Doctoral abstract

Thesis title: A socio-ecological resilience perspective to enhance hospital service delivery resilience to extreme weather events
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Candidate name: Anumitra Vikash Mirti Chand
College/University/City/Country: Built Environment Faculty, University of New South Wales, Sydney, Australia
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Thesis Supervisor(s): Professor Martin Loosemore and Professor Susan Thompson
Email: a.chand@unsw.edu.au

Context

Climate change-associated extreme weather events (EWEs) are becoming more pronounced in Australia, and the vulnerability of built infrastructure to these events is increasingly being recognised. The built infrastructure plays a significant role in supporting a disaster-resilient society as well as a nation's economy and quality of life. Poorly designed, constructed or maintained building and critical public infrastructure all increase the disaster risks for communities. Hospital facilities are critical infrastructure for disaster response that need to remain operational 24 hours and seven days a week. However, the capacity of many hospitals to sustain their critical service delivery during disasters has been compromised during past EWEs due to structural damage to the built infrastructure and interference to the operational capacity of the hospital itself. The unpredictability and the heightened incidences of EWEs make hospital disaster and facility adaptation more challenging, especially due to the ageing stock of the built infrastructure that was not designed with these risks in mind.

Approach

The complexity of hospitals and their facilities management during EWEs due to the multiple functioning units and services that are inter-related and their interdependence in external infrastructure creates new strategic challenges for disaster management and adaptation research. Socio-ecological resilience theory is useful in understanding these new challenges, as it is linked to complex adaptive systems that are characterised by the large number of individual elements, integrating with and influencing each other. The socio-ecological resilience perspective is able to throw light on the different adaptive capacities of a system, such as the structural (the hospital built infrastructure capacity to withstand EWEs) and the non-structural (people's capacity to learn and to adapt) components, in enhancing system resilience. Hence, socio-ecological resilience perspective was adopted to investigate how hospital infrastructure can be made more resilient to deal with growing EWE risks. Ontologically, socio-ecological resilience assumes that hospital service delivery resilience to EWEs is socially constructed by hospital stakeholders' learning, interactions and the transfer of knowledge into policies (adaptation). Recognising that the reality of learning and adaptation is a socially constructed phenomenon, which involves creating shared meaning and engaging in collective action to deal with built environment vulnerabilities, this research adopts a *constructionist* ontology. A constructionist ontology is linked to an *interpretivist* epistemology, which requires people to be studied in their social setting (within a case study framework), and requires the researcher to engage with these

people (using qualitative methods). In this research context, the qualitative approach adopted investigated how hospital stakeholders value their built environment as an asset or a liability in responding to EWEs, how they learn about their built environment in such events and how they transfer these lessons into adaptive strategies to make the built environment more resilient to future EWEs.

While the *panarchy* model or adaptive cycle (socio-ecological resilience) is useful to understand how systems, such as hospitals, adapt and respond to EWEs, this model is limited in explaining the process of learning that facilitates adaptation. Hence, Nonaka and Takeuchi's knowledge creation SECI model was adopted to help elaborate on this process. Both theories were combined into one new four-phased conceptual framework for hospital resilience, *Hospital Resilience Learning Cycle*. Three key questions emerged from the HRLC conceptual framework that informed the research propositions:

- the value of hospital built (hard) infrastructure in formal disaster plans;
- the transfer of lessons learnt from individual and collective levels; and
- the transfer of knowledge from people to disaster management policies.

A triangulation of methods consistent with the methodological framework allowed to capture multiple realities embedded in hospital stakeholders' experiences. This included thematic content analysis of formal disaster plans, semi-structured interviews, focus groups and further documentary analysis of past disaster records and reports.

Findings
The integration of the socio-ecological *(panarchy)* and *(SECI knowledge creation)* learning theories provided significant insights into understanding the complex network of relations that influence hospital service delivery resilience to EWEs. The results demonstrated that the hospital stakeholders have a limited understanding of their built infrastructure in terms of the role it plays in responding to an EWE. While this finding demonstrated that strict delineations in hospital disaster planners' responsibilities in services influence what lessons they learn and what knowledge goes in the disaster plan, the need to involve all key stakeholders in disaster planning is critical. This confirmed that reality is socially constructed by the people in their natural setting, which suggests that a better tool is needed to not only capture the knowledge acquired by all the hospital stakeholders but also facilitate better distribution and use of knowledge for future disaster management planning. This finding was further confirmed in the second phase of the study during interactions with the stakeholders that not all the lessons learnt from an EWE experience were externalised into the hospital adaptation process. This is due to the lack of mechanisms and structure to facilitate learning, capture and share different knowledge and the feedback processes at multiple scales and levels. Silo cultures, time limitations and economic constraints isolate and discourage a participatory approach towards building resilience in facility planning. These findings highlight the importance of disaster experiences for learning and the needs to capture different knowledge to increase the diversity of options and flexibility in hospital disaster adaptation. Additionally, the dynamic nature of hospital disaster management planning demonstrated the important relationship between the vulnerabilities, hospital adaptive capacities and learning that needs to be recognised, as they provide a new direction to enhance hospital resilience to EWEs. This research emphasised the need for a proactive, holistic and systemic approach to health-related disaster and facility management planning in supporting hospital service delivery resilience during EWEs.