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Abstract

Health facilities play a crucial role in maintaining healthcare services to the community during an extreme weather event. Health facilities managers operate within a wider network of organisations which include emergency services, health resource suppliers, local authorities, external health agencies and governmental organisations. Their response to an extreme weather event depends significantly on their ability to manage the network risks which may arise between actors in this complex system. Yet existing research has tended to look at facilities managers in isolation. Through an in-depth case study of how health services in the State of New South Wales, Australia would respond to an extreme weather event, the interface risks between these various agencies are explored from a facilities management perspective. An analysis of 139 documentary sources which would dictate the inter-agency response shows that health facilities managers face numerous hidden risks arising from overlapping, complex and unresolved governance conflicts between the agencies on which they depend. It is concluded that these interface risks can be reduced if facilities managers employ a number of strategies. These include: mapping hospital dependency on other agencies; resolve overlapping operational boundaries with other agencies; undertaking proactive risk reduction for critical external support infrastructure; and better understanding potential conflicts with external agencies in responding to an extreme weather event.

Keywords: Facilities management, hospitals, risk, inter-agency, governance

1. Introduction

Using systems theory, Loosemore et al. (2012) provided empirical evidence to show that if healthcare facilities are to become more resilient to extreme weather events (EWEs), they cannot be treated in isolation from the wider systems in which they exist. EWEs are defined as weather patterns such as heatwaves, storms and floods that exceed a particular threshold and deviate significantly from mean climate conditions (Linnenluecke and Griffiths 2010). These interdependent systems include other organisations such as: the police, the army, the fire services; water, electricity and gas authorities; off-campus hospital suppliers; polyclinics; aged care facilities; and other critical service providers. Although the health facilities management literature acknowledges that the health system is complex, it provides little insight into the interface risks associated with the coordination and integration of all these organisations when the system is under stress. The ability of these various organisations to effectively coordinate with each other before, during and after an EWE can have a direct impact on a hospital's ability to cope. For example, records from the 1997 heat wave in Adelaide, South Australia, show that hospital computers overheated and failed and that outages occurred in water supply, air-conditioning and energy supply (Emergency Management Australia 1998). The 2005 Sydney heat waves had similar impacts and particularly affected the elderly and other vulnerable populations such as the obese and chronically ill, causing increased hospital admissions relating to heatstroke and cardio vascular diseases. This is not a problem unique to Australia. For example, in 2007 a tornado hit Greymouth in the South Island of New Zealand cutting electricity lines, damaging buildings and flooding access roads to many critical facilities (New Zealand Ministry of Civil Defence and Emergency 2007). Many other EWEs such as Hurricane Sandy in the USA in 2012 and the UK floods in 2007, have highlighted the vulnerability and inherent interconnectedness of critical infrastructure such as hospitals, power generation, water and transport networks, leading to calls for greater investment to make these systems more resilient to these emerging risks (Gardiner 2013, Committee on Climate Change 2014).

This intricate interdependency on other infrastructure systems indicates that health facilities managers have to operate within a complex system containing 'systemic risks' which propagate through numerous pathways, spreading quickly and rapidly, in non-linear and unpredictable ways (Koubatis and Schönberger 2005). Helbing (2013: 51) defines 'systemic risk' as "the risks of not just having statistically independent failures but interdependent so-called 'cascading' failures in a network of N interconnected system components". In other words, systemic risks result from looped connections between different system components (sub systems), leading to localised initial failures spreading and potentially inflicting unbounded damage. As White (1995), Jaafari (2001), Stahl, et al (2003) and Koubatis and Schönberger (2005) argue, complex systems are inherently unstable and characterised by multiple elements which are so interlinked that it is rarely possible to trace a risk event back to one singular event. This inherent instability arises from the important property of 'self-organization' (the ability of a system's connections and interdependencies to change, adapt and develop on their own without the influence of external managers). Systems researchers have shown that the property of self-organisation ensures that complex systems tend to settle at a 'critical edge' where a small change in the system can lead to catastrophic changes in the overall system through 'cascading

interdependencies' which exist between different parts of a system. This property of systems is called 'self-organised criticality' and Kampmann (1999) argues that the world is made up of complex systems which may appear under control on the surface, but exist in a state self-organised criticality which makes sudden catastrophic collapses in response to external disturbances almost inevitable.

It is within this context that the paper aims to explore the systemic network risks which facilities managers face in the health sector. Responses to EWEs are studied as these events represent a real and growing threat to the health sector and address an important yet missing inter-organisational dimension in the facilities management and disaster management debate, which hitherto has been largely confined to intra-organisational issues.

2. Interface risks and extreme weather events

Numerous researchers such as Ansell and Gash (2008), have recognised the challenges of how multiple interdependent organisations mobilise, co-ordinate and control their actions and resources to respond to, cope with and recover from external threats such as an EWE. The earliest work in this field is attributed to Prince (1920), who derived a 'social theory' to explain human response to disaster. Later, Mileti et al. (1975) introduced the concept of the "disaster life cycle" and established the fundamental concepts of mitigation, preparedness, response and recovery used in most contemporary disaster management plans and facilities management literature. Drabek (1986) refined this work and introduced the concepts of emergent behaviour and human systems in disaster response, igniting the current debate over the validity of the centralised or bureaucratic model promoted in disaster management. Contemporary research into multi-agency responses to natural disasters (eg. Houghton et al. 2006; McMaster and Baber 2009) is concerned with the challenges faced by multi agencies in adapting their governance boundaries from standard operating procedures to accommodate the broader dynamic inter-agency interdependencies required in a disaster or crisis. During a threat such as an EWE, multiple agencies are required to change their modes of operation, to perform different functions and to work on multiple tasks simultaneously and under considerable time pressures. This requires path dependencies to be challenged and a certain degree of adaptive capacity to break with the 'normal' routines that are known to work when the system is not under threat.

From an interface risk management perspective, contemporary disaster management theory can be divided into two schools of thought. The first emphasises the importance of a centralised authority for a successful disaster response and the value of agreed, well-practiced operating procedures (Drabek and McEntire 2002). The second acknowledges emergent behaviours and is orientated towards decentralised or self-organising models operating on the basis of cooperation and collective problem solving (Mendonca et al. 2007). Recent research has also raised doubts about the effectiveness of the traditional command and control model (Mendonca et al. 2007, Kapucu and Arslan 2010). It is argued that while a central coordinating authority and pre-determined disaster management plans can be of value, it can also reduce the opportunity for improvisation and adaption to novel conditions which might typically arise during an EWE. Recent research is showing that the effectiveness of disaster response is highly dependent on

pre-existing relationships between responding agencies established prior to the event (McMaster and Baber 2008; 2009, Department of Homeland Security 2012). The body of research outlined above indicates the importance of facilities managers establishing and maintaining relationships well in advance of an EWE event, yet Heng and Loosemore's (2011) research shows that this can be problematic because facilities managers are often seen as trivial and marginalised from central social networks in and around healthcare operations.

3. Methods

To investigate the interface challenges that hospital facilities management might face in managing this network of interactions, we conducted an in-depth analysis of the complex inter-agency governance structure responsible for managing healthcare delivery in the state of New South Wales, Australia. Australia comprises six states and two internal territories. All states and internal territories have their own parliaments and administer themselves, working in partnership with the Federal Commonwealth Government. Each state also retains the power to make their own laws over matters not controlled by the Commonwealth and have their own constitutions, as well as a structure of legislature, executive and judiciary. In terms of health services, the Federal Commonwealth Government provides leadership, financing, research and national information management around health policy while the states and territories are largely responsible for the delivery of public health care services and the management of healthcare workers in the public and private sectors. The states and territories deliver public acute and psychiatric hospital services including school and child health programs. Residential aged care is financed and regulated by the Federal Commonwealth Government and is outsourced mainly to the non-government sector (religious, charitable and for-profit providers). The Commonwealth, states and territories jointly fund and administer community care (such as delivered meals, home help and transport).

The state of New South Wales (NSW) provided an ideal context in which to study interface risks in this system. It is Australia's most populous state, with a population of about 7.5 million people served by about 230 public hospitals over an area of 809,444 km² which provide a wide range of other connecting services including emergency care, elective and emergency surgery, medical treatment, maternity services and rehabilitation programs. In addition to the Ministry of Health, the NSW Health service structure includes Local Health Districts, statutory health corporations and affiliated health organisations. New South Wales public health services include public hospitals, community, family and children's health centres, ambulance services and an extensive range of specialty services including mental health, dental, allied health, public health, Aboriginal health and multicultural health services. There are 15 Local Health Districts that are responsible for providing health services in a wide range of settings, from primary care posts in the remote outback to metropolitan tertiary health centres. The Ambulance Service of NSW is responsible for providing responsive, high quality clinical care in emergency situations, including pre-hospital care, rescue, retrieval and patient transport services.

Data about the interagency response boundaries and interactions revolving around healthcare facilities issues were collected using 139 documentary sources which would dictate the inter-agency response to an EWE. These documents included:

- Published governance structures for operating and maintaining public hospitals in New South Wales;
- Hospital, agency and community disaster management plans; government policy and legislation;
- Building control and standards guidance; published agency and government analysis of past EWE disaster responses;
- Annual reports of responding agencies; government inquiries into EWE responses; internal discussion papers;
- Disaster and emergency agency websites.

This data was analysed by cross-tabulating the responsibilities of the various agencies' names in these documents. The focus was to look for gaps and overlaps in their response mechanisms which could compromise the business continuity of a hospital in delivering health care services to communities during and after an EWE. A single case study approach of NSW (albeit with multiple internal dimensions), like any approach, has well-recognised limitations, particularly around representativeness and generalizability (Yin 2009). However, as discussed in the literature reviewed above, the number of potential agencies potentially involved in the response to an EWE and the complexity of interactions requires an in-depth approach to properly understand. Furthermore, in response to potential criticisms around generalizability, Flyvbjerg (2011: 301) argues that "while it is correct that the case study is a detailed examination of a single example, it is not true that a case study cannot provide reliable information about the broader class". Therefore, while the advantage of large samples might be breadth and representativeness, the advantage of case studies is depth and validity.

4. Analysis of interface risks

Our analysis indicated seven critical governance risks that can potentially impact a hospital facilities manager's ability to respond effectively to an EWE. These are:

- Inter-agency cooperation;
- Surge capacity;
- Preparation time;
- Gaining access to and from the disaster field;
- Resolving overlapping operational boundaries;
- Coordinating with agencies external to the health system;
- Resolving potential conflicts between external agencies.

Each of these risks is discussed in more detail below:

4.1 Inter-agency cooperation

In NSW, responsibility for the formulation and maintenance of disaster plans is delegated to 152 local governments which develop individual whole-of-community plans coordinated across the 11 Emergency Management Districts. Responsibility for disaster management of individual hospitals (both public and private) is allocated to 17 Local Health Districts (LHDs) with a different set of operational boundaries. Not only does this complex and overlapping governance landscape create potential coordination problems for facilities managers in preparing and responding to an EWE, it also creates the risk for disaster planning for hospitals to be undertaken in isolation from the whole-of-community disaster plans that are coordinated by Local Government officials.

4.2 Surge capacity

Our analysis indicated that surge capacity is a recurrent problem in hospitals and while financial constraints are often blamed for this, other issues identified in post disaster reports include fragmented governance of surge resources, offsite storage of resources, over-loaded supply chains and poor communication about overflow management.

4.3 Preparation time

Post disaster reports show that hospitals need preparation time to deploy a response team, be sufficiently resourced to receive mass casualties, as well as to assist with the health response during the community's recovery period. It also depends on careful planning to provide sufficient temporary additional treatment space through a range of measures including cancelling elective surgery, diverting emergencies not related to the disaster to other hospitals, and potentially transferring patients.

4.4 Access to and from the disaster field

There is an assumption that access to and from the disaster field will be possible during the course of a disaster response and recovery period. Not only does this assumption rely on surrounding infrastructure remaining operational (for example, roads, helipads or airports), it also relies on transport vehicles and equipment being capable of handing the conditions within the disaster field. However, our analysis indicated that dependency on other overloaded agencies to supply transport and the inability of the available responders to negotiate flooded roadways or rough terrain can significantly affect the effectiveness of hospital responses.

4.5 Overlapping operational boundaries

Our analysis shows that EWEs typically affect a wide catchment area and are likely to be covered by more than one local disaster plan, and in severe cases potentially even some regional or district-based disaster plans. This requires hospitals to be familiar with the procedures and

arrangements contained within multiple disaster plans, and also to build operational relationships with a wide range of stakeholders and responding agencies.

4.6 Funding of asset development

In Australia, the state government will typically own a hospital's physical assets including the site, and through its various agencies, oversee and fund its upgrade or renewal. Individual hospital facilities managers and regional health boards tend to have funding and delegated responsibility to manage the operation including routine maintenance of individual sites and supporting built infrastructure. There are two obvious problems with this arrangement: firstly, the people on the ground with the responsibility for preparing for and responding to an EWE have limited influence over decisions to upgrade or renew their hospital which could affect their ability to respond. Secondly, at a state level, decisions regarding capital expenditure on the upgrade or renewal of assets within an individual site are typically prioritised, with reference to the entire hospital portfolio. What may be of high priority to an individual hospital in its disaster planning may not necessarily be considered so by government at the state level.

4.7 Coordination with agencies external to the health system

Although most health systems attempt to ensure independence through backup systems such as the installation of generators, our analysis showed that hospitals inevitably have to rely on interactions with agencies outside the health sector when an EWE strikes. LHDs have limited influence over the centralised procurement from warehousing facilities supplying support services such as linen, catering, IT or consumable medical supplies within their districts. In the same way, during an EWE, LHDs will have little influence in mobilizing other agency resources. Given that hospitals are not geared to provide their own disaster transport, they are highly dependent on other emergency service agencies to assist with the deployment of medical teams and supplies into the disaster field and also to transfer casualties from the field for treatment in hospital. Therefore, the quality and timeliness of the ‘health’ response is dependent on the cooperation of other agencies.

4.8 Potential conflict between external agencies and hospital objectives

One major problem for a facilities manager in dealing with an EWE is that external agencies may have conflicting objectives to those of the hospital. For example, records show that local aged care facilities often lack a disaster plan and tend to evacuate their patients and residents to tertiary hospitals during an event such as a flood, to prevent them being cut-off. Not only could patients become stranded en-route, but the arrival of additional vulnerable elderly persons into a hospital at a time when it is already under stress puts undue strain on the response effort.

5. Discussion

Past research on facilities risk management governance issues has taken an intra-organisational focus and the aim of this study was to balance this with inter-organisational insights. The findings add further qualitative evidence to Loosemore et al's (2012) research which argued that hospital facilities management is best conceptualised using a systems perspective that recognises the wider system in which hospitals are placed. The findings also support McMaster and Baber's (2008) and Uhr's (2009) contention that effective inter-agency coordinating is highly dependent on pre-existing relationships between responding agencies established prior to the event. In doing so it has also exposed the potential problems of 'sequential single agency response' highlighted by McMaster and Baber (2009). From a contemporary disaster management theory perspective, our results question the efficacy of the centralised governance school of thought which argues that a successful disaster response depends on the development of agreed, well-practiced operating procedures (Drabek and McEntire 2002). However, our findings also showed that the boundaries defining what each agency will tackle are often confused and are unlikely to adequately consider the dynamic inter-agency interdependencies required to ensure an effective response to an EWE. Furthermore, our research shows that while hospital facilities managers are responsible for managing critical assets during an EWE, they are unlikely to be an integral part of a common operational picture or a shared situational awareness which disaster management researchers like Wickens (2008) advocate. Our research suggests that during an EWE people will need to move outside these procedures and that it is therefore important to acknowledge emergent informal systems and behaviours, and the need for decentralised or self-organising models operating on the basis of cooperation and collective problem solving (Mendonca et al. 2007). In terms of future research, our findings therefore suggest that there is a need to more deeply explore the interaction between formal and informal systems and procedures in disaster response and in particular, how informal processes and procedures can act to support the formal systems that central policy-makers have put in place.

6. Conclusions

The aim of this paper was to explore the systemic network risks which facilities managers face in the health sector. Theoretically, these findings add to the facilities management literature by highlighting the importance of power for facilities managers as determined by their position in the social networks that are defined by disaster management plans. They also highlight the need to develop brokerage and relationship-building skills which are largely ignored in the facilities management literature. While interviews with key stakeholders would provide further valuable insights and while further research is clearly needed into the inter-agency challenges of the facilities management function, the value of this research is that it reveals a set of issues and skills which are not typically covered in facilities management research literature. In particular, it highlights the importance of: adopting a systems perspective in understanding the health system as a whole; understanding the power, politics and economics of governance; stakeholder management; inter-agency relationship building; and understanding the objectives, plans and constraints of other organisational functions (external and internal) which the facilities manager depends on. As evident from our findings, it is important that any future analysis of these issues

should take care not to neglect the social networks in which facilities managers are imbedded and of their power relationships with other disaster management stakeholders.

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