19 Climate Change and Health System Resilience: Reflexivity on an Integrative Conceptual Framework and Its Operationalization in Haiti and Bangladesh

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Key Messages

1. Analysis of the role of health systems in the relationship between climate change and population health is essential but still neglected in studies and practice.
2. The challenges of establishing an integrative conceptual framework for studying the role of the health care system in the context of climate change are immense.
3. Given the complexity of the phenomena involved, the relationship between the supply and demand for health care is not always easy to tackle from a conceptual and theoretical point of view.
4. The scientific community needs to pursue its conceptual reflections to better integrate health care systems into studies on climate change.

Introduction

In early 2022, the sixth report of the Intergovernmental Panel on Climate Change (IPCC) was able to demonstrate for the first time that the current climate changes are unequivocal results of human activities (IPCC 2022). The effect of climate change is felt worldwide and is expected to get worse, threatening our well-being, health, and the future of a healthy planet and possibly pushing out, or trapping in, some populations (Costello et al. 2023; IPCC 2022). Some coastal countries, such as Bangladesh and Haiti, are on the front line of climate change, as they combine higher exposure to extreme climate-related events with higher environmental and socioeconomic vulnerabilities. Population health is a crucial concern (Mora et al. 2022; Watts et al. 2020) and, in the context of a growing threat, the health system dynamics, specifically its resilience—usually defined as the capacity of a system to evolve in response to challenges while keeping its functions—needs to be understood to be strengthened (Ridde et al. 2019; Saulnier et al. 2021; Turenne et al. 2019). Very little evidence has been available yet on the effect of climate change on health systems, most studied disruptions were pandemics (Kruk et al. 2015; Sagan et al. 2021) or humanitarian crises (Fukuma et al. 2017; Odhiambo et al. 2020). Climate change was even recently excluded from a systematic review of health system resilience in Africa (Ayanore et al. 2019). However, climate change is expected

to exacerbate the current health system challenges (Ridde et al. 2019; Saulnier et al. 2021), highlighting the importance of considering multiple events, changes and crises and their interactions when assessing context.

This chapter aims to fill the gap by presenting the ClimHB project, a collaborative exploratory research focusing on the importance of local contexts for studying health system resilience (HSR) facing climate change in Haiti and Bangladesh. To address the challenge of conceptual maturity of resilience (Turenne et al. 2019) and its operationalization, we present and discuss its conceptualization and framework operationalization in Bangladesh and Haiti.

The ClimHB Conceptual Framework: An Approach Conciliating Health System and Population Dimensions for Health Care Access

The initial idea for ClimHB was to connect three concepts: climate change, migration, and health systems resilience. Our plans evolved toward an approach focusing primarily on climate-related events and access to health care while considering migration as a health care determinant and as additional contextual information, (un)related or (in)directly connected to climate change. Our conceptual framework is still evolving and includes other disruptions, such as the COVID-19 crisis, environmental degradations, and sociopolitical context, among others.

Conceptual Challenges

Identifying the dimensions at the intersection of the complex fields of research that are climate change, migration, and health systems resilience has proven to be challenging. The ClimHB project is an exploratory contribution to this endeavor. In each of these three areas of research, multilevel dimensions need to be factored into the analysis, and experts have all proposed multiple conceptual frameworks to understand their intrinsic specificities. Hence, capturing the complexity and studying these interactive dimensions inherently require solid interdisciplinary collaboration where conceptual issues are added to the challenges of international collaboration in the context of the COVID-19 pandemic and travel restrictions. In this project, we aspire to fuel a dialogue between public health, health system research, and social sciences to better understand health access and mobilities in the context of climate change. Climate change covers a wide spectrum of climate, weather, and ecological changes on an extensive time frame. A primary challenge lies in the need to seize the correlation between climate change and its meteorological and ecological impacts, such as extreme weather events, or slow-onset environmental change. Illustrating this intricacy, the field of attribution studies intends to investigate the links between the frequencies of extreme weather events and climate change (Swain et al. 2020). Another challenge of this investigation sits at the climate change and migration nexus: One can identify it as the absence of direct causality (Boas et al. 2019). On an empirical level, this absence requires mapping out the impacts of climate change on a given ecosystem first and then investigating how these environmental changes—that is, drought, sea-level rise, waterlogging—act on social organizations, ways of life, people's health and mobilities. Migration dynamics are always determined by a mix of "climatic, socio-economic, cultural and political factors" (Boas et al. 2019). There is no direct causal model between climate change and migration that supports

a theoretical use of the term climate migration: "This means that categorizing climate migrants as distinguishable from 'non-climate migrants' is not empirically possible in most, if not all, circumstances" (Boas et al. 2019). The interactions between the impacts of climate change on social and ecological environments and human mobilities are inherently context-driven. As an illustration, immobility in relation to ecological changes has long been neglected, yet "trapped populations" are a consequence of the environmental and economic impacts of climate change (Ayeb-Karlsson, Kniveton, & Cannon 2020).

On a meso level, health systems resilience is an emerging field in health system research, and as such, it is still aiming at conceptual accuracy (Turenne et al. 2019). A lot of scientific effort is currently channeled toward producing an integrative framework (Tan et al. 2022) that would cover all the empirically relevant dimensions of resilience and their inner dynamics.

ClimHB Conceptual Framework Elaboration

As a starting point, we have chosen to include the general population within the conceptual framing of a health system and access to care (Levesque et al. 2013). Simply put, health system comprises both health care providers and the general population, including potential beneficiaries. We define health system resilience as "the constituent's abilities of a health system facing destabilizing experiences, events, or shocks (contingent or expected, sudden or insidious, internal or external) to adapt and transform in order to maintain and/or improve access (for all) to comprehensive, relevant, and quality health care and services without pushing patients into poverty." We understand the system as all the public and private health facilities present in the study sites, but due to limited resources the study will focus on a sample of these facilities.

Our aim is to develop a framework that would support a conceptual appraisal of both the process of resilience and the output of resilience. We consider that health care access—a major determinant of population health—is the core outcome of the health system resilience process. Hence, we use Levesque's et al. definition: "Access is always defined as access to a service, a provider or an institution, thus defined as the opportunity or ease with which consumers [patients] or communities are able to use appropriate services in proportion to their needs" (2013). Empirically, the local levels of health care access can be considered a proxy benchmark to gauge whether the health systems under examination fall into the following categories of resilience: "improving," "recovering," "deteriorating," or "collapsing." Evaluating these local levels of health care access will allow us to study both the process and outputs of the local health system resilience and try to understand their drivers.

ClimHB framework (figure 19.1) is an adapted combination of two other frameworks, focusing on process and output. The first one is a widely conventional framework to study the process of resilience: the UK Department for International Development (DFID)—now Foreign Commonwealth and Development Office (FCDO) framework (DFID 2011). The second framework is Levesque's conceptual framework of access to health care (Levesque et al. 2013). We utilize it as a stand-in barometer to categorize the output of the health system resilience process. The Levesque framework has the asset to combine features of both health care service providers and population capacities and resources, in accordance with our health system resilience definition. Five dimensions are related to the institutional level

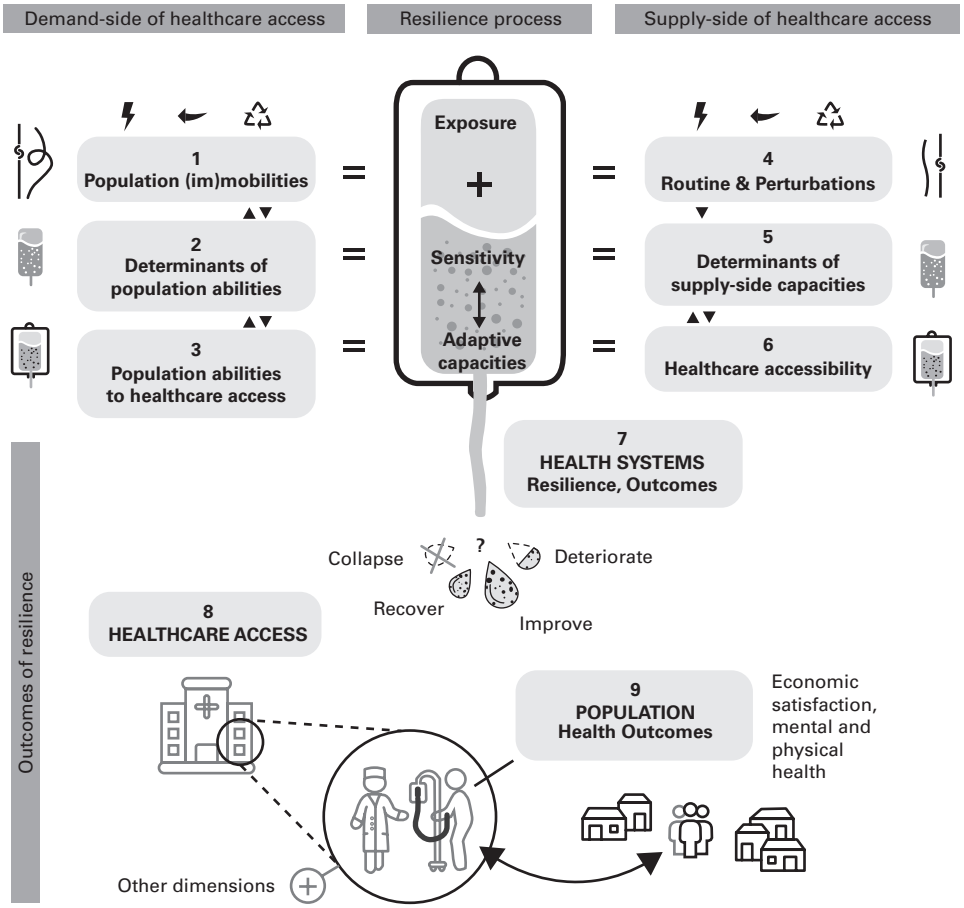

Figure 19.1
ClimHB conceptual framework of health care system resilience. *Source:* Clech et al. (2022).

(approachability, acceptability, availability and accommodation, affordability and appropriateness), and five capacities are related to individuals or households (abilities to perceive, to seek, to reach, to pay, and to engage). We use these ten dimensions—a combination of socioeconomic determinants and physical assets from health providers, households, and individuals—to consider the interactions between health care providers' resources and population's capacities as a health care access baseline.

Then we integrated three core resilience dimensions of the DFID framework: "exposure," "sensitivity," and "adaptive capacity," and their influencing factors, to the existing Levesque framework. Exposure covers the "presence of people; livelihoods; species or ecosystems; environmental functions, services, and resources; infrastructure; or economic, social, or cultural assets in places and settings that could be adversely affected" (IPCC 2018) and can be used as an "assessment of the magnitude or/and frequency" (5) of disruptive events. Sensitivity embodies the levels to which a system might be affected by, or respond to, a disturbing event, for example, by climate change, climate variability, and other shocks/events/disruptions/crises. Adaptive capacities and abilities represent the resources activated

by the different systems, institutions, individuals, and other bodies to adjust to potential damage, to take advantage of opportunities, or to respond to consequences (IPCC 2018), allowing actors "to anticipate, plan, react to and learn from events" (DFID 2011). The health system's global capacity to deal with all kinds of disruption depends on exposure, sensitivity, and adaptive capacities, with adaptive capacities being resulting from the type and level of exposure and sensitivity. We decided to integrate all kind of perturbations that might impact health systems, such as contextual events (i.e., environmental or political shocks, crises), everyday disruption (Kagwanja et al. 2020), and ongoing changes and risks at both patient and infrastructure levels. As part of these prominent factors to bear on the resilience process, we have also integrated population's access capacity to health care and health providers' capacities to deliver health care.

In this integrative framework, we have therefore tried to scrutinize both the process and output of health systems' resilience, thereby empirically supported by the dimensions of health care access. This approach enables us to move forward in our understanding of health systems as multi-meso-level organization including institutional resources and population capacities.

From Theory to Operationalization in Haiti and Bangladesh

While most of the past research has been highly theoretical (Turenne et al. 2019), the ClimHB project aims to understand the relevance of applying its integrative conceptual framework (figure 19.1) to two different countries, Haiti and Bangladesh (figure 19.2), by confronting it with empirical data collection. This research is exploratory, mixing qualitative and quantitative methodologies in a sequential design, allowing the combination of an inductive and deductive approach and a follow-up of the contexts. We developed the tools to support the different dimensions of the conceptual framework, from the perspectives of both the health care providers and the population. A scoping review of the use of the ten dimensions of the Levesque et al. framework helped to understand its operationalization and build the relevant tools (Cu et al. under review). An interdisciplinary approach, mixing socio-demography, economy, geography, anthropology, epidemiology, and public health, was mobilized. We designed and adapted to the local contexts focus group discussions, semi-directed interviews, and questionnaires. The initial protocol and the tools were published (Clech et al. 2022) and are still evolving with the project.

Haiti and Bangladesh were selected from among a list of the ten countries that are most vulnerable to climate change at the time of application for funding (Kreft et al. 2016), because institutional collaboration was facilitated there. Bangladesh and Haiti are coastal countries facing strong effects of global change with sea-rising, cyclones, changes in seasonal rhythms, heavy rains, drought, floods, and population (im)mobilities. However, contextual differences make each context unique. Bangladesh is a densely populated, rapidly developing country that will soon be a lower-middle-income country. Its formal health system, based on a mix of public and private sectors, with a strong presence of private organizations in urban areas and small structures in rural areas, is improving on a number of key Millennium Development Goals indicators but still faces institutional and organizational challenges (WHO 2015). Informal health care providers, such as pharmacists, are often the first visited by the population

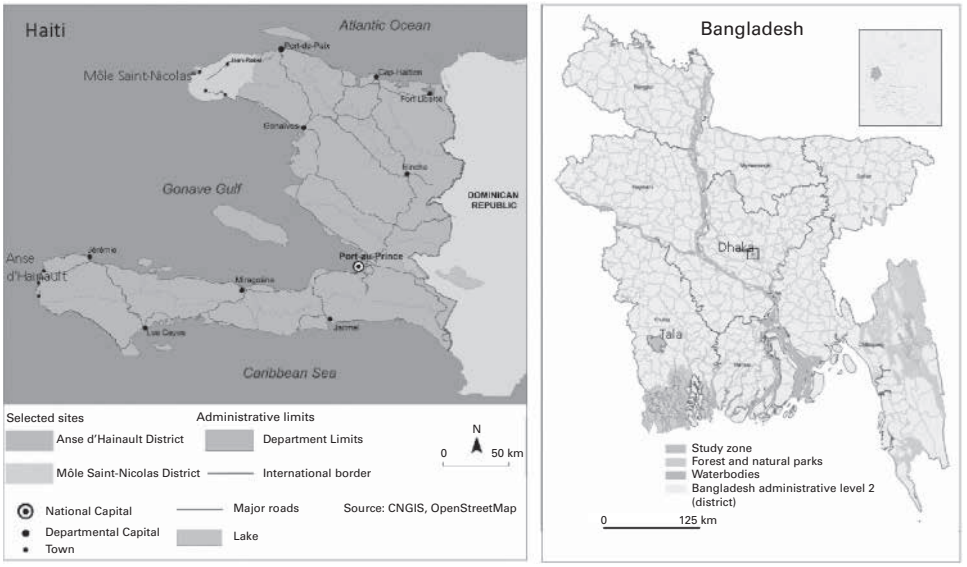

Figure 19.2
ClimHB study sites in Haïti (Môle st Nicolas et Anse d'Hainault) and Bangladesh (Tala upazila and Duaripara slum in Dhaka).

The strict policies of the 2020–2021 lockdowns slowed down local formal and informal economies, impacting many, forcing them to rely on loan systems and pushing others deeper into poverty. This was followed by a severe drought in 2022, making rural livelihoods even more difficult. In several communities, those events have occurred in an already fragile context of environmental degradation caused by chronic exposure to waterlogging. This problem is resulting from a complex combination of socioeconomic, historical, political, and natural causes, and is expanding with the development of shrimp farming (Dewan 2021; Paprocki 2021; Tareq et al. 2018).

Formal health care access is even more complicated in Haiti due to its topography of valleys, mountains, sparse population, and isolated communities; its proneness to disasters; and its complicated historical context of sociopolitical violence that sporadically hinders certain regions and deteriorates the local economy. Health indicators are improving (Watts 2014), but the damages due to the recent earthquake of 2021 (our sites were not impacted directly) (Ministère de la planification 2022) and the gas crisis of 2022 that impeded the mobility of people and goods were additional important factors affecting livelihood, people (im)mobility, health system, and health care access. While the private (formal) sector is present in urban areas in Haiti, it is almost absent in the countryside.

The following sections elaborate on the local contexts relevant to climate change and discuss local challenges to operationalizing the conceptual framework.

Bangladeshi Context

The succession or combination of multiple crises, such as the COVIDS-19 pandemic, environmental degradation due to floods, and catastrophic climatic events, deplete the resources

of rural households. Permanent and temporary migrations to other rural or urban destinations are some of the coping strategies to this multi-crises context. For some of the poorest, harsher impacts of climate change are forcing them out of their communities (Chen & Mueller 2018) to relocate to slums in the cities where living conditions are poor due to overcrowding, lack of proper water and sanitation facilities, and subjection to evictions as the settlements are illegal. Such poor conditions are further aggravated by waterlogging and floods in the slums, resulting in further loss of shelter, loss of properties, and waterborne diseases (Chen & Mueller 2018; Rahaman, Rahman, & Rahman 2019). The country's pluralistic health system has poor infrastructure and human resources capacity to deal with the shocks that come with climate change hazards and migration. Worse, resilience can decrease over time due to slow-onset climatic events (Rahaman et al. 2019).

ClimHB protocol in Bangladesh consists of four phases in a sequential design (ref): contextual analysis (phase 1), qualitative (phase 2), quantitative (phase 3), and nested qualitative (phase 4) for two sites, one in a rural coastal area (Tala Upazila) and the other in a slum of Dhaka. The quantitative phase (phase 3) was ongoing at the time this chapter was written and completed, followed by a nested qualitative phase (phase 4) in 2024 and a knowledge transfer final stage early 2025. Tools have been translated and adapted to the local context. The contextual phase (phase 1) and the pilot discussions and interviews helped to finalize the interview guides of the qualitative phase (phase 2) by being more specific about local migration and by including questions on traditional healers, mental health, and child labor after migration. The resulting qualitative data allowed us to adapt the questionnaire for phase 3 to confirm a local list of potential external events affecting livelihoods and refine the migration questions. Based on the qualitative data, we decided to consider waterlogging as a significant threat to livelihoods in Tala and thus base our cluster selection for phase 3 on waterlogging occurrences.

Challenges to Operationalization in Bangladesh

Some dimensions of the conceptual framework have been more difficult to explore than others and require some careful conceptual and methodological considerations, for example, concerning the resilience process. Regarding exposure, the frequency of events was complicated to assess in Tala (the rural site), where some areas are up to half the year underwater, thus calling into question the environmental baseline state and the time frame of the event. We realized that overflow of water on dry land could be classified into two categories: flood versus waterlogging (stagnant water). But the categorization was complicated as both were consistent problems, might be multifactorial, and could be defined in various ways, thus requiring multiple probing. Still about exposure, collecting data during the pandemic resulted in that COVID-19 (including the impacts of the lockdowns on local markets and mobilities) was always mentioned and ranked high in its importance of impact perception, leading to the overshadowing of climatic-related events.

The focus group discussions (phase 2) provided an understanding of the community contexts and captured some of the diversity of the community's experiences, thus fulfilling its purpose of preparing for the subsequent phases of the protocol (phases 3 and 4), which combined will provide a holistic understanding at the household and community level. Moreover, depending on the event, the difficulty of reaching a consensus during the focus group discussion varied, confirming the adequacy of our protocol design and the importance

of collecting quantitative and nested qualitative data from households on this topic. For example, for Cyclone Amphan (2020), impacts were heterogeneous, with consequences remaining for an indeterminate period of time for some households, while water overflows in the community were easier to characterize for all.

Methodological and conceptual challenges also arose when examining access to care and migration/mobility status, as our exploratory research focuses primarily on climate change and health system resilience. Its design, which is not a follow-up of migrants but a multisite study, was not intended to research mobility and migration. In multithematic exploratory research, this difficulty highlights the complexity of the trade-offs for concept articulation and methodological choices.

Finally, challenges included the data collection process. The well-being and health of the project data collectors were affected by the extremely hot and humid weather (up to 45°C and possibly higher), iron-contaminated water, poor sanitary conditions, and long, bumpy roads and slow transportation, which ultimately mirror the living conditions of the people on-site.

Haïtian Context

Haiti is an island of the Caribbean region highly prone to climate-related events, among which storms and hurricanes are the most common (Kreft et al. 2016). Internally, due to diverse social, economic, and political historical background, the population's stark vulnerability to other (interim) disasters like droughts and earthquakes continues. Furthermore, the many structural violences suffered by that side of Hispaniola create a different narrative from that of neighboring Dominican Republic, which shares the island. Predictably, given this combination of issues, the various systems collaborating to make a nation function are negatively impacted. Haiti's health system is by no way perceived as the best. Nevertheless, little to no literature exists on its capacity to respond to crises, especially those related to climate-induced events. Thus, exploring this subject and creating new knowledge for Haiti in this area is instrumental.

Two districts, Anse d'Hainault (South) and Môle Saint Nicolas (Northwest), were selected for the study based primarily on the events they are mostly faced with, predominantly floods and storms in the Southern department of Grand Anse, and recurrent droughts in the Nord-Ouest.

Challenges to Operationalization in Haïti

The local context is undeniably a difficult one. The country's constant and recurrent security issues, compounded by the worldwide COVID crisis (OCHA 2020), have significantly impacted the initial research timeline, shifting initial planning by over a year. The dramatic assassination of the head of state, Jovenel Moïse, in 2021 worsened the situation. As a result of these unprecedented events, changes had to be made to the tools, the data collection plan, and the general MO of the team of the field.

For ethical and security concerns, an advisory committee implying partner researchers and field practitioners, was put in place to guide and advise the team in monitoring challenging field interventions with reflections on security, outreach, adaptability, and ethical issues.

Following this decision, a new data collection plan was organized to adapt to the local security challenges. The initial qualitative, quantitative, and nested-qualitative phases were replaced by three sequential qualitative phases involving individual population interviews, health service provider interviews (which include informal service providers), and focus groups. Unfortunately, only phases 1 and 2 could be operated in Haïti due to a local situation that degraded to the worst, making the alternative protocol inoperable.

The Haiti ClimHB team built its focus group guides with attention to the particularities of language and the associated cognitive concepts while aligning to Bangladesh's tools when possible. An individual health service provider guide was adapted from the initial ideas created jointly by the national teams. The team used information gathered during the focus groups and the time on the field in the first week to create and adapt its interview guide. The latter was gradually fine-tuned as interviews took place and the pilot and first field approximate twenty-five hours of recordings were reviewed.

The Grand Anse department had become partly cut off from the rest of the country because the only access route by land was in a gang-controlled area. Furthermore, the department was still recovering from the August 14, 2021, earthquake, which was truly unforeseen. So, the safest option for travel was by air. The team encountered a similar issue in planning the Nord-Ouest data collection. Apart from the long distance and the poor road quality from the capital city to Môle Saint Nicolas, a variety of armed groups control the geographical areas to be crossed. Moreover, no airports exist in the specific selected locations, and chartering of an aircraft is the only option.

Initially, technical challenges were mainly related to the unequivocal translation of concepts in the local Haitian Kreyol language. Both adaptation and creation of guides required meticulous analysis of the root meaning of abstract concepts not pertaining to the various regional colloquial Kreyol.

Reflexivity on Conceptualization and Operationalization

Because climate-related events change ecosystems and interact with other global and local changes, the lives and health of individuals and the functioning of communities and (health) infrastructures are impacted. In fragile social–ecological systems, community capacities to resist, adapt, or transform may be, in some contexts, increasingly limited, resulting in fewer and possibly less desirable livelihood options. In our conceptual framework, the health system is intertwined with the community system (figure 19.1), to create an integrative approach (Levesque et al. 2013). The controversy around the concept of resilience points to a mechanistic and politically disconnected perspective (Topp, 2020; van de Pas et al. 2017). We approach climate change and the dynamics of health system resilience in the light of community and institutional contexts (figure 19.1). This allows us to develop both an upstream (from communities) and downstream (from policy and decision-makers) approach, which takes into account local contexts, includes communities and local (emic) perceptions that might be different from scientist-a-priori-assumptions (etic) about climate change (Ready & Collings 2020) and health care access, and the evolution of public health policies and institutional history.

Bangladesh and Haiti are coastal countries facing strong effects of global change with sea-rising, cyclones, changes in seasonal rhythms, heavy rains, drought, floods, the recent

COVID-19 crisis, and population mobilities. However, contextual differences, such as the integration of private/public sectors in the health system, the institutional, political and colonial histories, the territories' difficulties, and population characteristics, make each context unique. The different sites (figure 19.2) provide an interesting case study to analyze our conceptual framework and its operationalization. We decided on a contextual exploratory approach (1) by adapting and modulating the conceptual framework, (2) by adjusting the tools to the local context and challenges, and (3) by regularly going back and forth between the methodology, the empirical data, and the framework.

The challenges of conceptualizing health system resilience lie in the complex articulation of concepts across multiple fields of study characterized by debate, lack of consensus, and risks of depoliticization (Ridde et al. 2023; Topp 2020; van de Pas et al. 2017). Resilience is not necessarily a positive concept (Saulnier & Topp 2024). Reflection is needed on what we decide is the baseline state or dynamic of the system prior to disruption. Should we include the idea of system improvement when universal coverage is low and the baseline context is already facing challenges? How do we consider chronic versus acute, multifactorial, and/or interdependent challenges? How can local public policy decisions and societal expectations be integrated into this projection? We aim to explore those points in our research. Finally, thought should be given to what makes research socially and scientifically justifiable and what kind of research should be conducted on this topic. Here, the funding allows certain flexibility in elaborating exploratory research and its outputs, which would not be possible with commissioned research.

Involving natural sciences like climate, hydrology, and environmental sciences from the start would have helped us develop better tools to understand exposure and sensitivity dimensions and possibly a different sampling strategy (urban site closer to the rural site, rural clusters more dispersed for more climatic variations, etc.). It should be remembered that the project proposal had to be written in a few weeks, on a subject that was new to most of the researchers in the team, in order to respond to a call for tenders. An explorative interdisciplinary fieldwork at the start of the project could have solved this question, but the context in which it was launched did not allow for this. Such work also implies a reflection in inter- and transdisciplinarity (Redvers & Wyns 2023) and on mixed-methods approaches that are needed between social and natural sciences—that is, qualitative social data and quantitative physical data—that could have been key in elaborating our tools. If the use of mixed methods is already a challenge within a discipline, it is even more so in interdisciplinary research.

In addition, our conceptual framework considers climate change and other changes, but the social–ecological dimension is implied rather than emphasized, while environmental degradations and social–ecological interdependencies are key in understanding resiliences in rural area. The resilience of populations, whether we consider livelihoods or well-being and health, and the resilience of access to health care and health systems are intricately linked, the first one being a determinant of the second one, but are not exactly identical, and perhaps should be clarified more clearly conceptually.

Finally, we encountered some significant methodological questions concerning the planned analyses and their feasibility in practice. These questions are: (1) Should we use indicators to cover the entire conceptual framework in our analysis or use a combination of overlapping analyses to cover it? (2) Can we use the same analytical approach for both the demand (population) and the supply (provider) side of our framework? (3) Which analytical approach

should we adopt: a comparative analysis approach (Ragin 2014), a complex adaptive system approach (Carmichael et al. 2019), or some other approach?

Conclusion

This chapter presents a first collective reflexivity on the poorly researched links between health systems, climate change–induced events, and population movement. The research team met at the end of 2023 to examine the conceptual framework application challenges, which will give rise to a second publication in the near future. While the theoretical and conceptual debates around the notion of health systems resilience and its possible instrumentalization by the proponents of New Public Management remain essential to maintain (van de Pas et al. 2017), we believe that it is also becoming urgent to produce rigorous empirical data on the subject. Research on climate change seems to struggle to convince decision-makers and politicians to act and formulate public policies at the macro, if not global, level to tackle this unprecedented phenomenon. It can be hypothesized that the smaller, mesoscopic changes needed to adapt health systems will be more acceptable and feasible on the basis of the evidence that the ClimHB project and others in this field can provide. The fact that CoP 28 is finally taking health and the health system into account is perhaps good news, at the very least cognitive if not yet conative.

Acknowledgments

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Reflexivity Statement

This chapter is a summary of a collective reflection undertaken as part of the ClimHB project in the context of an international collaboration: Haiti, Bangladesh, France, Germany, US, Canada. The research program, whose principal investigator is Valéry Ridde (director of public health research at the Institut de recherche pour le développement, or IRD), was coordinated by Lucie Clech (transdisciplinary scientist, postdoc at IRD) with the support of Sofia Meister (PhD candidate at IRD). In Bangladesh, the project leader is Mrittika Barua (assistant professor and deputy director; Centre of Excellence for Science of Implementation and Scale-up; BRAC James P. Grant School of Public Health); and in Haiti, the analytical framework was developed with Alain Casseus (physician, head of Division of Infectious Diseases/Zanmi Lasante) and Marlène Sam (Ecole Supérieure d'Infotronique d'Haïti).

References

Ayanore, M. A., Amuna, N., Aviisah, M., Awolu, A., Kipo-Sunyehzi, D. D., Mogre, V., Ofori-Asenso, R., Gmanyami, J. M., Kugbey, N., & Gyapong, M. (2019). Towards resilient health systems in sub-Saharan Africa: A

systematic review of the English language literature on health workforce, surveillance, and health governance issues for health systems strengthening. *Annals of Global Health, 85*(1), 113. https://doi.org/10.5334/aogh.2514

Ayeb-Karlsson, S., Kniveton, D., & Cannon, T. (2020). Trapped in the prison of the mind: Notions of climate-induced (im)mobility decision-making and wellbeing from an urban informal settlement in Bangladesh. *Palgrave Communications, 6*(1), 62. https://doi.org/10.1057/s41599-020-0443-2

Boas, I., Farbotko, C., Adams, H., Sterly, H., Bush, S., van der Geest, K., Wiegel, H., Ashraf, H., Baldwin, A., Bettini, G., Blondin, S., de Bruijn, M., Durand-Delacre, D., Fröhlich, C., Gioli, G., Guaita, L., Hut, E., Jarawura, F. X., Lamers, M., . . . Hulme, M. (2019). Climate migration myths. *Nature Climate Change, 9*(12), 901–903. https://doi.org/10.1038/s41558-019-0633-3

Carmichael, T., Collins, A. J., & Hadžikadić, M. (Eds.). (2019). *Complex adaptive systems: Views from the physical, natural, and social sciences*. Springer.

Chen, J., & Mueller, V. (2018). Coastal climate change, soil salinity and human migration in Bangladesh. *Nature Climate Change, 8*(11), 981–985. https://doi.org/10.1038/s41558-018-0313-8

Clech, L., Meister, S., Belloiseau, M., Benmarhnia, T., Bonnet, E., Casseus, A., Cloos, P., Dagenais, C., De Allegri, M., Desgrées du Loû, A., Franceschin, L., Goudet, J.-M., Henrys, D., Mathon, D., Matin, M., Queuille, L., Sarker, M., Turenne, C. P., & Ridde, V. (2022). Healthcare system resilience in Bangladesh and Haiti in times of global changes (climate-related events, migration and Covid-19): An interdisciplinary mixed method research protocol. *BMC Health Services Research, 22*(340). https://doi.org/10.1186/s12913-021-07294-3

Costello, A., Romanello, M., Hartinger, S., Gordon-Strachan, G., Huq, S., Gong, P., Kjellstrom, T., Ekins, P., & Montgomery, H. (2023). Climate change threatens our health and survival within decades. *The Lancet, 401*(10371), 85–87. https://doi.org/10.1016/S0140-6736(22)02353-4

Cu, A., Meister, S., Lefebvre, B., & Ridde, V. (2021). Assessing healthcare access using the Levesque's conceptual framework—A scoping review. *International Journal for Equity in Health, 20*(1), 116. https://doi.org/10.1186/s12939-021-01416-3

Dewan, C. (2021). *Misreading the Bengal Delta: Climate change, development, and livelihoods in coastal Bangladesh*. University of Washington Press.

DFID. (2011). *Defining disaster resilience: A DFID approach paper*. https://www.fsnnetwork.org/sites/default/files/dfid_defining_disaster_resilience.pdf

Fukuma, S., Ahmed, S., Goto, R., Inui, T. S., Atun, R., & Fukuhara, S. (2017). Fukushima after the Great East Japan Earthquake: Lessons for developing responsive and resilient health systems. *Journal of Global Health, 7*(1), 010501. https://doi.org/10.7189/jogh.07.010501

Intergovernmental Panel on Climate Change (IPCC). (2018). Annex I: Glossary. *Global Warming of 1.5°C*. Cambridge University Press. https://doi.org/10.1017/9781009157940.008

Intergovernmental Panel on Climate Change (IPCC). (2022). *IPCC Sixth Assessment Report: Impacts, adaptation and vulnerability.* https://www.ipcc.ch/report/ar6/wg2/

Kagwanja, N., Waithaka, D., Nzinga, J., Tsofa, B., Boga, M., Leli, H., Mataza, C., Gilson, L., Molyneux, S., & Barasa, E. (2020). Shocks, stress and everyday health system resilience: Experiences from the Kenyan coast. *Health Policy and Planning, 35*(5), 522–535. https://doi.org/10.1093/heapol/czaa002

Kreft, S., Eckstein, D., Dorsch, L., & Fischer, L. (2016). *Global climate risk index 2016: Who suffers most from extreme weather events? Weather-related loss events in 2014 and 1995 to 2014.* Germanwatch e.V. https://www.germanwatch.org/sites/default/files/publication/13503.pdf

Kruk, M. E., Myers, M., Varpilah, S. T., & Dahn, B. T. (2015). What is a resilient health system? Lessons from Ebola. *The Lancet, 385*(9980), 1910–1912. https://doi.org/10.1016/S0140-6736(15)60755-3

Levesque, J.-F., Harris, M. F., & Russell, G. (2013). Patient-centred access to health care: Conceptualising access at the interface of health systems and populations. *International Journal for Equity in Health, 12*(1), 18. https://doi.org/10.1186/1475-9276-12-18

Ministère de la planification et de la coopération externe, République d'Haïti. (2022). *Évaluation post-désastre en Haiti séisme du 14 août 2021 dans la péninsule sud* (p. 327) [Rapports sectoriels]. https://www.undp.org/sites/g/files/zskgke326/files/2022-08/HAITI%20RAPPORT%20SECTORIELS%202021%20a%20partager%2016Nov21.pdf

Mora, C., McKenzie, T., Gaw, I. M., Dean, J. M., von Hammerstein, H., Knudson, T. A., Setter, R. O., Smith, C. Z., Webster, K. M., Patz, J. A., & Franklin, E. C. (2022). Over half of known human pathogenic diseases can be aggravated by climate change. *Nature Climate Change, 12*, 869–875. https://doi.org/10.1038/s41558-022-01426-1

OCHA. (2020). *Haïti Plan de Réponse Humanitaire janvier 2019—Décembre 2020, Révision due à la pandémie de COVID-19*. https://reliefweb.int/report/haiti/ha-ti-plan-de-r-ponse-humanitaire-janvier-2019-d-cembre-2020-r-vision-due-la-pand-mie

Odhiambo, J., Jeffery, C., Lako, R., Devkota, B., & Valadez, J. J. (2020). Measuring health system resilience in a highly fragile nation during protracted conflict: South Sudan 2011–15. *Health Policy and Planning, 35*(3), 313–322. https://doi.org/10.1093/heapol/czz160

Paprocki, K. (2021). *Threatening dystopias: The global politics of climate change adaptation in Bangladesh*. Cornell University Press. https://doi.org/10.7591/cornell/9781501759154.003.0001

Ragin, C. C. (2014). *The comparative method: Moving beyond qualitative and quantitative strategies* (2nd ed., with a new introduction). University of California Press.

Rahaman, M. A., Rahman, M. M., & Rahman, S. H. (2019). Pathways of climate-resilient health systems in Bangladesh. In S. Huq, J. Chow, A. Fenton, C. Stott, J. Taub, & H. Wright (Éds.), *Confronting climate change in Bangladesh* (Vol. 28). Springer. https://doi.org/10.1007/978-3-030-05237-9_9

Ready, E., & Collings, P. (2020). "All the problems in the community are multifaceted and related to each other": Inuit concerns in an era of climate change. *American Journal of Human Biology, 3(1), e23516.*

Redvers, N., & Wyns, A. (2023). Transdisciplinary collaborations on climate change and health. *The Journal of Climate Change and Health*, *10*, 100212. https://doi.org/10.1016/j.joclim.2023.100212

Ridde, V., Benmarhnia, T., Bonnet, E., Bottger, C., Cloos, P., Dagenais, C., De Allegri, M., Nebot, A., Queuille, L., & Sarker, M. (2019). Climate change, migration and health systems resilience: Need for interdisciplinary research. *F1000Research, 8,* 22. https://doi.org/10.12688/f1000research.17559.2

Ridde, V., Traverson, L., & Zinszer, K. (2023). Hospital resilience to the COVID-19 pandemic in five countries: A multiple case study. *Health Systems & Reform, 9*(2), 2242112. https://doi.org/10.1080/23288604.2023.2242112

Sagan, A., Webb, E., Azzopardi-Muscat, N., de la Mata, I., McKee, M., & Figueras, J. (2021). *Health systems resilience during COVID-19: Lessons for building back better*. WHO Regional Office for Europe.

Saulnier, D. D., Blanchet, K., Canila, C., Cobos Muñoz, D., Dal Zennaro, L., de Savigny, D., Durski, K. N., Garcia, F., Grimm, P. Y., Kwamie, A., Maceira, D., Marten, R., Peytremann-Bridevaux, I., Poroes, C., Ridde, V., Seematter, L., Stern, B., Suarez, P., Teddy, G., . . . Tediosi, F. (2021). A health systems resilience research agenda: Moving from concept to practice. *BMJ Global Health, 6*(8), e006779. https://doi.org/10.1136/bmjgh-2021-006779

Saulnier, D. D., & Topp, S. M. (2024). We need to talk about "bad" resilience. *BMJ Global Health, 9*(2), e014041. https://doi.org/10.1136/bmjgh-2023-014041

Swain, D. L., Singh, D., Touma, D., & Diffenbaugh, N. S. (2020). Attributing extreme events to climate change: A new frontier in a warming world. *One Earth*, *2*(6), 522–527. https://doi.org/10.1016/j.oneear.2020.05.011

Tan, M. Z., Prager, G., McClelland, A., & Dark, P. (2022). *Healthcare resilience—A meta-narrative systematic review and synthesis* [Preprint]. In Review. https://doi.org/10.21203/rs.3.rs-1803116/v1

Tareq, S. M., Tauhid Ur Rahman, M., Zahedul Islam, A. Z. M., Baddruzzaman, A. B. M., & Ashraf Ali, M. (2018). Evaluation of climate-induced waterlogging hazards in the south-west coast of Bangladesh using Geoinformatics. *Environmental Monitoring and Assessment, 190*(4), 230. https://doi.org/10.1007/s10661-018-6591-9

Topp, S. M. (2020). Power and politics: The case for linking resilience to health system governance. *BMJ Global Health, 5*(6), e002891. https://doi.org/10.1136/bmjgh-2020-002891

Turenne, C. P., Gautier, L., Degroote, S., Guillard, E., Chabrol, F., & Ridde, V. (2019). Conceptual analysis of health systems resilience: A scoping review. *Social Science & Medicine, 232*, 168–180. https://doi.org/10.1016/j.socscimed.2019.04.020

van de Pas, R., Ashour, M., Kapilashrami, A., & Fustukian, S. (2017). Interrogating resilience in health systems development. *Health Policy and Planning, 32*(Suppl_3), iii88–iii90. https://doi.org/10.1093/heapol/czx110

Van Olmen, J., Criel, B., Van Damme, W., Marchal, B., Van Belle, S., Van Dormael, M., Hoeree, T., Pirard, M., Kegels, G., & ITG Press. (2010). *Analysing health systems to make them stronger*. ITG Press.

Watts, J. (2014). Haiti making good progress in health but challenges remain. *The Lancet, 384*(9952), 1413–1414. https://doi.org/10.1016/S0140-6736(14)61835-3

Watts, N., Amann, M., Arnell, N., Ayeb-Karlsson, S., Beagley, J., Belesova, K., Boykoff, M., Byass, P., Cai, W., Campbell-Lendrum, D., Capstick, S., Chambers, J., Coleman, S., Dalin, C., Daly, M., Dasandi, N., Dasgupta, S., Davies, M., Di Napoli, C., . . . Costello, A. (2020). The 2020 report of *The Lancet* Countdown on health and climate change: Responding to converging crises. *The Lancet, 397*(10269), 129–170. https://doi.org/10.1016/S0140-6736(20)32290-X

World Health Organization. (2015). *Bangladesh Health System Review, 5*(3). WHO Regional Office for the Western Pacific. https://iris.who.int/bitstream/handle/10665/208214/9789290617051_eng.pdf

World Health Organization (Éd.). (2010). *Monitoring the building blocks of health systems: A handbook of indicators and their measurement strategies*. World Health Organization.

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