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Communication

Towards resilient health systems for increasing climate extremes: insights from the 2019–20 Australian bushfire season

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Abstract. The public health emergency associated with the 2019–20 bushfires in Australia was a wake-up call to increase the resilience of our health systems to respond to climate extremes. We must combine our understanding of predictions of extreme weather events with our knowledge on emergency preparedness and response to protect the health of citizens.

Keywords: Australia, bushfire, drought, emergency preparedness, extreme climates, healthcare, health systems, wildfire.

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Introduction

Australian climate extremes put enormous pressure on health systems. Heatwaves cause more deaths than all other natural hazards combined (Coates *et al.* 2014). The recent prolonged drought, which fuelled the early start of the 2019–20 fire season, coupled with the scale of the fires themselves have resulted in an unparalleled ecological crisis (Freund *et al.* 2017; Boer *et al.* 2020). An estimated 21% of Australia's forestlands was burnt in a single season, with a huge loss of biodiversity (Boer *et al.* 2020) and major cities experienced weeks to months of hazardous levels of bushfire smoke. For most of December, Sydney experienced 24-h $PM_{2.5}$ levels that were 4-fold the acceptable limit, on occasion reaching levels of 500 μg m^{-3}, or 20-fold the acceptable limit (Yu *et al.* 2020). Canberra, the nation's capital, was among the world's top 10 polluted cities for the last two weeks of 2019 (Fig. 1), reaching a 24-h $PM_{2.5}$ level of 855.6 μg m^{-3} on 1 January 2020 (ACT Health 2019). The smoke-related burden in itself is estimated to have resulted in over 3000 excess admissions for cardiovascular disease and respiratory conditions and over 400 excess deaths between October 2019 and mid-February 2020 in eastern Australia (Borchers Arriagada *et al.* 2020). Of the 1.5 million people living in the bushfire-affected regions, tens of thousands were evacuated by land and sea as the fires encroached. Many were evacuated to evacuation centres with limited connections with healthcare providers, placing further strains upon the health system through lack of power, blocked roads and failures of mobile phone connections.

The performance of Australia's healthcare system was ranked second after the UK in the Commonwealth Fund's 11-country comparison in 2017 (Schneider *et al.* 2017). Yet even this health system struggled under the environmental crisis. Here, we reflect on the challenges and capacity of the health system to deal with such extreme events and identify areas to strengthen the resilience of health systems to better prepare and respond in the future.

Effects of extreme climate events on the Australian health system

A health system consists of all the organisations, institutions, resources and people whose primary purpose is to promote, restore or maintain health (World Health Organization 2015). The three main goals of a health system are to improve the health of the population, to improve the responsiveness of the health system to the population it serves and to provide social and financial risk protection (World Health Organization 2015). A health system achieves these goals through six interrelated core components or 'building blocks' (Fig. 2), which can be used for planning and decisions on funding and priority setting. We outline the immediate and continuing effects of this past summer on the Australian health system, focusing on these six building blocks.

Service delivery

Service delivery was directly affected through loss of facilities and infrastructure. Medical practices were literally burnt down in some towns (Public Health Association of Australia 2020). Pharmacies and medical centres lost power (Brooker 2020).

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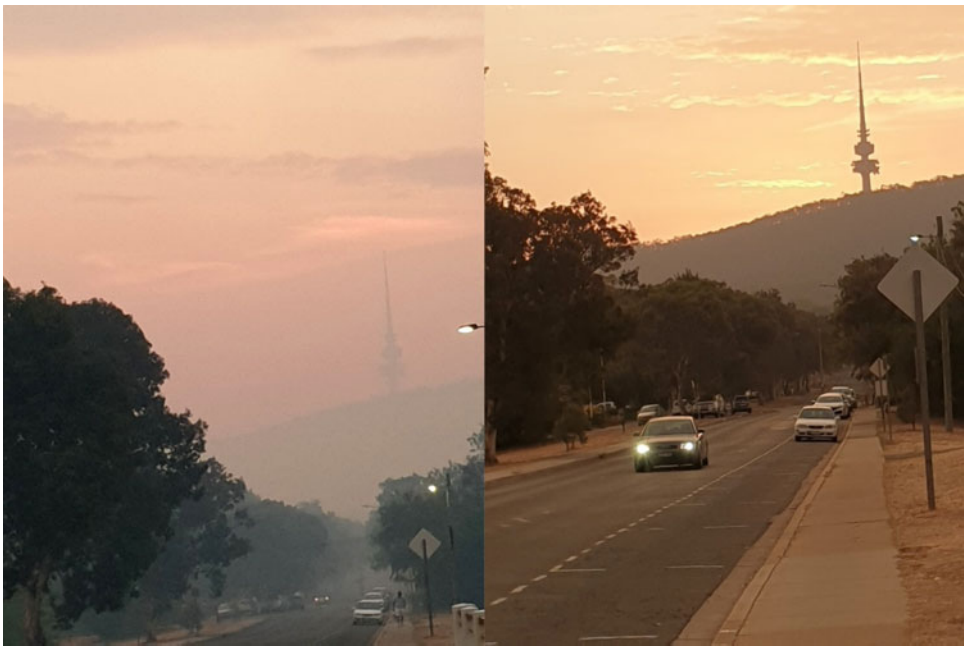

Fig. 1. Smoke pollution in Canberra from regional bushfires: the same view (*a*) 21 December (24-h $PM_{2.5}$ 269.7 ug m^{-3}) and (*b*) 22 December (24-h $PM_{2.5}$ 96.9 ug m^{-3}) at 4 p.m. in the evening (measured at the nearest air quality monitoring service, Civic (Central Canberra)) (Source: Aparna Lal).

Fig. 2. World Health Organization building blocks of health systems (World Health Organization 2015).

Five regional hospitals in New South Wales (NSW) and all their patients were relocated. Aged care patients were relocated to other towns, often into other aged care facilities already at capacity (Community Impact Group 2020). Health services that did not burn down were rendered almost non-functional by water scarcity and hot weather. Contamination of drinking water supplies and shortages were common in many bushfire-affected areas (Lal 2020). For rural communities in affected areas, whose resilience was already affected by the ongoing drought (Austin *et al.* 2018) or the experience of previous major bushfires (Bryant *et al.* 2018), the 2019–20 bushfires imposed significant mental burdens. The required service mix changed as a result of the fires, with more people requiring mental health services (Public Health Association of Australia 2020).

Nearly one-quarter of the NSW and Victorian Aboriginal populations live in the fire-devastated regions, comprising 5.4% of the bushfire-affected population, compared with 2.3% of the overall population of the states (Williamson *et al.* 2020). Aboriginal community-controlled health services, which have strong local roots and provide culturally safe care, were disproportionately affected by the bushfires. Some Aboriginal community-controlled health services were transformed into evacuation centres or distribution centres and temporarily unable to provide primary healthcare services (National Aboriginal Community Controlled Health Organisation 2020).

Medicine and technology

Supply chains for medicines broke down with road closures and loss of electricity in places that did not have generators (Brooker 2020). The states of Victoria and NSW were obliged to issue emergency public health orders to enable pharmacists to dispense medications (New South Wales Department of Health 2020; State Government of Victoria 2020). One hospital reported that the pervasive bushfire smoke and heat had caused magnetic resonance imaging and computed tomography scanners to fail, as well as contaminating sterile stocks (Evans 2020).

Health information systems

Health information systems include communications about healthcare provided to people during a climatic crisis and the information systems used by the healthcare services. The emergency information about the need to evacuate contributed to the relatively low loss of life during the bushfires. However,

information about how to manage the attendant environmental issues such as ambient smoke, water safety and medication management was less clear (Vardoulakis *et al.* 2020).

Many people evacuated from unliveable environments and who sought care in other rural health services found the available clinical health information systems insufficient, as 44% of all personal e-health records held no information at all (Australian Digital Health Agency 2020). Pharmacies with functioning electricity and which had data systems with information about patients' medications were able to dispense safely (Australian Digital Health Agency 2020). Clinical services without robust IT systems handed patients handwritten notes on their treatment (Public Health Association of Australia 2020).

Health workforce

The health workforce in rural areas destroyed by fires was already a fragile resource (Health Workforce Australia 2012). The bushfires placed extra strain on health staff who provide care to the community as first responders, to their fellow evacuees in places of evacuation, and as providers of ongoing health care (Public Health Association of Australia 2020).

Health sector funding

Severe climatic events reveal vulnerabilities in health sector funding. Primary care in Australia is delivered through small businesses charging a fee-for-service. Small communities with reduced incomes due to the effects of bushfire and drought may be unable to support a viable health service (Burns and Manderson 2020). The loss of a medical service in a rural community is a harbinger of the end of the community itself (Kenny and Duckett 2004).

Leadership and governance

Shortcomings in health system leadership and governance in relation to preparedness and response to severe climatic events may reflect limited awareness of the health sector to environmental crises, even as these events become more frequent. Of the health service managers and community members surveyed in NSW in 2018, 71% endorsed the statement that there was scepticism among health professionals about climate change (Purcell and McGirr 2018) Most health services do not have detailed plans for environmental crises such as massive bushfires. Those with plans are often developed in the wake of a bushfire and are not an integral part of national planning. An example is the detailed set of Victorian resources for preparedness and response in aged care facilities in a bushfire, developed after the 2009 bushfires (State of Victoria Department of Health 2010), but which was not included in the synopsis of national resources for aged care facilities during the 2019–20 bushfires. Community heat response plans are still underdeveloped across much of Australia and water security plans rarely include planning for environmental catastrophes.

Preparing health systems for a more extreme climate

Preparing health systems for resilience and effective functioning in a more extreme climate requires imagination and robust attention to ensure ongoing effective functioning of health services. Resilience is defined as the capacity of the health system to respond to, cope with and recover from health risks in a way that the essential functions and structure of the health system are maintained (World Health Organization 2015). To achieve this, each of the six building blocks has to become climate resilient (World Health Organization 2015).

First, leadership is essential for good governance, evidence-informed policy making and accountability within the health system, as well as for strategic planning to address the complex and long-term nature of climate change risks and their potential effects on the health system. This calls for collaborations to develop a shared vision among diverse stakeholders and coordinated cross-sectoral planning to ensure that policies are coherent and health-promoting, particularly in sectors that have a strong influence on health, such as water and sanitation, nutrition, energy and urban planning. Public health professionals and healthcare service providers must be at the table with other stakeholders when planning for extreme events.

Second, we need to ensure the viability and stability of service delivery. Options for emergency staffing methods if hospitals need to be evacuated (e.g. the role of the defence force) will require planning and preparation. A clear pathway for communication and service delivery options during such events is critical. Learning from our crisis response through reflection will help us to better prepare for the next event.

Third, health systems need to incorporate considerations about workforce capability and sustainability. Our future health workforce needs to understand the link between a changing environment and illness and recognise the potential implications for the well-being of their patients (Finkel 2019). A resilient health workforce will also require systems for relieving first responders directly affected by fires. The whole of the health workforce needs to be involved in supporting continuity of service provision, including aged care and primary care.

Fourth, we need technology to improve the resilience of health systems to extreme climate and related events. This includes providing stable energy sources that will function when the grid is interrupted and building facilities that are able to withstand heatwaves, fires and floods. A key recommendation of the Royal Commission following the 2009 Victorian bushfires was improving the building code to adequately fireproof hospitals and aged care facilities. Buildings that house health services in bushfire-affected and other high risk zones must be redesigned to withstand severe firestorms (Drew 2020) and have ventilation systems to manage ambient smoke, improve indoor air quality and protect the inhabitants from thermal stress (Haines and Dora 2012).

Processes to ensure the continuity of critical medicines supplied for doctors and pharmacists need to be incorporated into future plans. During the bushfires, pharmacies in the worst affected areas continued to supply medicines, frequently without power, and with no road access for resupply (Brooker 2020). Defence force helicopters were used to bring in medicines to restock dispensaries (Brooker 2020).

Fifth, clear, precise health information using evidence-based risk communication strategies (World Health Organization 2017) should be ready to go. Often the general public can be flooded with excessive information, without timely guidance on what is the most reliable, useful and practical advice. To ensure that risk communication strategies during extreme events are

effective, during and after the event, messages must be tailored for specific audiences including Indigenous communities, residents in different geographic areas and people with limited English language facility. Health information systems for clinical records must be optimised with increased uptake of personal health records, so that patients have up-to-date clinical records in a disaster.

Finally, the health effects of extreme events span the immediate, short-term and the long-term. This requires continued and stable funding to build expertise and capacity into the longer term health system response. After the fires, health resources were directed towards the immediate threats such as smoke inhalation or to intermediate needs such as psychological distress. Longer term strategies should include funding to enhance training for carers of patients with chronic health conditions and disabilities and preparing for the effects of heatwaves. Funding for research to study the medium to longer term effects creates an opportunity for co-learning across sectors to build a more resilient health system.

The way forward

The frequency and severity of extreme climate events have increased globally and will continue to escalate in the decades ahead (Diffenbaugh 2020; Swain *et al.* 2020). We need a radical shift in traditional thinking to build a resilient health system. To do this, we need to identify and address the flaws and failures in the health system when placed under stress. We need to engage with local communities, as well as across sectors, including the private sector. In Australia, the most developed health-focused plans for climate change adaptation are related to the effect of heat, with a national framework and local plans in place (PriceWaterhouseCoopers Australia 2011). Lessons from the 2019–20 bushfire season can be used to develop a national climate and health systems framework for bushfires, which can then be modified for floods, cyclones, drought-related effects and other extreme weather events.

Conflicts of interest

The authors declare no conflicts of interest

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