.

Keywords
Climate Change, Migrations, Health Systems, Resilience, Interdisciplinary

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Introduction

“Four thousand migrants arrive in Dhaka, the capital of Bangladesh due to various ‘push’ factors including frequent natural disasters”14. Indeed, environmental changes due to climate change are projected to cause substantial increases in population movement, within and between countries, in the coming decades. Haiti faces a similar situation according to a 2008 report estimating that 100,000 people had moved for climate change reasons from rural areas to the capital Port-au-Prince15. Environmental changes (e.g. drought, soil erosion, extreme weather events, etc.) lead to substantial impact on health, economic and political dimensions at the population level, including influencing migration patterns and may result in adverse health outcomes, both for displaced and for host populations, as we will discuss in more detail later16-18. Consistently, the World Health Organization (WHO) identifies climate change as a defining challenge of the 21st century; and considers it an emerging priority for the public health community to ensure protection against its health impact19-21. In 2015, The Rockefeller Foundation and The Lancet published the report of the Commission on Planetary Health22 and the UN Sustainable Development Goal 13 calls for “urgent action to combat climate change and its impacts”.

For this article, we conducted an heuristic literature review on climate change, migration and health systems. As a result of a peer-reviewed article search in the PUBMED database using climate change, health systems, and migrants as keywords, only 10 results published between 1994 and 2017 were identified. Of these, six (60%) were written in the past decade and included: two opinion papers, two study reviews, one qualitative study, and one protocol for a review that will be completed in 2018.

In this article, we describe and discuss the fundamental role that health care systems resilience can play in this regard and we identify interdisciplinary research as key to better understand the existing linkages between climate change, migration and health systems and how to build more resilient health systems. We also propose some questions and axes to orient future research proposals.

Climate migrants and health systems

Climate change can be translated into a wide range of environmental degradations, including hurricanes23, rising sea levels, and/or reduced rainfall in drylands and water scarcity24. Populations confronted by climate change consequences such as exposure to hazards, loss in land productivity, absence of habitability, and/or shortage of food/energy/water security may have difficulties to subsist in a given area25. Climate change consequences compounded by socio-economic pressures and/or political instability, increase propensity to migrate. Although evidence is still missing to prove this association, environmental factors are increasingly influencing an already complex pattern of human mobility. A recent paper suggests “a statistically significant relationship between fluctuations in asylum applications and weather anomalies”26. Climate migrants may be forced to leave their homes due to rapid-onset disasters, such as flooding and hurricanes (as in Haiti and Bangladesh for example)27,28.

Nowadays, there is no conceptual consensus on the notions of environmental refugee or climate change migrants yet, or the more rarely used terms ecomigrants or environmentally displaced persons29,30. Since 2007, the International Organization for Migration (IOM) has defined environmental migrants as “persons or groups of persons who, for compelling reasons of sudden or progressive change in the environment that adversely affects their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad”31. Others suggest restricting the definition to victims of extreme weather, drought/water scarcity, and sea-level rise and excluding the effects of the spread of tropical diseases32. The estimation that is most widely accepted is that over 200 million persons will be displaced globally by 2050 because of climate change33,34,35, and according to the last Lancet Countdown “the total number of people vulnerable to migration might increase to 1 billion by the end of the century without significant further action on climate change”36.

Climate-related migrants may or may not perceive how climate change influences and has an impact on their health needs and social patterns. For example, in Burkina Faso, the close relationship between climate change and flooding is not always fully perceived by the Burkina population suffering from it, as documented by the authors of this manuscript in previous studies (Box 1) However, climate-related migrants experience difficulties or face challenges similar to those of refugees fleeing war and/or political persecution: overcrowded settlements, unsanitary conditions, poor nutritional status, unsafety, inequity and limited access to health services27,37-40. In addition, environmental change migrant population is usually the most vulnerable as well because migration is often expensive and climate change factors can easily lie on the top of other strong socio-economic factors. For example, Haiti and Bangladesh were respectively ranked 3rd and 6th globally in the Long-Term Climate Risk Index (CRI) from 1995 to 201441, while their health systems’ performances were ranked by the WHO in 2000 as 138th and 88th, respectively, out of 191 countries42. The very recent Global Climate Risk Index 2018 confirms these two places for Haiti and Bangladesh but also shows that several African countries (Mozambique, Malawi, Ghana, Madagascar) are very affected and have little research on climate migrants25.

Box 1. Local perception about the link between climate change and flooding in Burkina Faso

A recent survey of Sahelian floods in Ouagadougou, Burkina Faso43, reveals that climate change is not seen by the population as responsible for the floods. They consider that the responsibility lies more with the authorities who did not act to maintain the water supply facilities. The links with climate change do not seem to be perceived by the citizens of Ouagadougou. In the meantime, they also report changes in overwintering dates, an increase in extreme rainfall incidence and precipitation variability. There are several documented direct and indirect health impacts associated with such patterns such as water-borne and vector borne diseases or food security40,45-48. These patterns in regards to the change in precipitation regimes with increases in the frequency of extreme wet and dry years are known to be intensified in the context of climate change49. It thus appears that, while the impacts of climate change on precipitation regimes are already observed by local populations, their perceptions about potential links still need to be enhanced.
In parallel, some individuals might be escaping slow-onset disasters, such as rising sea levels and declining agricultural yields; their migration patterns may be more similar to those of rural–urban migrants, and they might experience many similar obstacles and barriers to their health as well46. From the literature, it can be seen that some health related challenges may be identical: 1) Re-emergence of infectious diseases and geographical migration of diseases45; migrants spatially re-distribute infections from endemic areas to new populations; they are also exposed to new diseases due to unsanitary living conditions. 2) Reduced access to healthcare services: mass migration applies population pressure exceeding local health and social services capacity; perceptions of long wait times, confusing administrative procedures, or discrimination also impede health system access for migrants47. 3) Disrupted social support networks contribute to adverse mental health outcomes48, higher risk of violence, and spread of STIs, including HIV infection. Migrants are often seen as potential security challenges for countries49,50. Niger is one example for conducting more research to understand the phenomenon of infection diseases and migration, but at the same time for the health system to better adapt (Box 2).

However, the lack of consensus of climate change migrant definition makes research on its health needs and patterns still difficult.

**Climate change in the global health context**

With its inclusion in Goal 3 of The Sustainable Development Agenda, the concept of Universal Health Coverage (UHC) has obtained consensus from the international community51. UHC, regarded as the third global health transition52, or, according to former WHO director Margaret Chan, “the most effective concept that public health can offer”, aims at ensuring access to good quality care while limiting the impoverishment of people as a result of their illness53. In September 2015, the Director of WHO/PAHO for the Americas, Carissa F. Etienne, stated that “we must all cooperate to reduce those factors that are contributing to climate change and to mitigate its health effects.” Consequently, in September 2017, the new WHO Director-General has set UHC as his greatest challenge and highlighted at the UN General Assembly on Migration Health in New York City that “health systems must be sensitive to the needs of migrants.” The direct and indirect effects of climate change on population health and disease development are now well discussed54, but there is still little literature on the health effects of migration (within and between countries) influenced by natural disasters and droughts exacerbated by climate change55. In addition, the role of the health care system as a social determinant of health56 and its capacity to protect populations affected by climate change was recently identified by the WHO57 and the Canadian Public Health Association58.

Health systems (and health professionals) suffer the shocks provoked from climate change and migration59,60. These shocks can be the direct consequence of climate change (floods, heat waves, hurricanes, etc) or indirect effects, i.e. the influx of patients suffering from diseases whose emergence or abnormally high frequency is due to climate change61. Therefore, health care systems need to adapt to population migrations (in and across countries) due to climate changes by taking into account the effects of both phenomena on the epidemiology of diseases62 (e.g. dengue vs malaria) and, more globally, by identifying and responding to specific social (e.g. social acceptability of migrants)63 and health problems (e.g. mental health) in this context. In this sense, there is a very close link between UHC and emergency preparedness, as the WHO has just pointed out calling for “a mutual reinforcement of emergency preparedness and health systems strengthening strategies”. Health security must also be achieved through good health systems preparedness for the disasters caused by climate change64. The capacity of health systems and their actors to prepare for and adapt to these climate-related shocks is known as resilience.

**Health systems resilience in the climate change context**

Resilience is a longstanding concept in the disciplines of life sciences, psychology (Box 3) and climate change65, but it is relative new to the study of health systems66,67,68. Health system are compounded of both hardware (structure; organization; technology; resourcing) and software (values; norms; actors; relationships) components, and their resilience require to be measured and understand accordingly69.

### Box 2. Malaria and migration in Niger

Niger, and it’s Agadez region, has long been known as a crossroads for the regional transhumance and immigration to the North. Agadez is one of the driest regions of the country with a very low and irregular rainfall level and therefore it’s classed as a hypo-endemic region of malaria70. In 2016, Agadez region reported 55411 malaria cases, of which the age groups of adults aged 25 over and children aged from 1 to 4 being 37% and 20%, respectively. These data contrast with the other countries where adults aged 25 and over account for only 17.4% and children aged 1 to 4 for 42.6%71. In fact, this is not an isolated case because the data for the last 6 years show the same relationship. This may be explained in part by the irregularity of malaria transmission, which leads to a loss of immunity to malaria by the population72. But it is also necessary to take into account that people that travel through this region are mostly young adults. One hypothesis could be that several cases reported as indigenous cases are, in fact, imported cases that have very different profiles (Plasmodium falciparum strain, drug resistance, associated pathology, behaviour towards the illness, etc.). Niger’s malaria control programs must adapt to these challenges.

### Box 3. The origin of the concept of resilience in the field of psychology and its applicability on climate changes consequences today

According to the Merriam Webster dictionary, the first use of the term resilience dates back to 1807. It was then used in physics about the ability of materials to resist shocks or regain their original shape after being compressed or deformed73. During the 1970s, in community psychiatry, we look at the phenomenon of so-called “invulnerable” children who, in the confrontation of stress and adversity, do not develop psychological disorders. In 1979, the child psychiatrist Michael Rutter uses the term resilience to describe these children he is studying to understand what are the protective factors that allow them to cope with stress74,75. His work has notably helped to identify social support as one of the main protective factors. The definition of resilience used today to study the capacity of health systems to cope with the consequences of climate change is consistent with this work. The Intergovernmental Panel on Climate Change: “The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation”76.
In 2015, the WHO proposed an operational framework to build climate resilient health systems within the context of climate change\textsuperscript{51}, but the scientific and empirical basis for its production is unclear, and the issue of population migration is not mentioned yet.

Recently, an article has developed a non-normative index for assessing the resilience of health systems, but its validation has not yet been completed\textsuperscript{50}.

The 2017 and 2018 Lancet Countdown paper series suggests some indicators (at least: 2.1, 2.4, 2.6; 2.7, 2.8, 3.9) (Box 4), which could be useful to understand the link between climate change and health system resilience, even though the concept of health system resilience adoption is still limited and “does not capture the quality or effectiveness of efforts\textsuperscript{57}”, as it was said for the 2017 report\textsuperscript{57} neither the resilience of health staff (at its already important brain drain) nor community is taken into account. Health systems’ resilience cannot be evaluated only in terms of infrastructures. In contrast, from a more holistic and fundamental research perspective, several recent articles propose conceptual frameworks\textsuperscript{49,50,56} that suggest analysing the five main dimensions of a resilient system: awareness, diversity, self-regulation, integration, and adaptiveness\textsuperscript{56}.

![Box 4. The 2018 Lancet Countdown indicators\textsuperscript{57}](image)

In addition, according to the Sendai Framework (2015-2030) adopted at the Third United Nations World Conference on Disaster Risk Reduction in March 2015, it is essential “to enhance the resilience of national health systems”\textsuperscript{58} but very little attention has been paid to the role of the health system in responding to climate change and its resilience\textsuperscript{42,43,59}. One of the major global health journals (Health Policy and Planning) just released in November 2017 the first, to our knowledge, supplement issue about “Resilient and Responsive Health Systems”\textsuperscript{50}. But none of the 11 articles addressed climate change.

As seen and cited, migration and climate connections has followed similar research progress, typically by a different group of scholars, on understanding migration’s health dimensions\textsuperscript{43}. In the same way, migration, climate, population’s health and resilience of health systems are usually analysed as separated components through disciplines and approaches in silos. Research on the intersection between all these components is still very scarce. Consequently, there are gaps and a predominant compartmented analysis on the existing links between all of them.

In contrast, interdisciplinary means a certain level of integration of knowledge, methods and/or ideas to construct and analyse the problematic under study\textsuperscript{41,62}. Hence, interdisciplinary research can lead to the understanding of the links between migration and health require mixed methods\textsuperscript{63}, and the collaboration of environmental, health and social sciences, in order to inform strategies and interventions to protect population health. “By learning from other researchers one increases the possibilities of creative solutions”\textsuperscript{64}.

**For interdisciplinary research**

Climate change is one of the main challenges of our century, having the potential to trigger important changes in population health also by forcing migration. The role of health systems in the context of targeting universal health coverage may be central to address these challenges.

As exposed in this manuscript, the research on the intersection between climate change, health systems, and migrants is still very scarce. Because of its complexity, we need to move from a multidisciplinary to an interdisciplinary approach\textsuperscript{66} to understand the multiple pathways that link migration driven by climate change and population’s health.

We believe there is a need for an interdisciplinary approach relying on the concept of resilience to help to study adaptive strategies in both places of origin and destination. Further investments should be made to unravel the link between climate change, migration, and health system resilience. We propose a series of interdisciplinary research questions to provide initial guidance in this direction (Box 5). We suggest in Table 1 and Figure 1 a first summarization attempt of the challenges triggered by climate change for the resilience of health systems.

![Box 5. Some (non-exhaustive) future research questions](image)
### Table 1. Pathways, scenarios and challenges between climate change, migrations and health systems resilience.

<table>
<thead>
<tr>
<th>Pathways</th>
<th>Possible scenarios</th>
<th>Hard</th>
<th>Soft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1- Climate =&gt; Health System</td>
<td>Heat wave, extreme cold</td>
<td>Adaptation of buildings, targeted financing, electricity and water, cold chain strengthening, solar power, health staff uniforms</td>
<td>Engineer and health staff training</td>
</tr>
<tr>
<td>2- Climate =&gt; Space =&gt; Health System</td>
<td>Flood, hurricane</td>
<td>Adaptation and location of health facilities, emergency referral system, emergency preparedness</td>
<td>Disaster preparedness training for care and logistics, staff delay</td>
</tr>
<tr>
<td>3- Climate =&gt; Local Population =&gt; Health System</td>
<td>Epidemics, new pathologies (dehydration, dengue, etc.),</td>
<td>Organization of an alert system, epidemiological surveillance, adaptation / forecasting of diagnostic capacities (i.e dengue vs malaria tests), vector control prevention</td>
<td>Staff training (pathologies, tests, differential diagnostic, etc.)</td>
</tr>
<tr>
<td>4- Climate =&gt; Space =&gt; Displaced populations =&gt; Health System</td>
<td>Population movements, spread of (new) parasites / viruses, mental health</td>
<td>Logistics anticipation of patients’ care, free healthcare, surveillance system, emergency referral system</td>
<td>Migration of staff, social acceptance of the arrival of displaced population and free care for them (all), training of health staff (languages, pathologies, etc.)</td>
</tr>
</tbody>
</table>

![Figure 1. Health systems resilience in the climate change context.](image)

### Data availability
No data are associated with this article.

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References


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