Viewpoint

What is a resilient health system? Lessons from Ebola

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The fragility of health systems has never been of greater interest—or importance—than at this moment, in the aftermath of the worst Ebola virus disease epidemic to date. The loss of life, massive social disruption, and collapse of even the most basic health-care services shows what happens when a crisis hits and health systems are not prepared.[1] This did not happen only in west Africa—we saw it in Texas too: the struggle to provide a coherent response and manage public sentiment (which often manifests as fear) in a way that ensures that disease does not spread while also allowing day-to-day life to continue. In other words, we saw an absence of resilience. This Viewpoint puts forth a proposed framework for resilient health systems and the characteristics that define them, informed by insights from other fields that have embraced resilience as a practice.

Health system resilience can be defined as the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crisis, reorganise if conditions require it. Health systems are resilient if they protect human life and produce good health outcomes for all during a crisis and in its aftermath.[2] Resilient health systems can also deliver everyday benefits and positive health outcomes. This double benefit—improved performance in both bad times and good—is what has been called "the resilience dividend".[3]

Response to a crisis, be it a disease outbreak or other disruption resulting in a surge of demand for health care (eg, a natural disaster or a mass casualty event) needs both a vigorous public health response and a highly proactive and functioning health-care delivery system. These two systems must work in concert during a crisis—and indeed long before crisis strikes. Health-care systems are complex adaptive systems and resilience is an emergent property of the health system as a whole rather than a single dimension. Building resilience is thus context-dependent and iterative, needing advance assessments of system capacities and weaknesses, investments in vulnerable components of the system before a crisis, reinforcements during the emergency, and review of performance after a crisis. Resilience is not a static construct—for example, the rapid pace of recovery from crisis is a cardinal measure of success.[3]

The Ebola epidemic has illustrated that several preconditions for resilience were lacking. The first of these preconditions is recognition of the global nature of severe health crises and clarity about the roles of actors at all levels of the global health system. Although national governments are fundamentally responsible for their health systems, they need the capacity to mobilise the full range of local actors and to rapidly draw on external resources if necessary. The need for a global resilience network is both a moral imperative and a recognition of the fact that pathogens do not respect borders. Shocks to the health system of one country can reverberate across regions and the world. Health system resilience is thus a global public good and needs a collective response from the global community. Funding for this response can come from traditional domestic and donor sources or, as recently suggested, a new international health systems fund to which all countries contribute.[4]

A second precondition is a legal and policy foundation to guide the response and establish accountability. The implementation of International Health Regulations, which call on countries to build core public health capacities and establish a means of coordinating a response to health emergencies with regional and global partners, is a prerequisite for effective emergency response.[5–7] Additionally, legislation that clarifies the authority of public health agencies and the roles and responsibilities of private and public health actors is needed as are policies for involving the private and voluntary sector in the response and allowing flexibility in sharing and reallocating resources across the health system.

Third, there is a need for a strong and committed health workforce, characterised by health personnel who show up for work that might be difficult and dangerous. Establishing such a workforce begins with training and deployment of a sufficient number of doctors, nurses, managers, and outreach workers—a colossal task in a country such as Liberia with a population of 3·5 million people and fewer than 100 doctors—but also building and banking a stock of social capital in the health system before crisis strikes.[8] Just as strong social capital in communities promotes individual psychological resilience after mass trauma, social capital in the health system promotes system-wide recovery from crisis.[9] In the health system context, social capital has two dimensions: a sense of worth, community, and responsibility among health actors (clinicians, managers, engineers, outreach workers)[10] and an inclusive and robust community engagement with the health system.[10,11] Health systems that earn the trust and support of the population and local political leaders by reliably providing high-quality services before crisis have a powerful resilience advantage. Strong management of district level health systems is key to gaining that trust.

Diverse fields such as ecology, engineering, complex adaptive systems, psychology, and public health have produced resilience frameworks.[12–15] The Rockefeller Foundation has developed substantial data about resilient

cities and societies that can withstand and adapt to natural and human-made stressors, such as climate change.[3] For example, the City Resilience Framework identifies qualities and core functions that define resilient cities.[16] Building on these foundations, resilient health systems might be characterised by the following five elements.

First, resilient health systems are *aware*. Resilient health systems have an up-to-date map of human, physical, and information assets that highlight areas of strength and vulnerability. These might be functional areas (eg, information technology, specialty care), health domains (eg, malaria, maternal health), or particular contexts or geographic areas (eg, proximity to flood zones). They are aware of potential health threats and risks to the population from biological and non-biological sources. Awareness needs strategic health information systems and epidemiological surveillance networks that can report on both the status of the system and impending health threats in real time, allowing predictive modelling. Information can come from traditional (facilities, audits, surveillance, population surveys), and less traditional sources (social media, health worker call line, satisfaction surveys). This information should in turn inform planning, including tabletop exercises to simulate the logistics of a response to crisis.

Second, they should be *diverse*. Health systems that have the capacity to address a broad range of health challenges rather than a targeted few are more stable and capable of detecting disturbances when they arise. One example of a diverse platform is primary care. In a well functioning primary care clinic a patient presenting with an unfamiliar constellation of symptoms triggers a systematic investigation for new pathogens rather than dismissal because the patient fails to fit into known algorithms. The same systematic approach applies to hospital emergency wards, community health workers, and other first points of contact with the health system. In times of calm, systems that address diverse health needs will increase the number and quality of people's interactions with the health system, enhancing public trust and enabling more rapid recognition of a new health threat, realising the resilience dividend. This approach is most feasible where universal health coverage (UHC) is in place, which is why UHC is an essential resilience measure. Universal health coverage promotes broad-based provision of health services, and protects vulnerable families from financial hardship and helps to ensure health-seeking behaviour during normal times. This can foster relationships that make individuals more likely to seek timely care, which in a situation such as Ebola can be the difference between life and death, and an opportunity to contain the outbreak.

Third, they are *self-regulating*, with the ability to contain and isolate health threats while delivering core health services and avoiding propagating instability throughout the system. This has three elements: (1) ability to quickly identify and isolate a threat and target resources to it,

(2) minimising disruption to provision of essential health services during crisis, and (3) the availability, in particular locations, of excess or redundant capacity that can quickly be brought online. By keeping the non-affected population healthy, core health-care services will help to attenuate the effects of the threat on other spheres of life: productivity, education, and political processes. Robust, self-regulating health systems need investments in the so-called slow variables, ones that take a long time to change but are required to construct a stable platform for health care delivery (eg, infrastructure, health worker training) plus an infusion of fast variables (eg, quarantine, isolation units) to bolster emergency response.[13,17,18] This is resilience by design rather than happenstance.

Fourth, they need to be *integrated*. Resilient health systems bring together diverse actors, ideas, and groups to formulate solutions and initiate action. Sharing of information, clear communication, and coordination of multiple actors are hallmarks of integration and are best achieved by having a designated focal point in the health system. Public health activities, and in particular communication with the public, must be closely coordinated with health service delivery. An integrated response will need pre-existing legislation and cooperative agreements or compacts that accelerate resource flows and allow sharing and reassignment of funds, personnel, and capacities during crises. Because good health is contingent on inputs from outside the health system and because health emergencies reverberate throughout societies and economies, effective response to a health crisis requires involvement of non-health sectors such as transportation, media, and education among others. Depending on context, sectors such as agriculture, mining, and water and sanitation at both national and regional levels should be integrated into the response effort to ensure the continued provision of these crucial determinants of health. The private sector, non-governmental organisations, local community leadership, and civil society should also be engaged because they bring crucial complementary capabilities and perspectives. In particular, communities need to be recognised as a central actor in health systems and not simply a recipient of health care. In another example of the resilience dividend, consultation with and feedback from communities during normal times will bear fruit in more effective risk communication and community action to reduce risks during emergencies. Finally, resilience does not imply self-sufficiency and self-reliance. On the contrary, resilient health systems have strong external connections to regional and global partners that allow governments to trigger rapid deployment of a wider set of resources. This is an example of smart dependency.

Finally, resilient health systems are *adaptive*. Adaptability is the ability to transform in ways that improve function in the face of highly adverse conditions. Any adaptations should enhance performance in the short term and, ideally, contribute to building long-term

resilience. Too often the humanitarian response to health emergencies has a short half life, leaving little discernible benefit for the larger health system post crisis.

Adaptability does not manifest only in crisis: resilient health systems demonstrate the capacity to adapt in normal times, such as to changing epidemiological and demographic needs of people. In the context of natural disasters or other mass-casualty events, health systems might need to adapt to respond to health needs of refugees or internally displaced people. Adapting to emergent challenges needs strong and flexible leadership, data, and capacity to use it, and organisational structures and management systems that allow pivot. At the end of a crisis, an adaptive health system not only functions differently, but functions better: for example, extracting more efficiency and more productivity from human and capital investments.[19] Rigorous evaluation research on past responses can provide crucial feedback for adapting the system for future challenges.

During crises, resilient health systems will reduce loss of life and mitigate adverse health consequences by providing effective care for emergency and routine health needs. Resilient health systems can also minimise social and economic disruption that characterise outbreaks and other large-scale health threats by engaging people as partners in containment efforts, reducing fear, and hastening resumption of normal activity. Making this planning and investment even more worthwhile, building a resilient health system should also produce the "resilience dividend", apparent not only through effective functioning under duress and faster recovery, but also, through better routine health-care provision, social cohesion, and productivity during periods without exigent needs.[3]

This resilient health systems framework, based on research and experience in health and other fields, will benefit from further testing and refinement. Case studies of health systems that have been confronted with threats can demonstrate whether and how elements of the framework explain experiences and outcomes in different settings. We will apply the framework to understanding Liberia's experience during the Ebola outbreak and to use it as a guide for rebuilding the health system in the coming years.

Contributors
MEK and MM conceived the idea for the paper. MEK led the development of the conceptual framework, conducted background research, and wrote the first draft. All authors contributed to revisions of the draft by providing important intellectual input. All authors approved the final draft for submission.

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