

## Trans-disciplinary research to improve health systems' disaster readiness and response

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Several high-impact disasters in the last decade have shown diverse environmental and social settings to be vulnerable to natural hazards. According to the United Nations (UN), in 2011 302 disasters resulting from natural hazards killed 29 782 people and injured, displaced or otherwise affected another 206 million. Economic damages reached 366 billion United States dollars (US\$),<sup>1</sup> a record figure resulting from the concentration of disasters in middle- and high-income countries and the associated loss of costly infrastructure. This stands in contrast with 2010, when, consistent with historic trends, low-income countries were disproportionately affected. Economic losses (US\$ 110 billion) were less than one third as high as in 2011, but the death toll, estimated at 296 800, was 10 times as high.

The recorded frequency of natural hazard events has more than quadrupled since the mid-1970s.<sup>2</sup> The timeframe of millions of years required to detect patterns in such events precludes certainty over the drivers of this apparent increase, but the risk of natural disasters shows no sign of diminishing. Recent trends – the doubling of the global population since 1950, environmental degradation, urbanization and continued and uneven population growth – have increased human exposure to hazardous environments.<sup>2</sup>

Heightened awareness of vulnerability to disasters has sparked widespread interest in prevention, preparedness and response mechanisms. Disaster mitigation initiatives now commonly incorporate proactive and ex-ante components in which health systems play a key role.<sup>1</sup> The priorities laid out in the United Nations' Hyogo Framework for Action for 2005–2015 and within the broader mandate of the UN's International Strategy for Disaster Reduction (UNISDR) dovetail with this approach. The assignment of a central role to

health systems in disaster preparedness, resilience and response planning<sup>1</sup> gained momentum from a 2011 resolution of the 64th World Health Assembly calling for the integration of health systems into disaster planning at all levels. In support of this policy, the World Health Organization (WHO) has published practical guidelines on disaster preparedness and response<sup>3</sup> and, in concert with UNISDR, has sought to integrate disaster mitigation and response plans into the wider research stream of “disrupted health systems”,<sup>4</sup> a move intended to complement ex-ante mitigation measures with ex-post needs assessment and recovery planning. At a wider level, this emerging policy approach is grounded in a recognition that natural hazard events do not directly – or necessarily – translate into disasters (defined by their impact on society and the environment).<sup>1</sup> The risk of disaster posed by natural hazards can be reduced if preparations are made and the response is coordinated and timely.

Various obstacles, however, have thwarted attempts to translate this policy shift into strategic action. One is the urgent, unmet need for analytical and modelling tools complemented by conceptually unified frameworks for defining, assessing and informing health systems' ability to cope with and respond to natural hazard events. Another is a paucity of data on health system disaster preparedness and response in low- and middle-income countries. Research actively involving communities affected by disasters is needed to build up an evidence base for national and international policy-making.

We propose an embedded health systems analysis approach that unites expertise from the physical, life and social sciences to take forward in a coordinated way the research required for ex-ante disaster planning. The approach entails developing a knowledge interface for integrating research into:

(i) disaster risk assessment; (ii) vulnerability identification and modelling; and (iii) assessment of health system disaster response capacity and capability. To date, these three research streams have developed with little cross-fertilization of ideas and knowledge bases. We propose a trans-disciplinary approach for integrating them and grounding them in a sustained theoretical and empirical analysis of the relationships between pre-disaster conditions and response and recovery mechanisms.

The proposed integration would bolster an emergent, trans-disciplinary research field with room for methodological innovation. Remote sensing and geographic information system modelling techniques are already being used in research on disaster prevention, preparedness and response, but applications and developments remain relatively uncoordinated and isolated within disciplinary silos. Our conceptual framework stresses that knowing the geophysical features of specific natural hazard events – intensity, magnitude, spatial boundaries and warning signs – is necessary but not sufficient to forecast health repercussions and trajectories. Integrating multiple sites of knowledge into planning is important when high risk is compounded by uncertainty. The extent to which impact is mediated and moderated by the risk environment on the ground, within and beyond the health-care system, can valuably inform assessments of vulnerability and risk.<sup>5,6</sup> This allows health systems' surge capacity to be analysed not just in terms of an ability to accommodate immediate surge phases, but also, to alter the terrain on which latent or indirect phases (or separate future natural hazard events) occur. ■

### References

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