

Australian Journal of **EMERGENCY MANAGEMENT**

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About the Journal

The *Australian Journal of Emergency Management* is Australia's premier journal in emergency management. Its format and content are developed with reference to peak emergency management organisations and the emergency management sectors—nationally and internationally. The journal focuses on both the academic and practitioner reader. Its aim is to strengthen capabilities in the sector by documenting, growing and disseminating an emergency management body of knowledge. The journal strongly supports the role of the Australian Institute for Disaster Resilience as a national centre of excellence for knowledge and skills development in the emergency management sector. Papers are published in all areas of emergency management. The journal encourages empirical reports but may include specialised theoretical, methodological, case study and review papers and opinion pieces. The views in the journal are not necessarily the views of the Australian Government, Australian Institute for Disaster Resilience or its partners.

Aboriginal and Torres Strait Islander peoples are advised that this publication may contain images of deceased people.

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Contributions in the Research section of the *Australian Journal of Emergency Management* are peer reviewed to appropriate academic standards by independent, qualified reviewers.

Foreword

Dr John Bates, Bushfire and Natural Hazards CRC

Anniversaries provide a stimulus for us to pause and reflect, not just on what has happened in the past, but in what ways those lived experiences have influenced how we think and the ways we behave during times of stress and when we may be in fear for our lives.



At the time, the fires on Black Saturday in February 2009 were said to have been 'unprecedented'. In the last four months in Australia, we have had what are described as unprecedented fires in Queensland burning tropical rainforest and, in the Tasmanian wilderness areas, burning cool temperate rainforests. In the same period, there was massive flooding in Townsville and most recently, dual Category 4 cyclones simultaneously impacting on the north-east and north-west of the continent. All of this when Australia was experiencing massive droughts and recording record high temperatures.

There are two recurring themes from reviews of major disasters caused by natural hazards that affect public safety and preservation of life. These are the lack of acknowledgement or 'ownership' of real and present risks and an apparent unwillingness to agree with those around us (our partners, companions and family) on what we most value and what we want to protect. These factors underpin decision-making and contribute to the observed difficulties in making safe decisions in times of extreme stress. Until we as individuals and as a collective understand and own the risks that we are exposed to, we will continue to experience avoidable pain and suffering.

This issue of the *Australian Journal of Emergency Management*, shines a spotlight on some of the significant changes, borne from hard-won experience, that are helping to reduce the effects of natural hazards. The stimulus that came from the Royal Commission into the Black Saturday bushfires has been significant, driving changes in how we approach messaging in warnings and other communications, and helping us understand what

it means when someone makes a decision to stay and defend their property in the face of a massive firestorm. However, there is room for improvement in the levels of preparedness and planning if we are to minimise the short-and long-term impacts of major disasters caused by natural hazards on communities and environments. And more still needs to be done to understand why it seems so hard to avoid putting ourselves and those we love and care for in harm's way by walking and driving through floodwater.

Our approaches to relief and recovery have improved and the work of the Australian Red Cross is an example of this. But perhaps we are not yet as well developed in the way we plan to support people with disabilities who can manage their lives under normal circumstances but are frequently disadvantaged in crowded or temporary accommodation.

While there is always room for improvement, it is also important to share and acknowledge the benefits of the stories and the knowledge that we have gained and learnt. That is where publications like this are so important. As Editor-in-Chief, I am constantly impressed with what is being done and proud that we can help communicate this important work.

Dr John Bates
Editor-in-Chief
Australian Journal of Emergency Management

Research Director
Bushfire and Natural Hazards CRC

Black Saturday bushfires: counting the cost

Professor Mehmet Ulubasoglu and Farah Beaini, Deakin University Melbourne and the Bushfire and Natural Hazards CRC

When bushfires ripped through the heart of Victoria on a scorching Saturday a decade ago, the impact was likened to 1500 Hiroshima-style bombs exploding across the state.

In one of the world's worst bushfire events ever recorded, the Black Saturday bushfires claimed 173 lives, burnt 450,000 hectares of land, and destroyed 2000 homes and 1500 buildings. While the initial and obvious cost of the devastation was estimated, the more hidden and enduring economic loss is still being counted.

Ten years on, what economic legacy did Black Saturday leave the individuals and communities in its wake and how can this knowledge better protect us in the future?

Intangible costs

Calculating the full cost of a disaster such as the Black Saturday bushfires is a complex task that depends on a chain of influences such as geography, population and economic sectors.

While it's relatively straightforward to add up the tangible costs, estimating the long-term economic impact of a disaster on people's lives, health and wellbeing, business loss or disruption and clean-up, recovery and assistance activities is far more challenging.

As researchers within the Deakin Business School's Department of Economics and Centre of Energy, the Environment and Natural Disasters, we are working with the Bushfire and Natural Hazards Cooperative Research Centre looking at the income effects of the Black Saturday bushfires on the people who lived in the disaster-hit areas.

Income is a key indicator of economic resilience because the ability to bounce back to pre-disaster income levels shows an aspect of the individual's resilience to disasters.

Because disasters affect individuals differently, we delve beyond average income losses in the disaster-hit areas to examine different demographic groups such as gender, age, low income, middle income, high income individuals, homeowner status and how individuals in each sector were affected.

Until now, there has been a research gap in understanding the effects across different employment sectors. By examining the income changes in 19 sectors

we've been able to see how, over time, this calamitous event has rippled through communities and the broader economy.

Findings like this help policy makers better assess the levels of resilience and design effective plans for post-disaster interventions and assistance.

Methodology

Research commenced by computing the disaster severity of 12 non-contiguous bushfire hotspots of varying sizes within the state of Victoria. These 12 hotspots cover 37 Statistical Area-2s (SA2), which are medium-sized general-purpose areas that represent a community that interacts together socially and economically, roughly corresponding to postcodes. We found that the percentage of burnt areas in a given SA2 ranged between 0.1 and 72.2 per cent. These differences in the share of burnt areas provided useful information to see how incomes change across different levels of disaster severity.

Key data (income, residential SA2 and other economic, demographic and sectoral indicators) were gathered from the Australian Census Longitudinal Data of 2006 and 2011 of the Australian Bureau of Statistics. This meant we were able to track individuals and see how their situations had changed before and after the 2009 Black Saturday event.

We based this on a difference-in-differences approach that compared the incomes of individuals living in disaster hit areas before and after the catastrophe with those of individuals who live in the comparable neighbouring areas with no bushfire exposure.

Results

Not surprisingly, the results showed that the Black Saturday bushfires caused significant adverse economic effects to the incomes of those living in the disaster areas.



The township of Kinglake suffered the loss of many buildings.

Image: CSIRO

While incomes of males and female were affected there was a steeper decline in female income (14 per cent vs 9 per cent), individuals in the low-income group were most vulnerable with an 18 per cent drop.

While the income of employed people fell significantly (8 per cent), there was no significant income effect on unemployed individuals, presumably because they continued to receive their entitlements.

Looking at the incomes of different age groups, we found it was the 25-45 age group who experienced the most negative and significant income losses following the disaster.

Home renters suffered an average income loss of 14 per cent but the income decline for home owners was much less.

In terms of the individual's sector of employment, we found those who worked in agriculture lost 31 per cent of their income; the retail sector 13 per cent and the tourism sector 12 per cent.

However, individuals working in health care gained 8 per cent probably because they worked overtime. In economics literature this is known as the creative destruction effect of disasters.

Finally, individuals who moved out of the disaster zones are associated with a 19 per cent decline in their incomes.

These results confirm the need to dig deeper beyond aggregate and community trends and investigate the effects at the individual level.

The big four

There are four major implications from our research.

First, while average income effect is informative, the story is in the detail. Individual demographic groups and sectors of employment point to sizeable economic vulnerabilities.

Second, disaster recovery and relief assistance arrangements could be enhanced by considering an individual's vulnerabilities with a view to enhancing their economic resilience. In other words, there is room to re-think how we build a sustainable disaster recovery model on limited budgets.

Third, the migration effects of the Black Saturday bushfires are substantial. Bushfires are frightening and devastating. We found that the Black Saturday bushfires had permanent effects on an individual's location decisions in terms of moving out and not returning. This finding is also supported by anecdotal evidence.

Finally, the social effects were extremely negative and resulted in significant adverse mental health effects. Reduced incomes and financial capabilities were critical factors behind deteriorating mental health of the individuals who lived in the disaster zones.

The future

With the frequency and cost of natural disasters predicted to increase, research will play a crucial role in assisting governments with decisions on how to best allocate disaster funding. If there is \$100,000 in a budget, should it be spent on a fire truck or on bushfire prevention education? These are policy and decision-making problems and governments need the evidence to make these decisions appropriately.

Migration decisions – either into or out of – disaster-hit areas are also an important future avenue of research that could offer substantial policy implications.

A summer of extreme heatwaves

Andrew Gissing and Lucinda Coates, Risk Frontiers

Heatwaves are the most deadly type of natural peril in Australia, accounting for more deaths than the sum total of all other natural hazards.¹ Despite improvements in forecasting and warnings, more action is required to manage heatwave risk.

According to the Australian Bureau of Statistics, there were 114 fatalities between 2011 and 2017 as a result of excessive exposure to natural heat.² Recent heatwaves ran from November 2018 in Far North Queensland and finished with a burst of heat across Australia's south in late February 2019. According to the Bureau of Meteorology³, December and January were the hottest on record, with the entire summer the hottest recorded.⁴ Numerous cities and towns measured record high temperatures or exceeded previous records of the number of consecutive days above significant temperature thresholds.

Effects of heatwaves are typically not well reported, yet consequences are felt across the community, economy, environment and political spheres. In many cases, effects are compounded by drought, bushfire, poor air quality and water safety risks. It is tragic that 114 people drowned over the summer months.⁵

Australia's most recent heatwaves resulted in increased hospitalisations due to heat-related illness and increased visitations to waterways resulted in numerous drowning deaths. Additional demand for power during the heatwaves placed stress on electricity infrastructure and disrupted power supply to households and businesses. A heatwave in Victoria in January resulted in disruption of power to 200,000 customers who were advised to reduce their power usage.

Extreme temperatures posed significant risks to outdoor workers and, for some businesses, it was too hot to operate, resulting in temporary closure or the rescheduling of operations. There has also been impacts on business related to increased workforce absenteeism and lost worker productivity as experienced in previous heatwaves.⁶

The price of some vegetables increased in the latter half of February as supplies were affected. In some wine growing regions, grapes ripened quicker and required an earlier harvest.

The extreme heat contributed to large-scale fish kills in the lower Darling River⁷ and deaths of flying foxes in North Queensland and wild horses in Central Australia were attributed to heat stress.

Authorities have become proactive in providing heatwave alerts. The Bureau of Meteorology has developed heatwave forecast products and is drafting a heatwave warning framework. Communication with the most vulnerable, particularly the elderly, in advance of heatwave conditions is essential. The South Australian Red Cross activated its Telecross REDi service to reach out to people. It reported that from 1450 phone calls made, 270 people needed help including 17 who required ambulance assistance and five hospitalisation.⁸

Joint research between Risk Frontiers and the Bushfire and Natural Hazards CRC following heatwaves in 2017 found that many people did not act on heatwave warnings. Many were also reluctant to use cooling because of energy price concerns.⁹

Much more is needed to fully understand the effects of heatwaves across Australia given the likely increase in frequency as a result of climate change. Given the scale of mortality and disruption, the adoption of heat sensitivity in urban design, the adaptation of business practices and better risk communication are vital.

1 Coates L, Haynes K, O'Brien J, McAnaney J & de Oliveria FD 2014, *Exploring 167 years of vulnerability: an examination of extreme heat events in Australia 1844–2010*. *Environmental Science and Policy*, vol. 42, pp.33–44.

2 Australian Bureau of Statistics 2018, *Cause of Death, Australia, 2017*. Canberra, Australia.

3 Bureau of Meteorology 2019, *Special Climate Statement 68 - widespread heatwaves during December 2018 and January 2019*. Melbourne, Australia.

4 Bureau of Meteorology 2019, *High chance of drier and warmer than average autumn in the east following Australia's hottest summer on record*. At: <http://media.bom.gov.au/releases/645/high-chance-of-drier-than-average-autumn-for-eastern-australia-following-record-hot-summer/>.

5 Personal Communication: Amy Peden, Royal Life Saving Australia 6 March 2019.

6 Zander KK, Botzen WJ, Oppermann E, Kjellstrom T & Garnett ST 2015, *Heat stress causes substantial labour productivity loss in Australia*. *Nature Climate Change*, vol. 5, p.647.

7 Australian Academy of Science 2019, *Investigation of the causes of mass fish kills in the Menindee Region NSW over the summer of 2018–2019*.

8 Australian Red Cross 2019, *In South Australia, heatwave help is at hand*. At: www.redcross.org.au/news-and-media/news/telecross-redi-activated-in-sa [28 February 2019].

9 Tofas M & Gissing A 2017, *Rapid response report: study of heatwave impacts on residents and businesses in Western Sydney*. East Melbourne: Bushfire and Natural Hazards Cooperative Research Centre.

Cross-border response and resource management

Paul Considine, AFAC National Resource Sharing Centre

The AFAC National Resource Sharing Centre provides and coordinates international emergency management assistance and builds relationships between fire management communities.

The modern history of formal interstate resource sharing¹ dates back to 1994, when fire services across Australia contributed resources to combat fires in New South Wales. Since then, there have been many occasions when resources have been deployed across state boundaries including, the Sydney hailstorm in 1999, the Black Saturday bushfires in 2009 and the Queensland floods and Cyclone Yasi in 2011. Additionally, international resources have come to Australia from New Zealand, Canada and the United States and Australia has sent resources overseas when requested.

The Australian Government has plans in place such as COMDISPLAN and AUSASSISTPLAN to manage national and international emergency and disaster situations. These are regularly used to help Australian jurisdictions deal with significant events. State and territory fire and emergency services organisations have however, shouldered the bulk of the responsibility for administering fire and emergency service resource movements; initially communicating among themselves and, more recently, through the AFAC National Resource Sharing Centre.

The Australian Government has endorsed an arrangement whereby international calls for wildfire management assistance can be made directly from the United States and Canada to the AFAC National Resource Sharing Centre in Australia. This model for providing international emergency management assistance is built on many years of professional collaboration between the respective countries' bushfire management communities.

The way in which we share interstate and international resource requests is becoming increasingly important as we experience longer fire seasons and potentially more extreme storm and cyclone events. In the past decade, Tasmania has had three significant fire seasons, which it could not have managed without calling on interstate and New Zealand resources. The fires in Queensland at the end of 2018 were unprecedented and required significant interstate assistance to control. Overseas, British Columbia is regularly seeking international assistance as its own resources become depleted and other Canadian jurisdictions have exceeded their capacity to help.

AFAC recently hosted Serge Poulin from the Canadian Interagency Forest Fire Centre (CIFFC). CIFFC has been operating for 35 years meeting the need for Canadian jurisdictions to share resources efficiently and

effectively, and promote national situational awareness. Mr Poulin provided constructive feedback on our operations and on streamlining current arrangements with Canada.

The most significant message to come out of Mr Poulin's visit is that the AFAC National Resource Sharing Centre is on the same journey that CIFFC has been on for the past three and a half decades and is likely to evolve in a similar way, because that is what adds most value to the participants in resource sharing. Developments the AFAC National Resource Sharing Centre may see include:

- standardisation of resource typology, leading to more efficient requests and supply
- resource requests being brokered through the AFAC National Resource Sharing Centre, simplifying planning and improving national situational awareness
- flat rates for cost recovery for resources to simplify and speed up invoicing
- a national system of preparedness levels to create clearly defined trigger points for the use of international resources from New Zealand and further afield.

If the future holds longer, more intense operational seasons, then resource sharing across state and national boundaries will be the most cost-effective and practical way of managing resources. Smaller states and territories may simply be unable to afford to maintain emergency response resources to the extent of the risk potential they face, and even larger jurisdictions can expect to run up against resource constraints in their worst operational seasons.

The implication of this is that state and territory fire and emergency services agencies need to cede a measure of autonomy to make a national system work. The AFAC National Resource Sharing Centre has demonstrated that this is achievable. If we compare the arrangements we have in place today to the arrangements in place ten years ago (or even back in 1994) we can see the progress to a mature industry model of national and international cooperation in resource sharing. We must build on and maintain that momentum now: in more ways than one, we cannot afford not to.

¹ Beyond the 'closest resource' response that has been going on at a local level across state borders for decades.

The emergency manager as a regulator

Geoff Conway AFSM, Crossbow Consulting Services

A number of industries in Australia have come under close scrutiny in recent years and the revelations have been less than flattering. The government agencies that regulate those industries have been just as keenly scrutinised and their performance has been shown to be wanting.

Emergency services organisations (ESOs) have also had their share of scrutiny. Their performance in preparing for and managing the response to emergencies has attracted criticism. But what of the role of ESOs as a regulator? These agencies, particularly fire services and land management agencies, often have obligations under their own legislation to regulate industry in those areas where a hazard is present by the very nature of the work. They are also called on to support other regulators through the provision of specialist advice.

ESO personnel exercise their roles in preparedness and response through relationships based on trust. ESO personnel are usually experts and have earned the respect of others in their field.

As a regulator, they often require industry members to act on observations of weakness or oversight. These actions can incur significant expense and the potential for tension and conflict in these relationships is ever-present.

To be effective, the emergency service regulator must have a deeper understanding of the industry they are regulating; not just an awareness of the hazards and associated risk. The regulator must understand the context in which the industry manages those hazards and risks. If an ESO officer is to have any influence they must be credible. Regulatory decisions taken or directions given that have no regard for context will be resisted and open to challenge. The regulator's effectiveness comes from an understanding of the law and how to apply it consistently and proportionally.

To illustrate, fire services have regulations for the use of fire in the open, especially where it can potentially escape and threaten others. Most jurisdictions have systems of permits that allow for the use of fire as well as equipment that could be a possible ignition source at times of elevated fire danger. Fire service officers understand the risk of ignition and the nature of fire propagation. Their knowledge of risk and risk management is extensive.

Fire service officers as regulators must understand the nature of the industries that use fire or equipment that could cause a fire. If a permit is granted for these purposes, it must reflect a solid understanding of how the risk is generated, mitigated and managed. The conditions imposed through permits should complement this.

There is ample guidance for regulators at both national and international levels. The Australian, state and territory governments have published documents that reflect the principles of collaboration, consistency, efficiency, intelligence-led, outcomes-focused, proportionate, risk-based and transparency. These are well understood and one would hope they are applied.

When ESO officers are required, as part of their role, to regulate risks within the communities they serve, there must be a deep understanding of context. The regulator must demonstrate a credible understanding. They must be able to recognise the occasions where the people are obfuscating or misleading them – a rare but not unheard-of situation. They must be able to act with credibility and apply the law in context.

The relationships they have with those they are regulating is different to that of the emergency service responder. They must be able to act in both environments.

A key principle of good regulatory practice suggests that the regulator should be 'driven by outcomes'. Emergency service personnel understand the importance of the concepts of flexibility and adaptability. These can be applied effectively in the regulatory task as well. If you understand context and if you understand the nature of the relationship between the regulator and those subject to regulation, then achieving the community's expected outcomes from the regulatory process is far more likely.

What do we really mean by 'floodwater' and is it ever ok to enter?

Dr Melanie Taylor and Dr Katharine Haynes, Macquarie University and Bushfire and Natural Hazards CRC

Flood safety messages used extensively and consistently in Australia are 'If it's flooded, forget it', 'Never drive, ride or walk through floodwater', 'Don't play in flood water'. These messages are clear, unambiguous and definitive. The problem is, people continue to enter floodwater.

In partnership with State Emergency Services across Australia, we are looking at flood risk communication and examining the two behaviours most closely linked to flood fatalities; driving into and recreating in floodwater. This is part of the Bushfire and Natural Hazards CRC Flood Risk Communication research.¹

To assess the problem, we started with fatality data. Our analysis of vehicle-related flood fatalities showed that 96 people died in 74 separate incidents between 2001 and 2017.² Over that time, 51 people died recreating in floodwater³ and many of these fatalities were children or young adults. While fatality data provides the contexts and the numbers of individuals caught up in these situations, they tell us nothing about the incidence of entering floodwater generally. Why do people continue to enter floodwater against expert advice?

We collected data about people entering floodwater using a nationally-representative sample of 2000 adults. Although we are still working on a detailed analysis, we found that 27 per cent of respondents had entered floodwater and 18 per cent had entered flooded rivers, either on foot (wading or swimming) or in boats (on boards or inflatables). Over half of respondents (56 per cent) reported driving through floodwater at least once, with more than half of those doing so in the last five years. More than 1100 people described recent or memorable incidents and, interestingly, in 90 per cent of cases, there was no vehicle damage or consequence of their action to drive through floodwater. So, although many people enter floodwater, and it has resulted in around nine fatalities a year, most of the time there are no adverse consequences.

Given the general hard-line advice in official messaging to date and the reality that many people do enter floodwater, we started thinking critically about the contexts in which people do this. Are all floodwater situations equal? What do we really mean by 'floodwater' in the formal messaging? Are there situations when these messages don't apply? Who may enter floodwater and when, if ever, is it acceptable?

Media coverage of recent flooding in Townsville in Queensland⁴ provided us with an abundance of images of people in and around floodwater to review. Figure 1 is a selection of images from this flood event, the majority of which appeared in broadcast media as photographs and online video news articles.

Many images included personnel from response organisations (e.g. emergency services, military and journalists) standing in or appearing to stand in floodwater. Video showed personnel moving around on foot in floodwater or driving through floodwater. These people are at work and on duty; arguably doing what needs to be done in flooded conditions. Images of residents in floodwater were equally interesting. They showed people also doing what needs to be done. Images showed residents in kayaks checking on their property, in tinnies or inflatable boats retrieving belongings and standing in floodwater rescuing pets. However, there were images of people wading waist or chest deep in floodwater with no apparent purpose. There were people in floodwaters bare-footed or in thongs. There was also young people and children wading in floodwater, some holding the hands of adults or playing in floodwater. This raises questions of in what situations is it acceptable to enter floodwater and to whom does the official flood safety messaging pertain?

1 Flood Risk Communication research project. At: www.bnhcrc.com.au/research/floodriskcomms.

2 Haynes K, Coates L, van den Honert R, Gissing A, Bird D, Dimer de Oliveira F, D'Arcy R, Smith C & Radford D 2017, *Exploring the circumstances surrounding flood fatalities in Australia—1900–2015 and the implications for policy and practice*. *Environmental Science and Policy*, vol. 76, pp.165–176. doi:<https://doi.org/10.1016/j.envsci.2017.07.003>

3 Ahmed MA, Haynes K & Taylor M (in press) *Vehicle-related flood deaths in Australia, 2001–2017*.

4 Images are from a single flood event however, similar images can be found during any large-scale flooding event. No criticism of emergency services personal or residents is intended. Images are selected to convey the complexity and provide reference for the reader.

Few would question the broadcasting of positive images of emergency services personnel rescuing people and moving around flooded neighbourhoods in boats. However, what impact does the broadcast of images of responders (and others) entering floodwater have on the public, when they are told not to do so. What is the interpretation of official flood-risk messaging and how does that prompt people's subsequent behaviour? This aspect is important, but it's not new. A Churchill Fellowship by NSW SES Media and Communications Manager Phillip Campbell in 2014⁵ found that this issue was being struggled with internationally and that the minimal research in this area offered no answers. Little has changed.

In conclusion, although messages like 'If it's flooded, forget it' (Australia), 'Turn around, don't drown' (United States) and 'Stay out of floodwater' (New Zealand) are memorable, public behaviour suggests they are

easily discounted. Simple slogans don't provide advice about what to do or how to cope. Moreover, their uncompromising nature leaves emergency services agencies in danger of undermining their own messaging. There is very limited opportunity to enter into a public discourse about how to assess risk if the message is just to avoid it. In contemporary emergency management there is now an emphasis on public self-reliance and shared responsibility to support community resilience. To succeed, these principles require a shared ownership of the risk. Maybe taking a step back could allow for new and effective approaches to be employed to protect public safety during times of flood.

5 Campbell P 2014, *Effects of media images on influencing unsafe behaviour in disasters*. Churchill Trust Fellowship Report. At: www.churchilltrust.com.au/media/fellows/Campbell_P_2014_Effects_of_media_images_on_influencing_unsafe_behaviour_in_disasters_1.pdf.

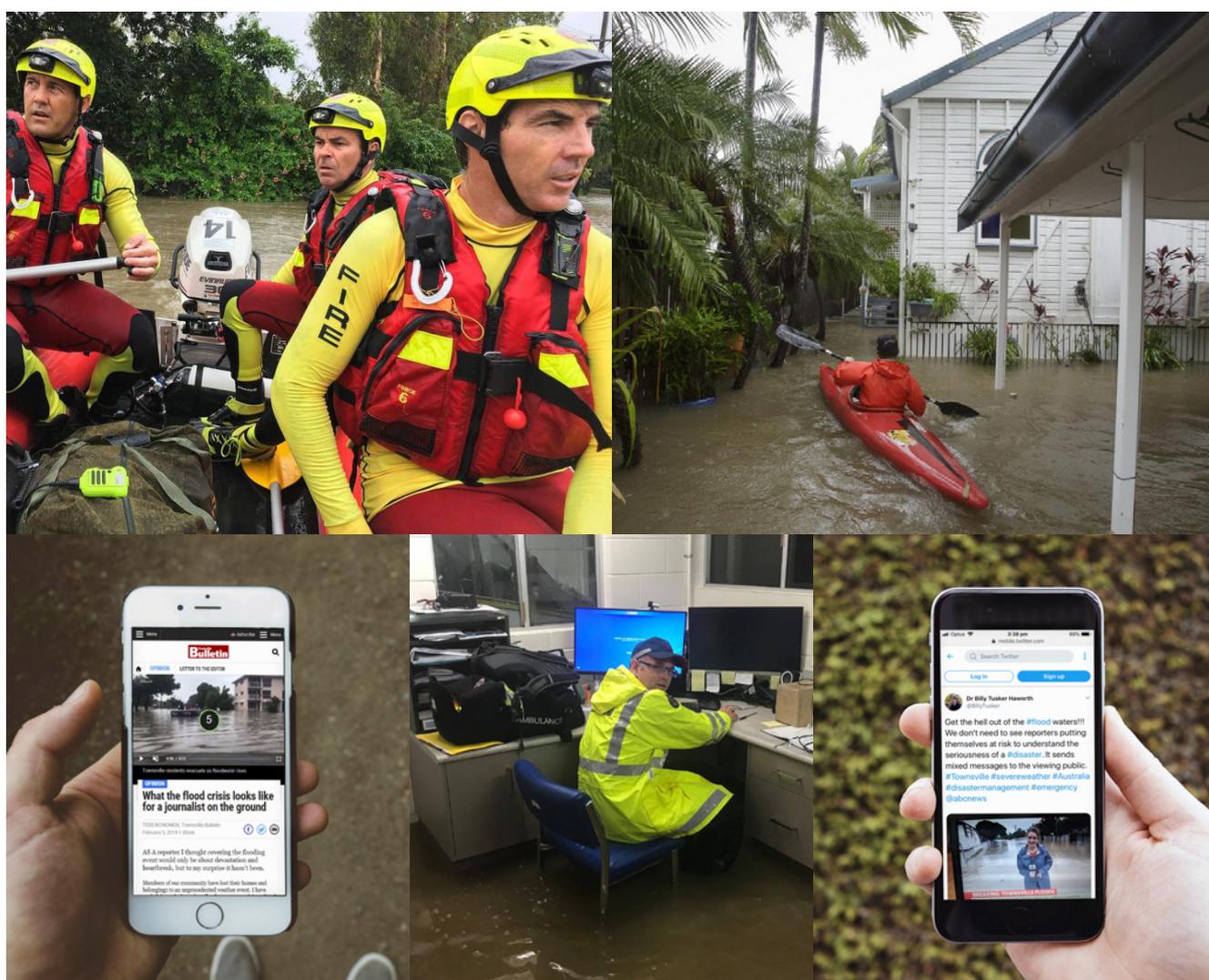


Figure 1: An assortment of images in the media and on social media that may send mixed messages to the public about entering flooded places.

Tropical Cyclone Oma: a near miss for Brisbane

Dr Thomas Mortlock and Lucinda Coates, Risk Frontiers

In February 2019, Tropical Cyclone Oma caused alarm in South East Queensland as the Category 2 system tracked south and then west in the Coral Sea. Some forecasts suggested it could make landfall near Brisbane but eventually it tracked back out to sea. While people in the Brisbane area had a near miss, there are some interesting aspects of this event regarding its track, position and damage potential that are worth noting from a hazard mitigation perspective.

Cyclone hazards can be significant without landfall

In Australia, the most hazardous tropical cyclones have been associated with strong winds and heavy rain associated with landfall. However, significant coastal damage can still occur without a cyclone making landfall. Tropical Cyclone Oma was a good reminder of this. As the cyclone approached the Queensland coast, it was caught in an upper troposphere stream that caused a 180-degree turn to the north and the system ran parallel to the coast for approximately 700 km offshore (Figure 1).

At the Brisbane wave buoy, located east of North Stradbroke Island, significant offshore wave heights of over five metres were measured between 23 and 25 February. Maximum wave heights exceeded ten metres over this period.² A significant wave height of five metres at Brisbane is higher than 99.9 per cent of all waves occurring in this area since 1997. Wave periods were around 13 to 15 seconds, meaning these waves were travelling at around 70 km per hour.

The waves generated from Cyclone Oma were felt as far south as Sydney and north to Bundaberg. At Byron Bay, wave conditions were similar to those recorded at Brisbane, with significant and maximum wave heights exceeding five and ten metres, respectively. At Coffs Harbour, wave heights exceeded four metres.

These waves carry a huge amount of kinetic energy; around 170 kW per metre wave crest length. This is about the same as a typical car engine, bound in a single metre length of the wave. Large waves caused coastal erosion on the Sunshine Coast and Gold Coast and into northern NSW. Beach and dune erosion were exacerbated by spring high tides, which meant waves were able to erode higher up the beach slope.

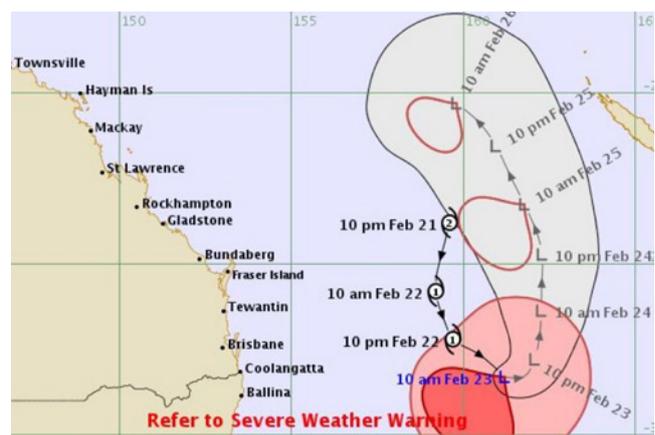


Figure 1: Observed and forecast track of Tropical Cyclone Oma at 10 am on 23 February 2019 in the Coral Sea.

Source: Bureau of Meteorology 2019¹

Coastal inundation was limited and, of the flooding that did occur on the coast, images and videos shared on social media indicated this was mostly wave-driven. Large waves lead to super elevation or 'setup' of coastal water levels in the surf zone, equivalent to approximately 15–20 per cent of the offshore wave height. This means that five metre waves offshore can increase water levels at the coast by up to one metre above the tide level (Figure 2). For this reason, activities such as rock fishing or rock-pool swimming are highly dangerous during large wave events, even if the cyclone is 700 km offshore.

¹ Bureau of Meteorology 2019, *Tropical cyclone forecast track map*. At: www.bom.gov.au/products/IDQ65002.shtml [23 February 2019].

² Significant wave height is equivalent to the average of the highest one-third of waves observed within an hour.



Figure 2: Wave setup resulting in beach inundation and vehicle damage at Rainbow Beach, north of the Sunshine Coast.

Source: Rainbow Beach Towing and Roadside Assist³

On the Gold Coast, water levels reached the highest astronomical tide (HAT) level, while around Brisbane and on the Sunshine Coast, levels remained below the HAT. Most coastal infrastructure is designed using HAT as a baseline, thus large-scale coastal flooding was not seen. However, some locations around Brisbane and the Sunshine Coast adjacent to tidal rivers experienced minor flooding (Figure 3), which calls into question the capacity of these areas to deal with larger flood events and the impacts of sea level rise.

Oma's southerly track was unusual but not unprecedented

Over the last 50 years, most tropical cyclones in Australia have remained equatorward of 25° South but occasionally they track lower into South East Queensland. Risk Frontiers maintains a database of natural hazards in Australia dating back to 1788 (considered complete from 1900). The *PerilAUS* database shows there have been 46 tropical cyclones near Brisbane and the Gold Coast. Most have been minor; the most damaging were tropical cyclones Dinah in January 1967 and Wanda in 1974.

The entry in *PerilAUS* for tropical cyclone Dinah is:

Dinah developed in the central Coral Sea and tracked southwest before recurving just off the Queensland coast between Gladstone and Bundaberg. The system caused severe damage at Heron Island initially from inundation from large NE swells and then a day later from winds. Although the system remained off the coast, winds caused damage along the coast between Rockhampton and Grafton. Huge seas and storm surge caused severe erosion at Emu Park, Yeppoon

and in the Maryborough to Bundaberg area. More than 100 homes were flooded and at Cribb Island 1 house was washed into the sea. Storm surge also affected the Gold Coast with water lapping on the decking of the Jubilee Bridge which is about 1.5 metres above highest astronomical tide. A section of the esplanade collapsed at Surfers Paradise. A similar storm surge occurred on the Tweed River isolating Fingal.

In addition, the 'Great Flood of 1954', which resulted in the largest flooding on record for northern NSW and South East Queensland, was caused by a tropical cyclone that made landfall just inside the Queensland border at Coolangatta.

Previous research by Risk Frontiers estimated the likely insured and economic costs of a similar event to the Great Flood of 1954 occurring today.⁴ The lower-bound estimate of the insurance loss using current exposure and assuming 100 per cent insurance penetration for residential buildings and contents was \$3.5 billion, which would make it the third-highest ranked insured loss due to an extreme weather event in Australia since 1967. The corresponding and normalised economic loss was estimated at \$7.6 billion.

Tropical cyclones may shift south with global warming

Research suggests that southward-tracking tropical cyclones may become more frequent with anthropogenic global warming.⁵ The assumption is that preferential warming at lower latitudes extends atmospheric conditions favourable to cyclones further south. In addition, a southward extension of the warm-water East Australian Current that runs down the east coast of Australia, may elevate sea surface temperatures providing an extended energy source for tropical cyclones into the South Coral and North Tasman seas.⁶

If this trend were to eventuate, this could signal increased tropical cyclone risk for Brisbane and Perth. These two cities do not regularly experience tropical cyclones but have large potential exposure compared with the lesser populated areas in northern areas of Queensland and Western Australia.

3 Rainbow Beach Towing and Roadside Assist 2019, *Mudlo's victim this morning*. At: www.facebook.com/170992086298033/posts/2240918175972070/ [22 February 2019].

4 Roche KM, McAneney J, Chen K & Crompton R 2013, *The Australian Great Flood of 1954: Estimating the Cost of a Similar Event in 2011*. *Weather, Climate and Society*, vol. 5, pp.199–209.

5 Kossin JP, Emanuel KA & Vecchi GA 2014, *The poleward migration of the location of tropical cyclone maximum intensity*. *Nature*, vol. 509, pp.349–352.

6 Cetina-Heredia P, Roughan M, van Sebille E & Coleman MA 2014, *Longterm trends in the East Australian Current separation latitude and eddy driven transport*. *JGR: Oceans*, vol. 119, pp.435–4366.



Figure 3: Minor river flooding in Maroochydore, Sunshine Coast associated with high spring tides and the storm surge component from Cyclone Oma.

Source: Bruce Atkinson⁷

Sea-level rise and marine heatwaves add to cyclone severity

Sea level is projected to rise between 0.5 to 0.9 metres in the Brisbane area by 2090, relative to the 1986–2005 mean.⁸ A 0.9 metre rise would have increased the total inundation of Tropical Cyclone Oma by approximately 60 per cent. The observed flooding, which barely exceeded the HAT level during Cyclone Oma, demonstrates a significant vulnerability to sea level rise particularly around creeks and rivers with a tidal component.

It is worth noting that these estimates of sea level rise are highly uncertain and could be considerably larger depending on the response of the Antarctic ice sheet to global warming. Previous periods in the Earth's past with comparable temperatures to today experienced sea level rise in excess of six metres higher than present day levels. It is perfectly conceivable that the rate of sea level rise over the next 100 years may be two to three times greater than current projections if the West Antarctic ice shelf 'decouples' (Ian Goodwin, *pers. comms.*).

For areas north of Rockhampton, sea level rise coupled with the effects of prolonged marine heatwave events could increase exposure to cyclone-related coastal hazards. At present, the Great Barrier Reef significantly attenuates wave energy during cyclone events.⁹ A reduction in the roughness and depth of coral reefs (as occurs during bleaching events and subsequent die-off associated with marine heatwaves)¹⁰ will likely reduce the wave energy dissipation effect reefs have for the adjacent mainland coast. An event such as Tropical Cyclone Oma may therefore have more impact in the future simply by virtue of higher mean sea levels and coral bleaching and die-off, without considering uncertain changes in tropical cyclone climatology.

Tropical Cyclone Oma was a near miss for the highly populated area of South East Queensland but serves as a reminder of the vulnerability of this area to present and future tropical cyclones compounded by a rise in the mean sea level.

The Risk Frontiers tropical cyclone loss model, *CyclAUS*, models a 50,000-year tropical cyclone climatology under present-day climate conditions for the Australian region and can be used to explore scenarios and changes in cyclone activity and sea-level rise on the Australian coast. The Risk Frontiers *PerilAUS* database provides a longer-term view of cyclone risk in South East Queensland.

For further information, contact thomas.mortlock@riskfrontiers.com.

⁷ Bruce Atkinson 2019, *Water expected to come over Bradman Avenue at Maroochydore with the high tide*. At <https://twitter.com/bruceatkinson17> [23 February 2019].

⁸ CSIRO and Bureau of Meteorology 2015, *Climate Change in Australia. Projections for Australia's NRM Regions*. Technical Report, CSIRO and Bureau of Meteorology, Australia.

⁹ Gallop S, Young IR, Ranasinghe R, Durrant TH & Haigh ID 2014, *The large-scale influence of the Great Barrier Reef matrix on wave attenuation*. *Coral Reefs*, vol. 33, pp.1167–1178.

¹⁰ Hughes TP, Kerry JT, Alvarez-Noriega M, Alvarez-Romero JG, et al. 2017, *Global warming and recurrent mass bleaching of corals*. *Nature*, vol. 543, pp.373–377.

Australian Red Cross deployment, Townsville, February 2019

| Amanda Lamont, Australian Red Cross volunteer

Australian Red Cross emergency service volunteers from across Australia have provided support to people affected by the unprecedented monsoonal floods in North Queensland.

By 14 February, over 50 schools and early childhood centres had been closed, over 1800 homes were damaged by floodwaters and people were without power. Over 31,000 applications for emergency hardship assistance had been received and more than \$5.5 million had been paid in benefits.

The Australian Red Cross was activated by the Queensland Government to support the flood response and recovery. Their role was to provide psychological first aid in recovery centres and in the community. Red Cross also reconnected people who had been separated or had lost contact during the disaster using the Register.Find.Reunite.¹ service.

The first wave of Red Cross volunteers came from within Queensland, but as more resources were called on, the Australian Red Cross national deployment system supported the mobilisation of volunteers from across Australia, from as far away as Bunbury in Western Australia.

The Queensland Department of Communities was responsible for the recovery centre where volunteers were deployed. The centre included services from the Queensland Department of Communities, Centrelink, Salvation Army, Lifeline, Save the Children, Orange Sky (a free, mobile laundromat), Housing Assist and Australian Red Cross. Insurance and telecommunications companies were also present.

Conditions on the ground were challenging. Townsville was entering a week of heatwave with temperatures exceeding 37 degrees every day. At the recovery centre, volunteers met people as they arrived, listened to their stories and provided psychological first aid as they waited for assistance.

In just four days the team met with over 1000 people. For some, it was simply a friendly hello or goodbye. For others, the team spent over an hour with them as they came to terms with their situation and rallied their strength and resources for the long road to recovery.

Connecting people with support and encouraging self-efficacy are important elements of psychosocial



The Australian Red Cross volunteers supporting one of the Townsville Recovery Hubs in February 2019.

Image: Amanda Lamont

support. When people are preoccupied with the urgency of cleaning mould, arranging for rubbish removal, managing jobs and businesses and supporting others, they often don't take the time to look after their own physical and mental health needs. Supporting people in the recovery centre is important, as this is often the time when the emotion and stress catches up and their resilience starts to falter.

The unprecedented monsoonal floods in North Queensland have had a devastating impact on people and property and will be followed by a long road to recovery.

¹ Register.Find.Reunite. At: www.redcross.org.au/news-and-media/media-centre/media-releases/dfgdfg.

Queensland's Disaster Management Officer's Network

Sarah Dean, Tablelands Regional Council, Matthew Dyer, formerly of Bundaberg Regional Council and Nicola Moore, Office of the Inspector-General Emergency Management

Before, during and after emergency events and disasters, local government employees are often at the frontline and play a significant role in coordination and communication for their communities. In Queensland, the Disaster Management Officer's Network allows these people to connect, keep up with developments in disaster management arrangements and to share their skills, knowledge, resources and ideas.

Disaster Management Officers (DMOs) are, in many cases, stand-alone employees within councils and face significant challenges and limitations in being able to meet the needs of their communities. Some councils have full-time, permanent DMO capacity, but most do not.

The Office of the Inspector-General Emergency Management co-designed the Disaster Management Officer's Network in collaboration with DMOs. Creating a community-of-practice where practitioners support each other in delivering world-class disaster management services and identifying and implementing best practice. The DMO Network is the first state-wide, peer-driven network of DMOs from local governments in Australia. Its success is based on its genuine intent and the authentic engagement of DMOs in its development and implementation.

The network operates through regular virtual meetings and a secure online discussion and repository platform.

There is also a three-day, face-to-face forum held each year. Network members are disaster management staff, local disaster coordinators and chief executive officers from the majority of 77 local councils from across Queensland.

The value of the DMO Network has seen membership and outputs boom since its commencement in 2016. In February 2019, the network comprised 98 registered members from 55 councils (70 per cent of all local councils in Queensland) and boasts more than 370 years of combined emergency management experience.

Ready access to this collective knowledge supports DMOs in further promoting a sense of shared responsibility within their councils, local disaster management group, stakeholders and local communities.

At DMO Network forums, members identified four themes that help them effectively influence stakeholders and engage better with their communities:

SMO Network Membership

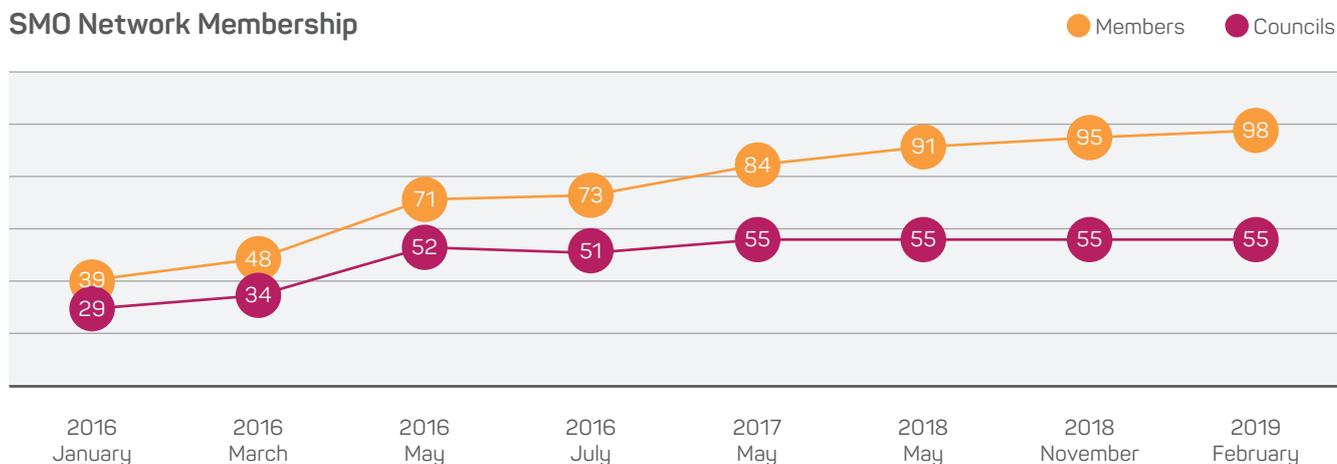


Figure 1: DMO Network membership growth.

- **The future of disaster management: the role as influencer** identifies the drivers of disaster management and ways to influence decision-makers in councils, communities and within the emergency management sector, using an evidence-based approach of research that generates trustworthy data.
- **Capitalising on capability: empowering and enabling** identifies the varied capacities across councils, how DMOs and councils support each other and ways to improve collaboration for shared responsibilities as outlined in the *Standard for Disaster Management in Queensland*.¹
- **Stakeholder engagement: recipes for success** identifies ways to involve and mobilise local disaster management groups to build community resilience before, during and after events.
- **Mobilising community: collaborating and empowering through partnership** identifies ways to entrench disaster management practice within communities and create a whole-of-community approach.

The DMO Network has provided benefit beyond local practitioners to councils, communities and the emergency management sector by:

- strengthening relationships between councils
- creating skills and knowledge for members
- sharing valuable information and resources
- helping DMOs achieve important community outcomes as well as address commonly experienced issues
- giving access to local staff from 55 councils to collaborate on state-wide initiatives.

As disaster management continues to evolve in the contexts of climate changes and geographically, economically and ethnically diverse communities, the DMO Network will be supported and its growth driven by its members with opportunities to link with state agencies and academics.

¹ Standard for Disaster Management in Queensland. At: www.igem.qld.gov.au/assurance-framework/Pages/standard.aspx.

Vale Professor Beverley Raphael AM

It is with sadness that we mark the passing of Beverley Raphael on the 21 September 2018.

Beverley was the psychiatry subject matter expert and member of the Australian Health Protection Policy Committee and its several predecessor entities for the best part of two decades; guiding decision-makers and providing advice to governments on all aspects of mental health in the management of disasters.

Bev was an articulate and persistent advocate for mental health in disaster response and recovery, not only for people affected by disasters but also for first responders, particularly in health emergency management including policy makers and public servants. Bev had a keen interest in chemical, biological and radiological terrorism and the potential mental health effects of such events on the population.

She was a keen contributor to health emergency management at the national level because it gave a voice to mental health in the response and recovery phases, underpinned by the science of psychiatry. Often, discussions would be interrupted when Bev politely interjected with important wisdom that others had not considered. Her sense of humour and self-deprecating manner as well as her sharp wit endeared her to everyone, even former students who did not excel in matters of psychiatry!

She was a former Chair of Psychiatry at the University of Queensland and nearly failed me when I was a medical student; something we joked about together when sitting in committee meetings. Getting to know Bev gave me a new-found respect for her specialty and the way in which she practised and taught.

In her career, Bev held chair positions in psychiatry at the University of Newcastle, University of Queensland and the Australian National University. In addition, reflecting a very practical application of her high-level academic work, Bev headed mental health services delivery for NSW Health for a decade.

Bev was appointed a Member of the Order of Australia in 1984 for services to medicine, particularly in the field of psychiatry. Her valuable contribution will be greatly missed.

Dr Gary Lum AM BMedSc, MBBS, FRCPA, FACTM, FASM
Australian Government Department of Health



Earthquakes happen in Australia, but are we prepared?

Jane Sexton, Trevor Allen and Mark Edwards, Geoscience Australia

People in Australia are surprised to learn that hundreds of earthquakes occur below our feet every year. The majority are too small to feel, let alone cause any damage. Despite this, we are not immune to large earthquakes.

Australia records at least one magnitude 5 earthquake every year and a magnitude 6 approximately every ten years. In 1968, the small town of Meckering in the wheatbelt of Western Australia was devastated by a magnitude 6.5 earthquake. And who can forget the loss of 13 lives in Newcastle almost 30 years ago from a magnitude 5.4 earthquake?

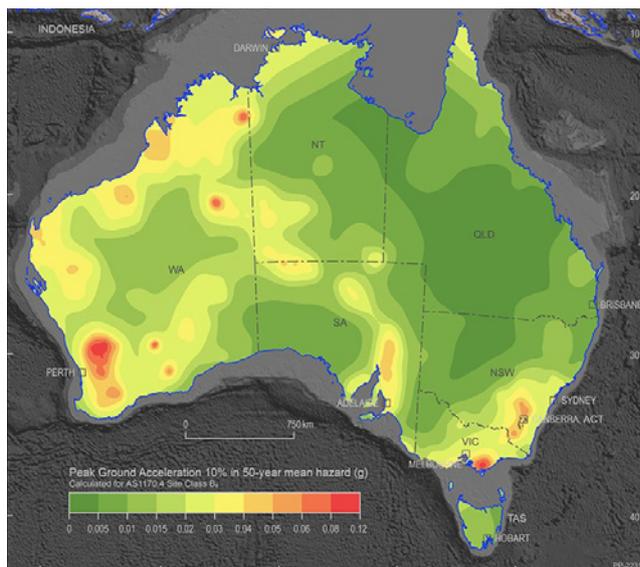
Earthquake scientists, engineers and emergency managers are always working to answer questions of where the next damaging event will occur and how we can better prepare. It's impossible to accurately predict when and where an earthquake will occur, but the history of earthquake activity in a region can tell us a lot about its potential risk for the future.

Many buildings in Australia are constructed without taking earthquakes into consideration. In the aftermath of the Newcastle earthquake in 1989 the earthquake loading standard was incorporated into National Construction Code 1990. This standard requires information on the level of ground shaking that has a ten per cent likelihood of being exceeded in a 50-year period.

The Geoscience Australia National Seismic Hazard Assessment (NSHA) helps define the level of earthquake ground shaking across Australia that has a likelihood of being exceeded in a given time period. The NSHA provides the information required for the Code as well as information for much longer time periods that are required for critical infrastructure.

In October 2018, Geoscience Australia released a new version of the NSHA. This update introduced a host of improvements including converting the earthquake catalogue to a Moment magnitude scale to replace the 1930s-era Richter magnitude scale. The Moment magnitude scale provides a physically based representation of an earthquake's size and provides consistency with models that estimate ground shaking.

Earthquakes can occur in unanticipated locations where there may be no historical observations. In May 2016, a magnitude 6.1 earthquake ruptured over 20 kms of the ground surface in a remote area west of Uluru in Central Australia. Rupturing of the surface is a rare event in Australia. In November 2018, a magnitude 5.7 earthquake in the Lake Muir region of south-west Western Australia ruptured the surface, this time 6–7 km in length. These events resulted in minimal damage. The same rupture under a major city would have severe to catastrophic effects.



National Seismic Hazard Assessment of Australia map.

Image: Geoscience Australia

It is impossible to say where the next damaging earthquake will occur, so being prepared for future events is critical. What we can do is be aware of earthquakes and educate people on what to do in the event of an earthquake. Communities can also investigate options to improve homes and buildings to be better prepared should an event occur.

Geoscience Australia is part of a collaborative project with the Shire of York, the WA Department of Fire and Emergency Services and the University of Adelaide to reduce the vulnerability to a major earthquake of the township of York. With this knowledge, the Shire of York, and other towns with similar structures, can strengthen their valuable buildings and be a more resilient community. The project is part of the Bushfire and Natural Hazards CRC project, 'Cost-effective Mitigation Strategy Development for Building related Earthquake Risk'.

The National Seismic Hazard Assessment is available at www.ga.gov.au/nsha.

People from refugee backgrounds contribute to a disaster-resilient Illawarra

Shefali Juneja Lakhina and Dr Christine Eriksen, University of Wollongong, Jenny Thompson, Wollongong City Council, Raquel Aldunate, Illawarra Multicultural Services, Joshua McLaren, NSW State Emergency Service and Sherryl Reddy, Strategic Community Assistance to Refugee Families

This case study summarises key outcomes from a collaborative research project conducted in the Illawarra, NSW in 2017. It outlines ways to inform, engage and partner with people from diverse refugee backgrounds for strengthening disaster resilience.

The project, 'Resilient Together: Engaging the knowledge and capacities of refugees for a disaster-resilient Illawarra', responds to a gap in current understanding on how people from refugee backgrounds learn about natural hazards and find safety as they settle into new homes and cities.

The Illawarra is a coastal region comprising the Wollongong, Shellharbour and Kiama local government areas. The project presents important insights for disaster resilience as the Illawarra, a 'Refugee Welcome Zone', accommodates new and emerging communities and prepares for climate changes in the coming decades.

The research objective was to understand the diverse experiences, beliefs and everyday practices for disaster resilience among people from culturally and linguistically diverse refugee backgrounds.

from diverse refugee backgrounds, namely Burma, Congo, Iran, Iraq, Liberia, Syria and Uganda. At the time of the interviews, research participants had been living in the Illawarra for periods of at least six months and up to 15 years. Interviews were conducted at a time and place chosen by the research participants. Interviews were facilitated by community interpreters hired by the project. They were audio recorded with prior verbal or written consent from the research participants.

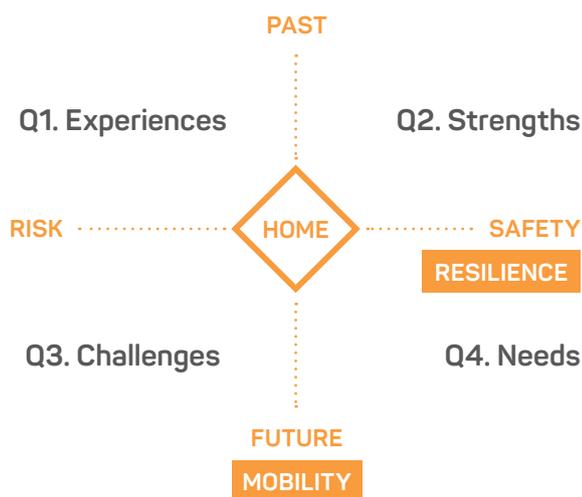
The interviews were transcribed verbatim for analysis. The interview transcripts were anonymised and systematically plotted using a person-centred mapping tool to create resilience narrative maps (Figure 1). The resilience narrative maps show how people strive to move from conditions of risk towards safety, while relying on their past experiences, capacities and relationships.

Methodology

Following ethics approval from the University of Wollongong Human Research Ethics Committee (ref. HREC 2017/268), the project adopted a two-pronged approach from June to September 2017. With support from Wollongong City Council, the University of Wollongong conducted consultations with 12 local emergency and multicultural agencies and service providers in the Illawarra. The objective was to understand the operating environment in which daily and emergency support is provided for newly arrived and recently settled people from refugee backgrounds. In addition, with assistance from the Illawarra Multicultural Services and the Strategic Community Assistance to Refugee Families, the University of Wollongong conducted semi-structured interviews with 26 people

Findings

The research revealed three particular and unmet needs in the Illawarra. Firstly, people from refugee backgrounds do not have ready access to local hazard and risk information. Ten of the 26 participants reported being caught unaware by bushfires, flash flooding, hail, heavy rain, lightning and strong winds during their first year of living in the Illawarra. Secondly, nine of the 26 participants reported having lived in what they perceived was unsafe, insecure and low-quality housing during the first months of living in the Illawarra. Finally, the research found that people from refugee backgrounds do not receive timely and culturally and linguistically relevant information and training on issues of personal safety and home preparedness.



Resilience narrative maps can reveal important insights about how people consistently strive to move from conditions of risk to safety, relying on their experiences, skills and relationships, in and across places.

The mapping tool is multi-scalar and can also facilitate an understanding of the collective experiences, strengths, challenges and needs as expressed by a household, groups or community.

The resilience narrative map template and examples are included in the *Co-learning Disaster Resilience Toolkit: A person-centred approach to engaging with refugee narratives and practices of safety*.

Figure 1: Resilience narrative map template used in this study.

Key outcomes

Research findings were presented to eight participating institutions¹ and 22 community representatives at a workshop in November 2017. During workshop discussions, participants acknowledged the general lack of partnerships between local emergency services, settlement and multicultural services, community-based organisations, places of worship and community leaders. As such, there was no effective outreach and connection with new residents from refugee backgrounds. The research found that local settlement and multicultural services can play a key role in informing newly arrived entrants of local hazards and risks, and how to access safe housing in secure locations, as they are often the first point of contact on arrival. Research participants also emphasised the need for in-home preparedness training and support for socially and physically isolated individuals, especially the elderly and women with young children, in their first language and from a trusted member of the community.

In response to these findings and recommendations, NSW SES invited 20 people from diverse refugee backgrounds to participate in a fast-track training program to form the NSW SES Multicultural Liaison Unit. The unit comprises multicultural community liaison officers from diverse refugee backgrounds. These liaison officers receive ongoing training to support their role and strengthen community capacity to respond to emergencies including flooding, fires and storms. The unit also allows the NSW SES, through the liaison officers, to better reach out to people from refugee backgrounds with hazard and safety information in a timely, relevant and culturally appropriate way. The liaison officers also provide a sustained mechanism for sharing community safety concerns and suggestions with local councils and emergency services.

Conclusion

This research demonstrates how local councils, emergency services, multicultural services and research institutions can effectively engage and partner with new and emerging communities to strengthen disaster resilience. Future work in this area includes designing and implementing more collaborative, accountable, responsive and empowering programs and services with people from diverse refugee backgrounds.

Acknowledgment

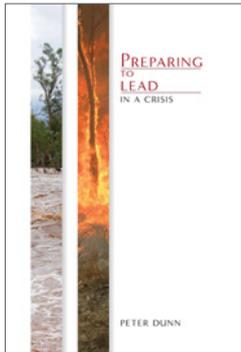
This project was funded under the joint NSW and Commonwealth Natural Disaster Resilience Program. It was highly commended in the 2018 Resilient Australia Awards (NSW Business Category). The views expressed here do not necessarily reflect the views of the NSW Government.

Further information is available in the *Co-learning Disaster Resilience Toolkit: A person-centred approach to engaging with refugee narratives and practices of safety* (2018). University of Wollongong, Australia. At: www.preventionweb.net/go/57379.

¹ Wollongong City Council, Shellharbour City Council, Kiama Municipal Council, NSW Rural Fire Service, NSW State Emergency Service, Illawarra Multicultural Services, the Strategic Community Assistance to Refugee Families and the Australian Red Cross.

Preparing to Lead in a Crisis

Reviewed by Lisa Marie Jackson, Emergency Management Victoria



Published by Barrallier Books Pty Ltd, trading as Echo Books

Author: Peter Dunn

ISBN: 9780648202585

Crises can occur at any time and in any organisation or community. At such times, leaders at all levels are tested and very few would say that, on reflection, they did not learn from such a difficult experience. Good leaders are always learning.

Australia has experienced complex and increased frequency of emergencies. Leadership during these emergencies is critical to supporting the community and emergency management organisations through the response and recovery efforts. The nature of emergencies means there is likely to be periods of chaos and uncertainty. Reducing this period of chaos through ensuring leaders have the skills and tools to effectively lead in a crisis is what Peter Dunn's *Preparing to Lead in a Crisis* is focused on. Dunn walks the reader through a practical guide supported by Australian case studies to provide techniques to support the contributors to a leader's success during emergencies and crisis of leadership skills, planning, using information and intelligence and resource allocation.

Peter Dunn began his career in the Australian Army and retired in 2002 as a Major General. Dunn then worked in the public sector before moving into private enterprise gaining extensive experience in crisis management techniques, emergency management and capability development.

The book discusses senior leaders and planning providing guidance on framing events, thinking strategically, planning and testing plans. Dunn uses leadership theories from existing literature and experiences from Australian events to provide useful techniques for leaders to consider when preparing for and understanding the initial stages of an event. He specifically discusses the ambiguity that occurs at the initial stages of an event and the importance of paying attention to the signals that indicate that the event is not what is expected. Regular contact, accessibility and presence with staff is discussed through being visibly present and removing barriers within organisational hierarchies. This part ends with a discussion on effective planning processes and

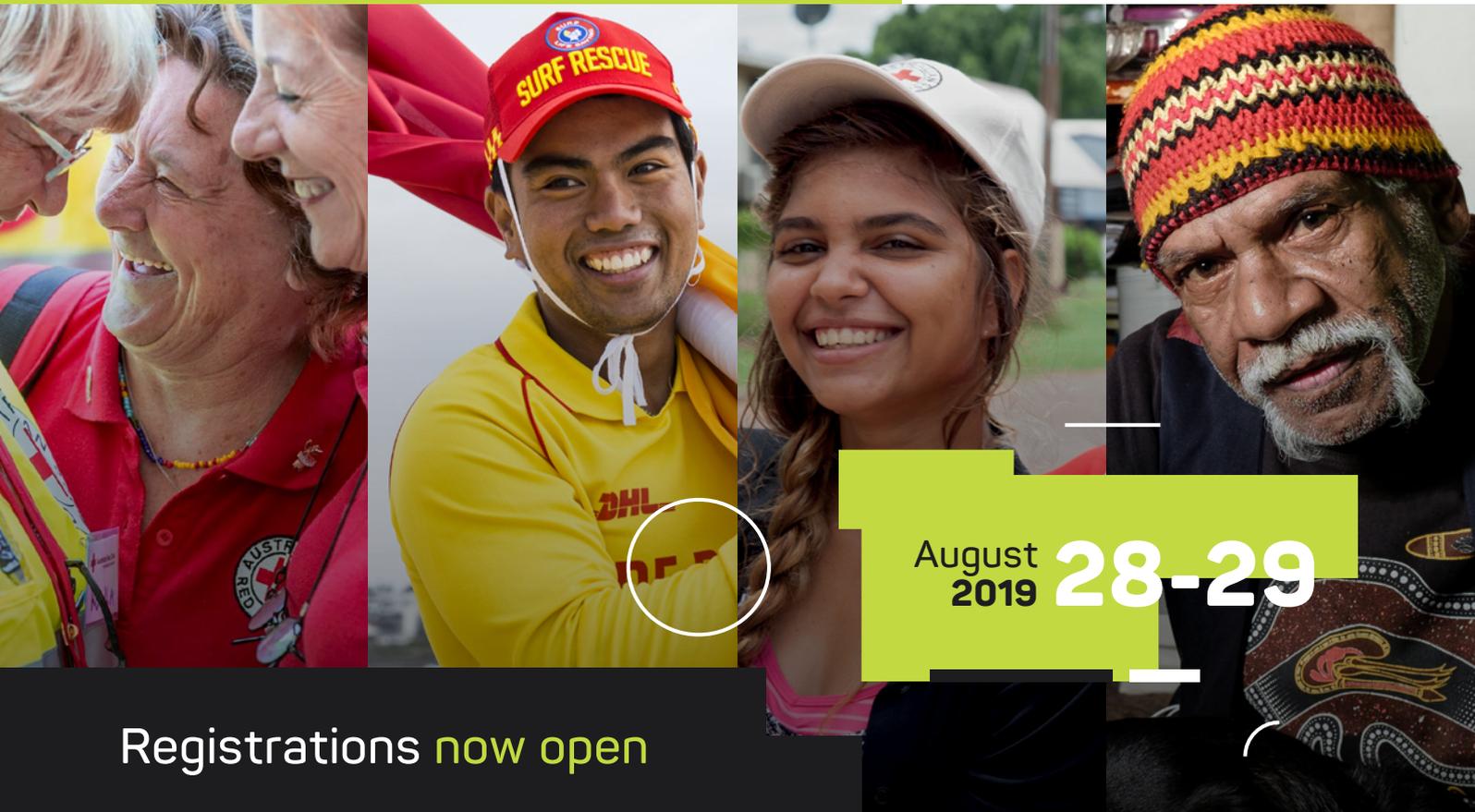
the importance of worst-case scenario planning and stress-testing plans including the use of capabilities such as 'red teaming'.

Organisational leadership techniques are covered in part two that covers the distributed leadership model, role clarity, intelligence and resourcing. Dunn discusses the importance of building trust and confidence within teams and supporting the distributed leadership model to allow senior leaders to remain at the strategic level. Capturing, analysing and using intelligence is then discussed, particularly the importance of understanding intelligence sources and information reliability together with continuing to assess for signals. The final chapter is based on resourcing and interoperability to ensure leaders understand what capability the organisation has prior to an event, what can be used during an event and where the gaps are.

Reflect on the senior leaders that you have admired most. It would be surprising if there were any on your list that were not approachable and did not listen to options that you presented. In a high-pressure situation where you have presented an option to your senior leader and they accepted it, and thanked you for your efforts, how did you feel about the leader?

The book concludes with a discussion on senior leaders' behaviours during a crisis including the characteristics of being approachable, sensibly optimistic and calm. Approachable relates to a leader who has intimate knowledge of the planning process. Work involved in implementing plans effectively means managing resources and collaborating with others to be effective. Balancing optimism and realism is a challenge. Dunn discusses how leaders are sensibly optimistic and show they understand rising challenges. Having an in-depth understanding of the plans and available capabilities prior to the event is critical to the success of achieving this. Dunn also covers being calm and having emotional intelligence to assist effective functioning and leading in high-pressure situations.

As a supplementary resource for crisis and emergency management personnel, people in leadership roles and those striving to be future leaders in the field, this book provides a range of techniques that support leaders during crisis and emergency events.



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ABSTRACT

Despite frequent exposure to bushfires, cyclones and floods, remote Indigenous communities across northern Australia typically have little involvement in managing, mitigating or planning for such events. This scenario planning project explored how people in remote communities, through Indigenous ranger groups, can contribute effectively to the mitigation and delivery of emergency services. This research revealed the importance of developing effective partnerships between emergency management agencies and members of remote communities to integrate and assess the resources and services needed for responsible agencies in the Northern Territory. Using three remote communities as case studies, the potential engagement opportunities with ranger groups was explored to identify solutions to deliver efficient, cost-effective and culturally appropriate emergency services. A collaborative policy framework involving emergency services organisations and Indigenous communities is proposed to mitigate and manage incidents while meeting Indigenous cultural protocols. This recognises and takes advantage of community networks and knowledge of local socio-cultural and natural systems. This research offers practical insights into the delivery of cost-effective and improved emergency services to empower north Australian remote communities.

Long-term solutions to improve emergency management services in remote communities in northern Australia

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Introduction

Northern Australia is defined here as the region north of the Tropic of Capricorn. The area is at risk from bushfires, cyclones, storms and floods (Figures 1 and 2, Bushfire and Natural Hazards Cooperative Research Centre 2015). Between 2007 and 2016, the average cost of all major natural hazard events across Australia was estimated at \$13.2 billion per annum (Australian Business Roundtable for Disaster Resilience and Safer Communities (ABR DRSC) 2017). For northern Australia, the average costs roughly equate to \$11 billion per annum across the Northern Territory, Western Australia and Queensland, which includes cyclones (\$3.4 billion per annum), floods (\$7.3 billion per annum) and bushfires (\$0.13 billion per annum¹). These costs are expected to significantly rise in the coming years with natural hazard events increasing in both frequency and severity (ABR DRSC 2017). Thus, the ABR DRSC recommended a nationwide need for mitigation activities that build resilience in communities.

Across the top of Australia from Broome in Western Australia to Townsville in Queensland, there is more than one million people, of whom approximately 14 per cent are Indigenous (Australian Bureau of Statistics 2016). Outside of major towns, Indigenous people comprise a much greater proportion of the total population (Figure 3). In the Kimberley and Top End, about half of the population is Indigenous while in very remote regions, more than 90 per cent of communities are Indigenous peoples (Taylor 2006). Population density in the region is about 0.75 persons per km², which is low compared to Australian (average three persons per km²) and global standards (Archer *et al.* 2019). In addition, the non-Indigenous population is concentrated in coastal towns, mainly Broome, Darwin, Cairns, Townsville and Mackay.

There is a distinct seasonal distribution of cyclones and bushfires across the top end of Australia. The coastal areas experience 11 tropical cyclones every wet season (average between 1981–1982 and 2012–2013, Dowdy 2014) (Figure 4). These are often associated with catastrophic wind speeds, storm

¹ These costs are for Western Australia only.

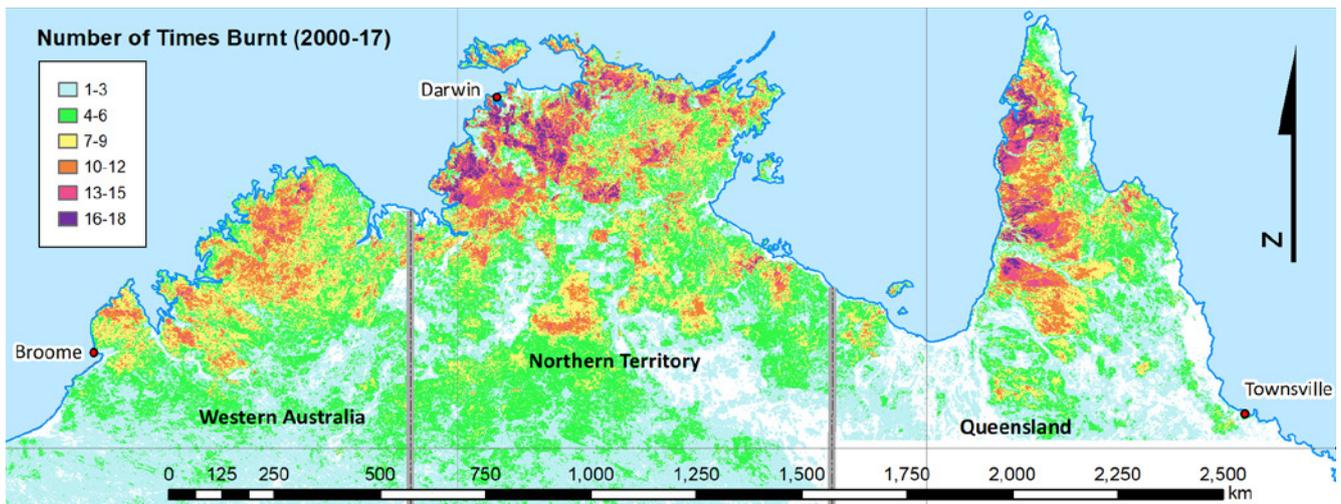


Figure 1: Fire frequency between 2000 and 2017 within 300 km radius of Darwin.

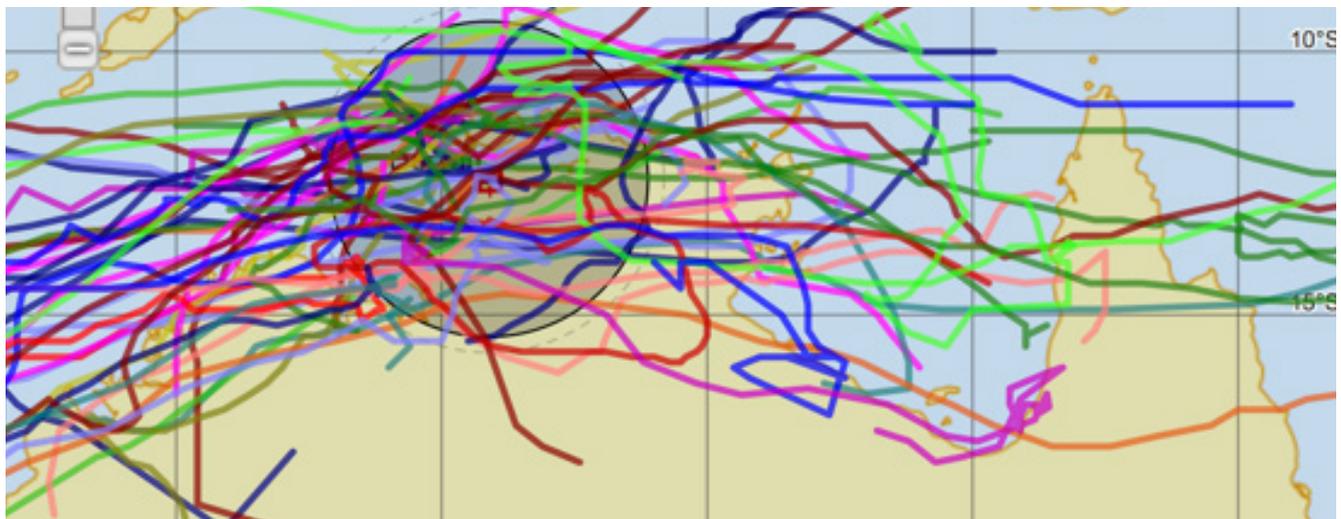


Figure 2: Cyclone tracks between 1970 and 2015 within 300 km radius of Darwin.

Source: Bureau of Meteorology 2018

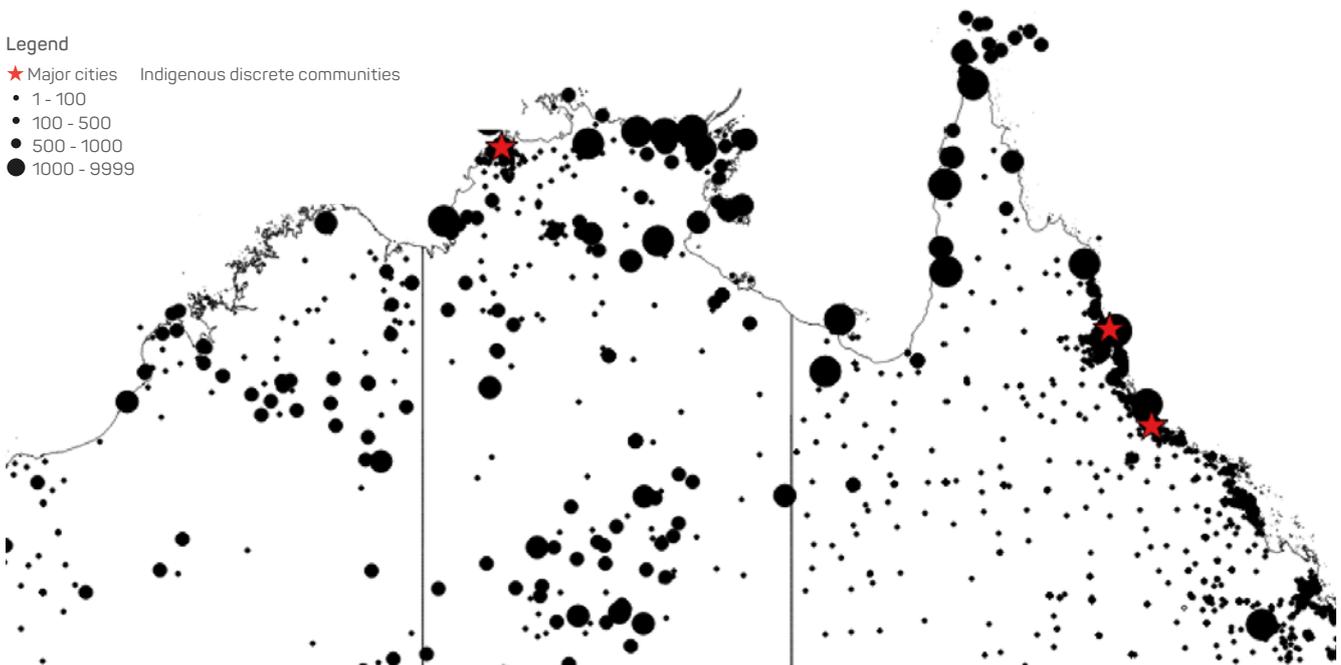


Figure 3: Distribution of Indigenous discrete communities across northern Australia.

Source: Australian Bureau of Statistics 2016

surges and heavy flooding. Subcoastal and inland areas experience bushfires that burn extensive areas (Figure 1). Unlike more populous areas with the availability of emergency services organisations and associated infrastructure, most isolated and remote communities lack emergency management amenities and, as such, are at heightened risk in the event of hazardous events (North Australian Indigenous Land and Sea Management Alliance (NAILSMA) 2014a, 2014b, Sangha *et al.* 2017, Sithole *et al.* 2017). These issues are well recognised in national policy (Remote Indigenous Advisory Committee 2007, Attorney-General’s Department 2011).

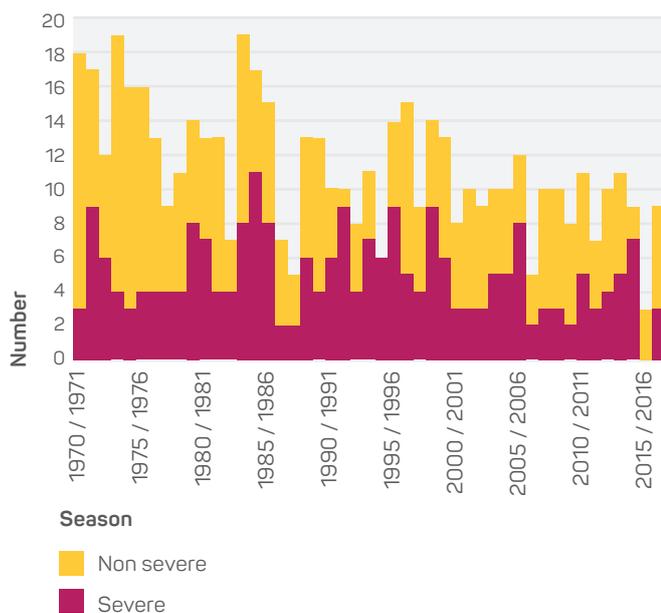


Figure 4: Occurrences of severe and non-severe tropical cyclones in northern Australia between 1970 and 2017. Source: Bureau of Meteorology 2018

To demonstrate a typical emergency management situation from an Indigenous perspective across northern Australia, the Northern Territory was used as an example where three remote communities were selected as case studies to examine the Indigenous context.

To address emergency issues, a collaborative approach is required to build capacity and empower remote communities for the preparation and management of natural hazard events. In particular, government investment in Indigenous ranger groups, for example through the Working on Country and Indigenous Protected Area programs that provide a ready framework for using and developing required capacity. This paper explains how involving Indigenous ranger groups and locals from remote communities could help to develop feasible and sustainable pathways to improve emergency management capacity as well as services in regional and remote locations.

Emergency management resources

The Northern Territory is an area of 1.34 million km² with a population of 228,800. Four major population centres of Darwin, Katherine, Tennant Creek and Alice Springs are home to more than 76 per cent of all residents (Australian Bureau of Statistics 2016). Outside of these centres, 75 per cent of the population is Indigenous (Australian Bureau of Statistics 2016) and reside in 96 discrete communities of greater than 100 people and over 600 family outstations (Bushtel 2018). Notably, Indigenous communities are dispersed across the Territory (Figure 5), unlike other populations that are mostly in major urban centres.

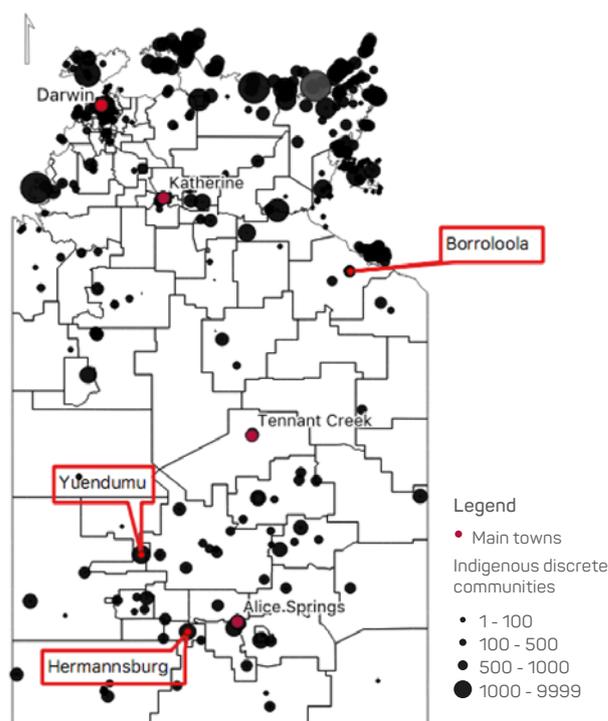


Figure 5: Locations of the three remote communities selected for this study: Borroloola, Hermansburg and Yuendumu.

Source: ABS (2016) census data

Most of these communities are frequently prone to floods and storms during the wet season (November to March) and extensive bushfires during the dry season (May to October) (Figures 1 and 2) (Russell-Smith *et al.* 2018). As shown in Figure 6 and Table 1, the Northern Territory Emergency Services (NTES), Northern Territory Fire and Rescue Services (NTFRS) and Bushfires NT, have very limited resources to manage emergency situations in remote communities. Importantly, the resources listed by the emergency services agencies (Figure 6) may not be operational as they are missing (as experienced for one of the three study locations).

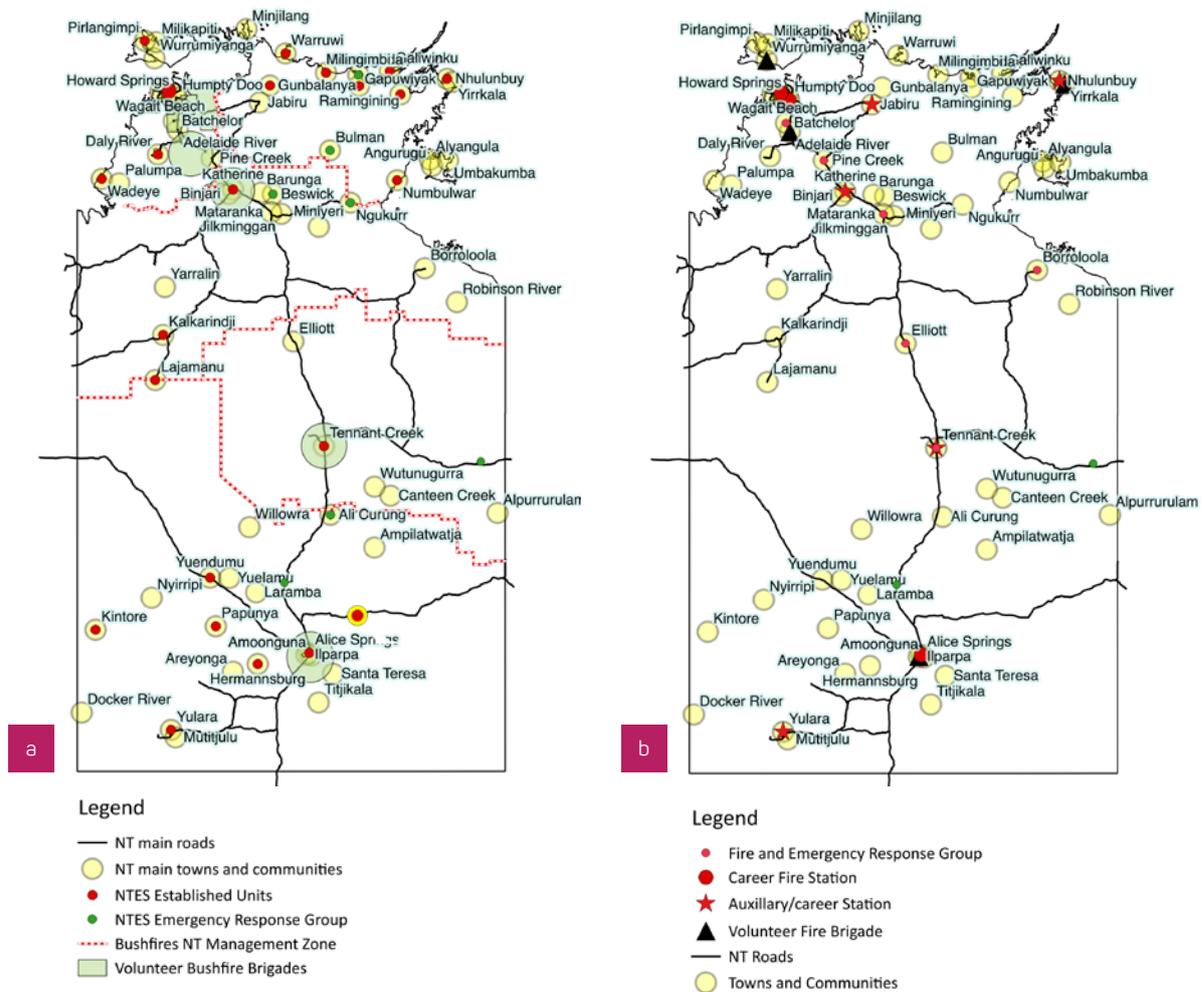


Figure 6: Distribution of emergency services resources and the main towns and communities in the Northern Territory.

- a) NTES resources include established units, emergency response groups, volunteer bushfire brigades and Bushfires NT management zones (<https://sites.google.com/site/bfntvolunteers/volunteer-brigades>).
- b) NTFRS resources include fire stations, fire and emergency response groups and volunteer fire brigades.

Source: NTPFES 2016–17 and respective websites: www.pfes.nt.gov.au/Fire-and-Rescue/Locations.aspx and [/www.pfes.nt.gov.au/Emergency-Service/Your-local-volunteers/Volunteer-location-profiles.aspx](http://www.pfes.nt.gov.au/Emergency-Service/Your-local-volunteers/Volunteer-location-profiles.aspx)

Table 1: Northern Territory emergency services and fire management organisations.

Organisations	NT Fire and Rescue Service	NT Emergency Services	Bushfires NT	Parks and Wildlife Commission
Employees*	250	21	22	283
Volunteers and Auxiliary staff	300	360	500	Not known
Main responsibilities	Fire prevention and response management in and around residential areas.	Management and mitigation of emergencies such as cyclones, land searches and floods.	Bushfire mitigation and management in non-urban areas to protect life, property and the environment.	Broad management of national parks and other conservation and historical reserves, including fire management, weed and pest control to protect biodiversity.

* total number, full-time and part-time.

Method

Three remote communities, Borroloola in the Northern Territory Gulf region, and Hermannsburg and Yuendumu in Central Australia (Figure 5) were examined. All of these communities are vulnerable to natural hazards, especially bushfires. Yuendumu and Hermannsburg are located about 300 km and 130 km, respectively from Alice Springs. Borroloola is 900 km southeast of Darwin and is highly vulnerable to cyclones and flooding. Each community comprises 500–800 people.

Indigenous ranger groups from each community were involved to assist with the research. Ranger group members are experienced and skilled in managing fire and other emergency situations (e.g. land searches). Initially, informal discussions were held with the Garawa and Waanyi Garawa rangers at Borroloola. This allowed the identification of issues relevant to the local community. A questionnaire was developed in collaboration with the Garawa and Waanyi Garawa rangers to garner the views of community members. Results were discussed in focus group meetings. Focus group meetings were also held with Indigenous ranger groups in Yuendumu and Hermannsburg. Ethics approval was granted by Charles Darwin University (H17134).

Results

The research revealed that, typically, there is little involvement of local community members in managing and mitigating natural hazard events, emergency management decision-making processes or services delivery. One exception was Hermannsburg (Table 1) where the Tjuwanpa women rangers (trained NTES volunteers) and the men rangers, separately conduct preventive burning around the community. Table 2 provides a summary of the findings as well as the identified emergency-related issues and available resources.

Moreover, there are limited resources available to mitigate and manage natural hazards and emergency situations in each community (Table 2). Access to these resources is restricted and limited to personnel from Police, NTES and NTFRS. Indigenous ranger group members also had limited knowledge about the content or existence of community emergency plans. Where these did exist, they were not readily accessible being either online or as hard copy documents in the local police station.

During the research, ranger groups and other local community members showed marked interest in being involved with community risks of bushfire, flood, search and rescue and vehicle breakdowns. However, there was a general reluctance to be involved in vehicle accidents, except to help with traffic control.

Developing effective approaches

Australia's *National Strategy for Disaster Resilience* (Attorney-General's Department 2011) describes the role of governments in managing natural disasters, particularly by focusing on 'developing and implementing effective, risk-based land management and planning arrangements and other mitigation activities'. Engaging communities in natural disaster management is a significant step to help local communities and Indigenous ranger groups build resilience in remote communities (Sangha *et al.* 2017). This was reinforced during the group discussions, '*...emergency planning needs to have decisions by clan leaders front and centre putting plan together. Plan for the whole country (including outstations)*' (cited in Sithole, Champion & Hunter-Xénié 2018). To this end, appropriate engagement could be achieved through the establishment of a formal Joint Natural Hazards Management Platform (JNHMP) in each remote community (Figure 7). Such a platform will help enhance micro-scale management of natural disasters to deliver multiple benefits to communities.

The platform involves linking socio-cultural, natural and institutional structures, knowledge and processes at a community scale to create emergency management plans, policies and procedures in a collaborative way (Figure 7). For example, local knowledge of the landscape (e.g. road access, cultural sites, family outstations) assists in applying prescribed burning and understanding the potential of bushfire spread. Local communities can actively plan for fire management along with relevant fire management agencies (Russell-Smith *et al.* 2013). Similarly, in the event of cyclones and floods, emergency management organisations need to manage the situation in an effective and culturally appropriate way and in acknowledgment of the local customs and traditions. This includes who should lead discussions, who can talk with whom and when, cultural norms and regulations to approach the elders and traditional owners, and resources and services required by the community. Community networks can help emergency management agencies in raising awareness, planning and preparing for events. They can also share information about road access, people living at family outstations and their health needs (personal communication during focus group meetings). One of the community members explicitly pointed out the need for a meaningful engagement with the community:

We know our people and we know our land. We blackfellas mob should make our own plan for our people. Family still strong and we should look out for our people.

(Interview, part of an umbrella project on Building Resilience in North Australian Remote Communities; cited in Sithole, Champion & Hunter-Xénié 2018).

Establishing joint platforms helps to address the concerns highlighted in '*Keeping our mob safe*' *A national emergency management strategy for remote Indigenous communities* (Remote Indigenous Advisory Committee 2007).

Table 2: Focus group meeting outcomes from Borroloola, Hermannsburg and Yuendumu.

Topics	Borroloola	Hermannsburg	Yuendumu
<i>Rangers (number of participants in focus group meeting)</i>	Garawa and Waanyi Garawa rangers (9–10)	Tjuwanpa women rangers (9)	Warlpiri rangers and traditional owners (8)
<i>Identified main hazards</i>	Floods, storms, car accidents, bogged vehicles, cyclones and bushfires.	Floods, bushfire and road accidents.	Road accidents, land searches and floods.
<i>Current management of natural hazards and emergency situations</i>	NTFRS FERG* unit and Police deliver emergency services in the event of road accidents, bushfires, floods and cyclones. However, not much effort in mitigating or managing natural hazards. Sea rangers assist during floods with their own boat.	NTES, Police and NTFRS deliver emergency-related services, involving local NTES volunteers (including some women rangers).	Police manage the main emergencies (i.e. road accidents). Local council help in controlling bushfires, if needed.
<i>Ranger current role in emergency management and services delivery</i>	Rangers or locals are not involved in any decision-making, managing natural hazards nor during emergency situations.	Rangers conduct preventive prescribed burning around the community but are not confident taking a lead role in emergency situations such as bushfires and floods and need further training. Local emergency agencies are supportive of ranger involvement in emergency-related events.	Rangers and local community members manage land searches. Locals are not involved in decision-making nor managing natural hazards and emergency situations.
<i>Rangers and Indigenous community member willingness to participate in emergency management in the future</i>	Willing to join NTFRS volunteer brigade, to mitigate bushfires in the community and help in other emergencies. Rangers had their first meeting with the NTFRS local area volunteer brigade captain.	Three women rangers are already NTES volunteers, others are planning to join.	Rangers and elders did not want to join the volunteer brigade. However, it was suggested that the younger people need to be involved in emergency management.
<i>Engagement of local communities in managing or planning for emergency situations</i>	Little or no formal involvement to date.	Some degree of engagement exists between emergency agencies and the Tjuwanpa women rangers.	Little or no formal involvement to date. Rangers help their community, especially during land searches.
<i>Awareness of emergency management plans</i>	Emergency management plans are typically kept at the police station. Locals have little idea of what they are about.		
<i>Existing emergency-related resources</i>	NTFRS has a FERG* unit and NTES has a rescue boat. Garawa and Waanyi Garawa rangers have a fire truck and Sea rangers have a boat.	NTES, NTFRS and Police have their own resources. NTES has an established unit in the community. Tjuwanpa rangers were planning to buy a grassfire unit.	NTES unit was reported as not functional. The local council owns a fire truck. There are no other emergency resources.
<i>Ranger emergency management and local area knowledge</i>			
	Rangers and traditional owners have local knowledge especially of people and areas prone to bushfire and flood and know how to manage bushfires around towns and outstations. They can be trained to manage floods and vehicle breakdowns. Moreover, community members confide in them.		

* FERG – Fire and Emergency Response Group, a local volunteer group.

Joint platform to manage natural hazard disasters in remote locations

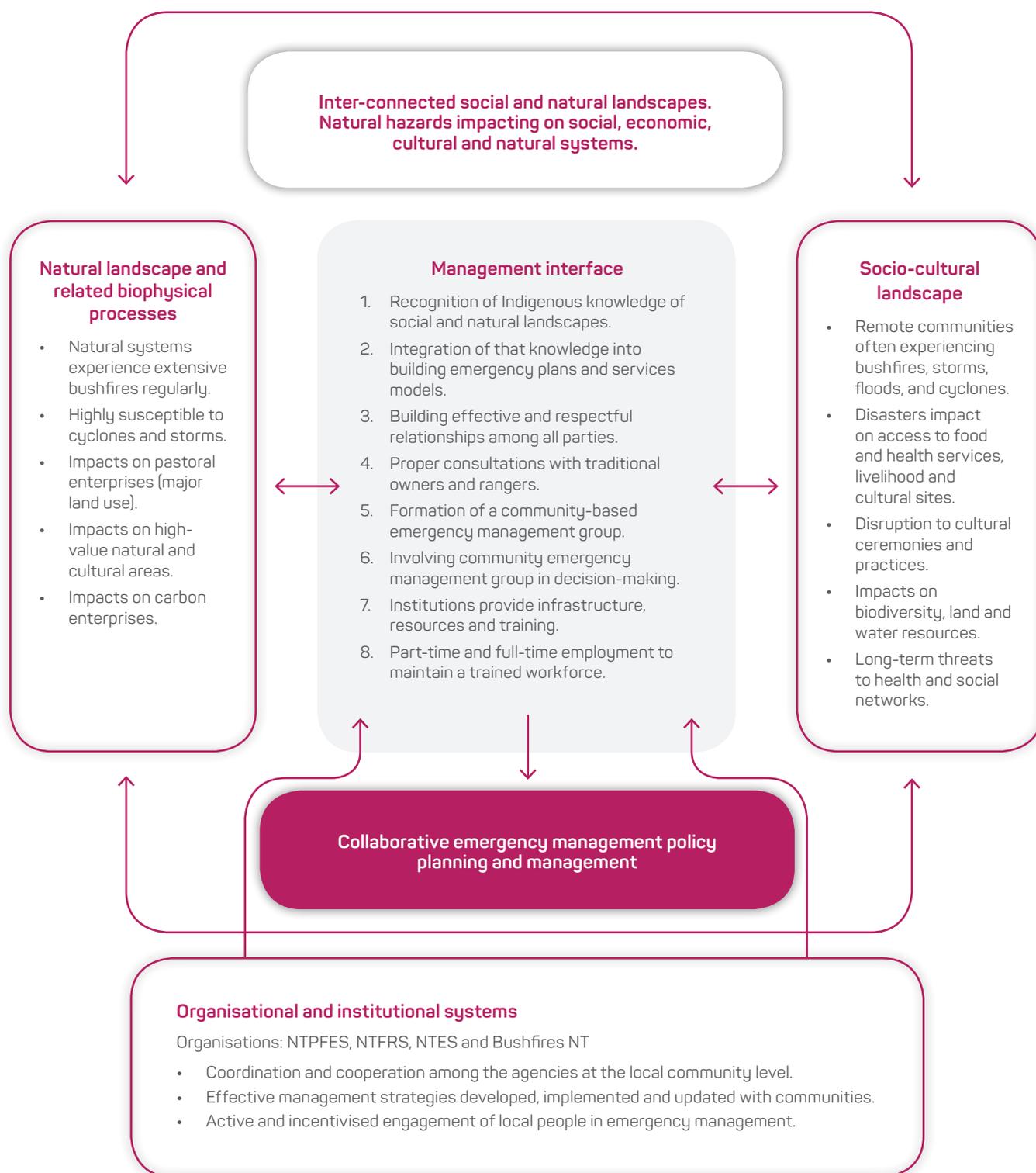


Figure 7: Interactions between natural and socio-cultural systems and the institutions responsible for provisioning resources and services to manage natural hazards and disasters.

It helps to establish an understanding of the social, cultural and biophysical context to build effective and respectful partnerships between government and people in remote communities. Collaborative arrangements potentially deliver several benefits such as culturally appropriate management of emergencies, cost-effective outcomes for the emergency services organisations and improved mitigation and management of natural ecosystems. However, genuine engagement of the ranger groups and their local communities in a respectful and meaningful manner is essential (Howitt, Havnen & Veland 2012). Ultimately, collaborative arrangements reduce costs for the emergency services agencies by involving a local labour force that is enduring, invested and dedicated, as long as they are provided with appropriate training and resources (Sangha *et al.* 2017). The JNHMP approach is in line with the Remote Indigenous Advisory Committee emergency management strategy that recognises and accepts collective community decision-making structures as a first priority in emergency situations.



A ranger group in Borroloola discuss their engagement in the emergency management sector for the local area.

Image: Kamaljit K. Sangha and Andrew Edwards

Conclusion

Building community resilience in remote communities is a key requirement to address the 'Keeping our mob safe' policy framework (Remote Indigenous Advisory Committee 2007). However, effective engagement and partnership with Indigenous communities is an ongoing challenge for emergency services organisations (NAILSMA 2014a, 2014b, ABR DRCS 2017, Sangha *et al.* 2017). There are practical and long-term solutions to engage and empower communities to identify and mitigate their risk and manage emergency situations. Focus group meetings with the ranger groups who participated in this research clearly demonstrated

their willingness and capacity to participate in local emergency planning and decision-making processes.

There are 35 Indigenous ranger groups in the Northern Territory funded through the Working on Country and Indigenous Protected Area programs (Russell-Smith *et al.* 2019a), which offer some funding security depending on government policy. The ranger groups are contracted to meet a variety of biodiversity conservation targets. However, they could be also contracted to deliver emergency mitigation services to their communities if appropriate training and resources were provided. This was demonstrated by Girrigan rangers in Cardwell following Cyclone Yasi in Queensland in 2011 (Phil Rist, Nywaigi traditional owner, sharing Indigenous experience at the Australian Institute for Disaster Resilience conference 2018). The effectiveness of ranger groups as front-line responders could be enhanced using a collaborative platform. A salient example of this collaborative arrangement is the establishment of Volunteer Emergency Services Units by the Western Australia Department of Fire and Emergency Services (DFES) in two remote communities in the Kimberley, Bidjadanga and Beagle Bay. There is genuine engagement between the DFES, the local council and the ranger groups (personal communication Lee Vallance DFES Indigenous Co-ordinator). To date, the ranger groups provide services at no cost and DFES has invested in emergency resources (e.g. a fire truck and control room with modern facilities), training equipment and other materials and services in the communities. If such programs are to be expanded at a community and regional scale to ensure success, security and long-term outcomes, then contractual arrangements are essential.

A total cost-benefit analysis, including marketable and non-marketable aspects, needs to be undertaken to assess the long-term outcomes of any proposed JNHMP arrangements. The rationale that the benefits of engaging ranger groups in planning and providing emergency services will outweigh the costs borne by governments seems credible due to continuous and substantial Commonwealth investment in the ranger programs and the flow of multi-fold benefits. Fire management, undertaken by Arnhem Land Indigenous ranger groups, who are partly self-funded through carbon projects and partly through Commonwealth Working on Country and Indigenous Protected Area programs, is a prime example offering both effective bushfire management and socio-economic benefits, which are contributing significantly to reducing government costs (Russell-Smith *et al.* 2013, Sangha *et al.* 2017). Involving Indigenous people in building resilience and, more broadly, developing the northern areas of Australia is outlined by Russell-Smith and co-authors (2019b) who indicate there is a huge potential for land sector-based and local economies in remote communities. At time of print, a detailed cost analysis of the frequent natural disasters in the Northern Territory (i.e. cyclones, storms, floods and bushfires) is being undertaken as part of the Bushfire and Natural Hazards Cooperative Research Centre scenario planning project.

Developing a locally inclusive, participatory emergency management model that genuinely involves Indigenous communities and sets up contractual arrangements, is critical to enhance emergency preparedness and management for remote communities across the north.

Acknowledgments

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ABSTRACT

Ten years ago, 173 people lost their lives and more than 2000 homes were destroyed in the Black Saturday bushfires. The fires of 7 February 2009 led to a royal commission and significant changes to bushfire management throughout Australia. Research played an important role in the royal commission and subsequent changes. This paper reflects on what was learnt from research into human behaviour and community safety undertaken as part of the Bushfire CRC 2009 Victorian Bushfires Research Taskforce. The research involved interviews with over 600 householders and a mail survey of 1314 households affected by the fires. This paper reviews findings from subsequent post-fire research to consider the extent to which there have been changes in findings related to community planning, preparedness and responses to bushfire. The review suggests that many of the issues encountered on Black Saturday—limited awareness of and preparedness for bushfire risk, a tendency for leaving (or evacuating) at the last moment and a commitment to defending, even under the highest levels of fire danger—persist, despite major changes to policy and public messaging.

Ten years after the Black Saturday fires, what have we learnt from post-fire research?

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Introduction

Ten years ago, the Black Saturday bushfires devastated Victorian communities. Saturday 7 February 2009 saw unprecedented fire danger conditions in many parts of the state. A new maximum temperature of 46.4°C was set for Melbourne and the McArthur Forest Fire Danger Index reached 170, considerably higher than during the 1939 Black Friday and 1983 Ash Wednesday fires (Karoly 2009). Tragically, 173 people perished and over 400 people were hospitalised. More than 3500 buildings were destroyed, including over 2000 houses. Public and private infrastructure, agricultural assets, timber and other values were damaged or destroyed. Wildlife, pets and livestock were killed and ecosystems were adversely affected. Longer-term effects of the fires include increased rates of mental health problems, relationship breakdowns and domestic violence (Bryant *et al.* 2018, Parkinson 2015).

Black Saturday transformed bushfire management throughout Australia. The 2009 Victorian Bushfires Royal Commission investigated the circumstances leading to widespread losses of human life and property. It heard evidence from 434 expert and lay witnesses and examined more than 1200 public submissions before handing down 67 recommendations to improve bushfire management (see Teague, McLeod & Pascoe 2010). Subsequent changes included greater emphasis in public messaging on leaving early as the safest response to bushfires, revision of the Fire Danger Rating system to include an additional 'Code Red' or 'Catastrophic' rating, stringent land-use planning and building controls and greater provision of sheltering advice and options such as 'Neighbourhood Safer Places' and personal bushfire shelters.

Research has played an important role in changes to bushfire management since Black Saturday. This paper reflects on what was learnt from research into human behaviour and community safety undertaken as part of the Bushfire CRC 2009 Victorian Bushfires Research Taskforce. The paper outlines the research approach and identifies research findings. Findings from subsequent post-fire research are also reviewed. The paper considers the extent to which post-fire research findings have changed since Black Saturday and the implications for future research.

The 2009 Victorian Bushfires Research Taskforce

The Taskforce provided Australian fire and emergency services with an independent analysis of the factors that contributed to the severity of the fires and the impacts on communities. Three areas of research were identified:

- fire behaviour
- building and planning
- human behaviour and community safety.

The latter research focused on questions of householder planning, preparedness and responses to the fires as well as the impacts of the fires on individuals and households. The research was designed with distinct qualitative and quantitative phases.

Method

Ethics approval was obtained from RMIT University's Human Research Ethics Committee. Semi-structured interviews were undertaken to gather data in a way that allowed people to tell their stories and share their experiences on their own terms. The interview guide comprised open-ended questions about people's awareness of bushfire risk, measures to plan and prepare, information and warnings received, intended and actual responses and effects of the fires. Researchers were advised that participants would likely answer some questions unprompted and that it was not necessary to ensure all questions and issues were covered in each interview. An advantage of this approach is that interviewees frame and structure the interview in their own terms and according to their own perspectives and experiences (Marshall & Rossman 2011). Such an approach helps researchers to understand how people experience bushfire. This can help to identify issues or lines of questioning not previously considered.

Researchers began interviewing residents on the 12 February and more than 600 interviews were conducted over a 12-week period. Researchers visited properties in fire-affected areas, accompanying members of the building and planning team who were conducting building impact assessments. Most interviews took place at people's homes or property and were digitally recorded with the participant's consent. Recordings were transcribed in full, generating approximately 9800 pages of interview transcript. The first report presented to the royal commission was based on analysis of 301 (approximately half) of the interviews (Whittaker *et al.* 2009). Later analysis used all of the transcripts. Transcripts were analysed using the qualitative data analysis software *NVivo v.10*, with segments of interview text grouped into like-categories to enable closer analysis and comparison.

Survey

A postal survey collected quantitative data on the human behaviour and community safety issues addressed in the interviews. Questionnaires were mailed to 6000 addresses in fire-affected areas in October 2009. A total of 699 questionnaires were returned unanswered because they could not be delivered or because the residence was uninhabited. The survey resulted in 1314 completed questionnaires (25 per cent response rate) from each of the major fire complexes of Beechworth-Mudgegonga (3 per cent), Bendigo (3 per cent), Bunyip (5 per cent), Churchill (9 per cent), Horsham (4 per cent), Kilmore East (59 per cent) and Murrindindi (14 per cent). Women (53 per cent) and men were generally equally represented in the sample. The majority of respondents were aged between 35 and 54 (59 per cent). One-third (33 per cent) of respondents reported that their house was destroyed in the fires. Initial analysis was based on 1104 responses and was limited to simple descriptive statistics (Whittaker *et al.* 2009). Further analysis used all 1314 responses and more advanced statistical analysis was undertaken.



Researchers were deployed within days of the Black Saturday bushfires in 2009, assessing community behaviour, fire behaviour and building construction.

Image: Bushfire and Natural Hazards CRC

Findings

Analysis of interview data identified a range of factors that influenced people's responses to the Black Saturday fires. Levels of planning and preparedness were varied, ranging from those who did little or nothing in anticipation of the bushfire to those with highly sophisticated plans and protections. Some people in areas perceived as 'suburban' had not planned or prepared for bushfires because they did not consider themselves to be at risk. There was considerable evidence of last-minute planning and preparation once the fire threat was clear.

Importantly, many of those who did plan and prepare found their preparedness level inadequate for such a severe fire.

Interviewees described weaknesses in their planning and preparation that influenced their ability to respond safely. For example, some who intended to 'leave early' were forced to stay with their homes during the fire because they were unable to safely evacuate. Failure to plan for this possibility meant some remained to defend or shelter at properties despite little or no preparedness to do so. Similarly, some who stayed to defend abandoned their house because of the intensity of the fire and the failure of defensive endeavours. Failure to consider how or where they would evacuate led to late and dangerous evacuations and forced some to seek immediate shelter. Situations such as these demonstrated the need for people to plan for multiple possibilities if their preferred response is not possible.

These findings were supported by postal survey results. Although seven-in-ten respondents claimed to have a 'plan', most had not considered what they would do if other household members were not home during a fire. People were more likely to undertake simple and 'easy to do' preparations as part of general property maintenance (e.g. clearing leaves, grass and debris from around the house) than more complex, costly and time-consuming actions (e.g. installing seals and draft protectors around windows and doors). Most believed their preparedness level for bushfire to be 'high' to 'very high' (46 per cent) or 'average' (36 per cent) yet almost three-quarters acknowledged they could have been better prepared. Self-assessments of preparedness levels were lower in suburban areas. For example, people in Horsham and Bendigo were more likely to have previously considered it unlikely that a bushfire would occur (72 per cent and 53 per cent, respectively) than respondents overall (22 per cent).

Data on intended and actual responses to the fires suggest broad support for 'staying to defend' and limited acceptance of the 'leave early' message. Half of all interview respondents previously intended to stay and defend against bushfire (50 per cent) while just two-in-ten (21 per cent) intended to leave. Significantly, the research found a quarter of the respondents were undecided (26 per cent); intending to stay and defend but leave if threatened or to wait and see what the fire was like before deciding what to do. These findings are consistent with earlier research highlighting the tendency for some people to wait and see and the risks associated with this approach (e.g. Rhodes 2005, Tibbits & Whittaker 2007).

In terms of actual responses, 53 per cent of survey respondents stayed to defend, 43 per cent left their homes or properties before or when the fire arrived and 4 per cent sheltered inside a house, another structure, vehicle or somewhere outside. More than a third of those who defended left at some stage during the fire (38 per cent), most commonly because of perceived danger, failure of equipment or utilities or because their house caught fire. More than half of those who left considered that they left too late (54 per cent) and most perceived

the level of danger to be high or very high (80 per cent). The prevalence of late evacuations can, in part, be attributed to the failure of warning systems (see Teague, McLeod & Pascoe 2010); 62 per cent of respondents did not receive an 'official' warning from police, fire and emergency services. Most people did, however, receive an unofficial warning from family, friends or neighbours (63 per cent).

Analysis of survey data revealed a lower rate of house destruction among households where people stayed to defend (Whittaker *et al.* 2013). Where at least one person stayed to defend, two-in-ten houses were destroyed. Where all householders left or stayed and did not defend, five-in-ten houses were destroyed.

An important caveat is that the interview sample was not random and cannot be said to be representative of the affected population. Nor can the extent to which defended homes were threatened be known (i.e. some 'defended' houses may have had little or no direct exposure to embers, radiant heat or flames). Nevertheless, the finding that defended houses fared better than undefended ones is consistent with findings from previous studies (e.g. Wilson & Ferguson 1984, Ramsay, McArthur & Dowling 1987).

Subsequent research using the Taskforce data

Following initial analysis and submission of associated reports to the royal commission, several studies undertook further analyses of the data. McLennan and co-authors (2013) applied a content-coding and rating scheme to the interview data to identify quantitative trends and associations among householder safety-related factors. Important findings:

- Very few (two per cent) people evacuated on the sole basis of official extreme fire danger weather predictions (i.e. before any fires were reported).
- Success or failure in defending a home was not associated strongly with prior preparations. Under the extreme weather conditions on the day, chance often played a role.
- Householder decisions to stay and defend their homes were based on several factors, including emotional attachment to their home, the desire to protect assets and the belief (sometimes ill-founded) that they would be successful.

Two other studies examined in greater depth two issues that emerged from the initial analyses, being the influence of gender on people's decisions and actions and experiences of sheltering during the fires. Gendered analysis of interview and survey data found that men more often wanted to stay and defend than women (56 per cent v. 42 per cent) while women more often intended to leave when they knew a fire was threatening (23 per cent v. 11 per cent) (Whittaker, Eriksen & Haynes 2016). These patterns were evident in actual responses to the fires, with men more often staying to defend than

women (62 per cent v. 42 per cent) who more often left before or when the fire arrived (54 per cent v. 35 per cent).

These findings are broadly consistent with those from earlier studies of gender and bushfire (e.g. Proudley 2008, Eriksen, Gill & Head 2010). Women were also more likely than men to leave on the advice of relatives, friends, neighbours and emergency services personnel. This suggests there are opportunities to tailor messages specifically for women encouraging early evacuation. Interviews provided insights into how responses to bushfire were negotiated within households, with gender relations often playing a key role. There were numerous instances where disagreement arose due to differing intentions. Disagreement often stemmed from men's reluctance to leave, particularly in households where there had been little planning or discussion about bushfire. Despite identifying clear and statistically significant relationships between gender and intended and actual responses, the research cautioned against broad-brush characterisations of staying to defend as a masculine response and leaving or evacuating as a feminine response. Results showed many women intended to leave (42 per cent) and did stay and defend (42 per cent) during the fire. Clearly, gender is an important factor influencing decisions to evacuate or stay and defend, however, it is not the only factor.

McLennan (2010) examined people's use of informal places of shelter and last resort on Black Saturday. The research found many residents previously understood sporting ovals to be 'official' places of refuge or assembly. Others identified them as places of relative safety once the fire was threatening because they were large, open (relatively low fuel) areas. There was little evidence that people planned to use Country Fire Authority sheds prior to 7 February. Instead, they '... simply 'ended up' there because they did not know of any likely safer alternative' (McLennan 2010, p.5). Despite finding little evidence of preparedness for sheltering, McLennan (2010) found many people survived hazardous conditions by sheltering in vehicles on cleared areas or by sheltering in buildings. The study clearly demonstrated the need for greater provision of local sheltering options for people who are unable to leave fire-affected areas.

Blanchi *et al.* (2018) used Taskforce data to examine people's use of shelters and sheltering practices on Black Saturday. Initial analysis of the survey data found very few people sheltered throughout the fire (just four per cent) (see Whittaker *et al.* 2013). However, the survey response categories, which asked people to 'fit' their response to categories such as 'stay and defend', 'leave' and 'shelter', failed to account for shorter-term, periodic sheltering that may have been engaged in as part of property defence or evacuation. All 611 interview transcripts were searched for references to sheltering using a range of search terms. This process identified 315 interviews where shelters or sheltering were discussed, ranging from short-term sheltering undertaken while defending property to sheltering throughout the fire. Subsequent analysis found,

despite limited planning and preparation specifically for sheltering on Black Saturday, many people protected themselves from the fire and its effects by sheltering inside houses, other structures and in open spaces. Most sheltered actively and carried out regular fire monitoring and actions to protect the shelter and its occupants. Some found sheltering challenging due to the heat, smoke and responsibilities for children, vulnerable household members or the incapacitated. A very small proportion of interviewees sheltered inactively, including in rooms with limited visibility and egress, such as bathrooms.

The study recommended education materials and campaigns to encourage planning and preparation for active sheltering, emphasising that sheltering should not be planned for as a sole response. Active sheltering was defined as sheltering involving regular monitoring of the fire and conditions inside and outside the place of shelter, as well as actions to protect the shelter and its occupants, including timely egress. The research highlighted the need for local dialogue about the suitability of places of shelter, including informally organised community refuges and so-called 'safe houses' (Whittaker *et al.* 2017).

Research since Black Saturday

There have been numerous post-fire studies of community preparedness and responses to bushfires throughout Australia since Black Saturday. McLennan, Paton and Wright (2015) reviewed post-bushfire interview studies undertaken between 2009 and 2014, including fires in Western Australia (2011 and 2014), Tasmania (2013) and New South Wales (2013). There are limitations of this review, in particular the difficulty of drawing comparisons between summary findings from studies of different fires and affected communities. Nevertheless, it found an 'appreciable minority' did not believe they were at risk (ranging from 7–33 per cent) and had no bushfire plan prior to the fire (8–32 per cent). Results indicated an increase in the proportion of householders who planned to leave when threatened by bushfire (24 per cent on Black Saturday and 26–65 per cent in subsequent studied fires). Similarly, the review indicated a decline in the proportion of people who planned to stay and defend (48 per cent on Black Saturday, down to 10–34 per cent). A substantial minority planned to wait and see how the threat developed before making a decision to leave or stay (6 per cent on Black Saturday, and from 5–29 per cent subsequently). Very few people were found to have left for a safer location based on predicted fire danger conditions. Many stayed to defend their properties under extreme and catastrophic fire danger conditions, despite fire service advice to the contrary (ranging from 27–52 per cent).

McLennan, Paton and Wright (2015) emphasise the need for caution when assessing changes in householder planning and preparation since Black Saturday. Indeed, some differences in results are considerable. For example,

just 7 per cent of those interviewed after the 2011 Lake Clifton fire in Western Australia did not consider themselves at risk from bushfire, compared to 33 per cent following the October 2013 fires in NSW. Clearly, there are important differences from fire to fire and community to community. Furthermore, different research methods, interview and survey questions and interpretations of researchers will have influenced results.

A study following the January 2014 bushfires in South Australia involved interviews with people affected by the fires and a state-wide survey (Trigg *et al.* 2015). Findings from the survey included that 43 per cent of people did not believe bushfire posed a risk to their home and family, yet 85 per cent reported having a 'mental bushfire plan' and 28 per cent had a written plan. Research into the 2015 Samson Flat bushfire (Every *et al.* 2016), also in South Australia, found much higher levels of fire awareness with 85 per cent of survey respondents reporting they had previously been concerned about bushfire in the area. People were found to be more likely to prepare than plan for a bushfire and were more likely to undertake lower cost preparations than higher cost ones.

More recently, research examined community preparedness and responses to bushfires in NSW (Whittaker & Taylor 2018). It involved interviews with people affected by the Currandooley, Sir Ivan and Carwoola fires and an online survey of people in bushfire-risk areas. The research found a high degree of satisfaction with warnings and most people found them understandable, sufficiently localised and useful. However, many did not respond to warnings in ways intended by fire services. For example, most found official warnings about Catastrophic Fire Danger easy to understand (87 per cent), timely (83 per cent) and useful (78 per cent), yet just 12 per cent of respondents followed official advice to leave the day before or early in the morning. Furthermore, more than a third (38 per cent) began protecting their house or property, despite official advice that houses are not defensible under Catastrophic conditions. Interviews revealed that many people regarded advice for Catastrophic Fire Danger days as impractical and will only leave once a fire is threatening.

The research found many people remain committed to defending property. Almost half (47 per cent) of survey respondents who were threatened or impacted on by fire in NSW in 2017 stayed to defend. Significantly, almost three-quarters (71 per cent) of those who were not at home when they learnt of the fire attempted to return. While many were stopped at roadblocks, some were able to pass through or circumvent them to return home (Whittaker & Taylor 2018).

An important development since Black Saturday is the greater extent to which animals are considered in bushfire research. Research has demonstrated the influence animals have on human behaviour and safety and has investigated how people plan, prepare and respond to protect animals. For example, Taylor and colleagues (2015) highlight the centrality of pets to household bushfire plans and responses. Their survey of

pet owners impacted on by a range of hazards, including bushfire, found most people (over 80 per cent) kept their pets with them when they evacuated. Results suggest pets influence the mode of transport people use when evacuating, the time it takes to leave and the number of trips required. Responsibility for pets was also a factor in non-evacuation.

Similarly, Smith and co-authors (2015) studied the risk perceptions, preparedness and responses of livestock producers to bushfires in South Australia. This research found the majority of livestock producers stayed to protect their animals and livelihoods. While most did not have formal bushfire risk management plans, livestock producers incorporated bushfire preparation into routine property maintenance and were well equipped to defend their properties.

Conclusion

Much has been learnt from the devastating Black Saturday bushfires. Research into community preparedness and responses has helped us to understand and explain the effects of the fires. For this, we are indebted to the many research participants who shared their stories, knowledge and experiences of the fires by participating in interviews or completing questionnaires.

Research highlighted many issues and challenges on Black Saturday, including limited awareness and preparedness for bushfire risk, a tendency for people to leave or evacuate at the last moment and the inadequacy of preparedness and defensive actions in fires burning under what are now considered 'Catastrophic' fire danger conditions. Given the applied nature of the research, which aimed to provide evidence to improve policy and management, it is understandable that the focus has often been on problems or deficiencies in risk awareness, preparedness and response. However, the research also compiled evidence and examples of highly effective preparedness and response. This is evident in the higher survival rate of houses defended by occupants and the survival of the majority of those who took shelter during the fires.

Arguably the greatest change to bushfire management since Black Saturday, at least in terms of community preparedness and response, has been the shift in messaging to emphasise that leaving is the safest option. However, research since Black Saturday indicates that many people remain unaware of bushfire risk and will only leave once a fire is threatening. Many regard official advice to leave on days of Catastrophic Fire Danger as impractical and intend to wait until they see fire before leaving. Others remain committed to defending against fires under Catastrophic Fire Danger, despite advice that houses are not defensible in these conditions.

The Bushfire CRC and Bushfire and Natural Hazards CRC have commissioned 11 post-bushfire studies using researchers from across Australia. As a result, Australia has a strong capacity for post-incident

research, which is not limited to bushfires. Nevertheless, more work is needed to ensure the consistency of approaches, while maintaining flexibility. There is a need for greater consistency in questionnaire instruments to allow differences from fire to fire and community to community to be meaningfully compared and tracked over time.

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ABSTRACT

Traditionally, the human face of emergency services organisations has lacked diversity. However, escalating natural hazard risks due to social, environmental and economic drivers requires a transformation in how these risks are managed and who needs to manage them. With communities becoming more diverse, building community and organisational resilience to more frequent and intense emergency events needs organisations to change from working *for* communities to working *with* them. This requires greater diversity in skills and capabilities in the people who apply them, making diversity and inclusion a moral and business imperative. This paper summarises findings from an assessment of the diversity and inclusion literature relevant to the emergency management sector. Three case studies that are elements of the Bushfire and Natural Hazards CRC project, 'Diversity and Inclusion: Building strength and capability' are examined. The research assessed the current context in which diversity and inclusion exist in each organisation and identified barriers, needs, challenges and opportunities. The major findings provide a basis to develop a support framework for effective management and measurement of diversity and inclusion.

Effective diversity in emergency management organisations: the long road

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Introduction

As stated in AFAC (2016), 'Unacceptably low levels of diversity, particularly in urban fire and rescue services' are widely acknowledged within emergency services organisations. In Australia, over the past two years, this has led to a sector-wide focus on the development of programs to address this deficit. At the sector level, AFAC convened the Male Champions of Change program in 2017 to redefine men's roles in taking action on gender inequality in industry (Male Champions of Change 2018). It has also seen the growth in numbers of diversity officers in most emergency management organisations and the development of programs, frameworks and policy in this area. These have also been supported by industry conferences, including the Women and Fire Fighting Australasia biannual conferences since 2005 and the Diversity in Disaster Conference 2018.

Emergency management organisations are also responding to increasingly dynamic risks, constrained resources and changing technologies (Attorney-General's Department 2011, Young *et al.* 2018a). As a result, these organisations are placing greater emphasis on strategic planning and collaborations that manage shared ownership of economic, social and environmental values. This requires the expansion of skills from traditional tactical response to strategic planning for preparedness, prevention and recovery (AIDR 2013, Bailey 2018, Attorney-General's Department 2011, Young *et al.* 2015).

This improves understanding of how risks can affect communities and the development of comprehensive community-wide plans that allocate risk ownership and build resilience (Young *et al.* 2017). The diversification of activities undertaken by emergency management organisations and the need to represent diverse communities (e.g. Mitchell 2003) heightens the need for more diversity in workforces (Young *et al.* 2018a, Maharaj & Rasmussen 2018). Achieving this is not a straightforward task.

Project background

The 'Diversity and Inclusion: Building strength and capability' project began in July 2017. During the scoping phase, extensive consultation revealed the

need to understand what constitutes effective diversity and inclusion implementation. In particular, what this means for emergency management organisations in terms of management and measurement. The research aim, therefore, was to develop a practical framework for the implementation of diversity and inclusion that builds on and leverages current strengths and expertise within emergency management organisations and their communities. Its purpose is to support better management and measurement of diversity and inclusion by providing a platform that uses evidence-based decision-making.

The project has three stages:

- understanding how diversity and inclusion operates within emergency services systems
- developing a suitable diversity and inclusion framework for the emergency services sector
- testing and using the framework.

This paper reports on the results of the first year's work (2017–18). In this phase, the project examined diversity and inclusion systemically through a values, narratives and decision-making lens across organisation, community and economic themes. Aspects of diversity examined were culture and ethnicity, gender, demographic status (age and education) and disability (physical).

Case studies were undertaken with assessments conducted in the Queensland Fire and Rescue Service (QFES), Fire and Rescue New South Wales (FRNSW) and South Australian State Emergency Services (SA SES). These organisations were selected as representative the sector in terms of size, purpose and organisation structures. Community case studies and a community survey (Pyke 2017, McCormick 2017) were undertaken at the same time, but are not reported here.

Method

The literature review focused on what was effective in terms of diversity and inclusion practice and how it was measured. Literature on the systemic nature of diversity and processes that support its implementation, innovation and change management were sought. Google Scholar and Google Web were searched using the key words 'effective diversity', 'effective inclusion', 'measurement of diversity and inclusion', 'management of diversity and inclusion', 'diversity in emergency services/emergency management sector', 'inclusion in the emergency services/emergency management sector', 'systemic diversity', 'diversity systems and diversity process' and 'change management and innovation'. These terms were also searched substituting 'organisations' for 'emergency services/emergency management sector'. In addition, agency-related searches of emergency management-specific studies and grey literature relative to Australia (ambulance, firefighters, police, State Emergency Services, government) were also undertaken.

In total, 126 documents were selected based on their salience and relevance to the core theme.

An audit of the images used on the websites of the case study organisations was completed. This included public and archived documents relating to diversity and inclusion activities in each organisation. Images were categorised according to the type of activity represented as well as the ethnicity, age and gender of people or images used. This helped to determine the key visual narrative being presented.

The interviews were held under the guidelines of an ethical research plan within Victoria University. This plan includes provisos that interview recordings and any transcripts made are kept confidential, that people not be identified via reported comments without their consent and that all quotes are used with permission.

Thirty-three, semi-structured interviews of up to an hour long were held with people nominated by each participating emergency management organisation. Interviewees covered a variety of professional and operational departments and ranged from executive to officer levels. This provided a cross-section of employees and diversity of ethnicity and gender. The interviews were recorded and key themes and observations were extracted and synthesised into the following subject areas:

- understandings of diversity and inclusion
- governance, policy and strategy context
- communication
- monitoring and evaluation
- organisation strengths
- barriers
- needs
- benefits
- opportunities
- vision of the future.

Follow-up phone conversations were conducted with various interviewees for clarification. Coding across the subject areas was undertaken using a grounded-theory approach. Data and findings were verified with each case study organisation. The three sources of data were synthesised to identify common themes and nuances related to context. Two interviews were undertaken with Gloucestershire Fire and Rescue Service in the United Kingdom. This allowed for comparisons to be made and synergies to be identified that exist beyond the local context and that apply to emergency services organisations. Interviewees remain anonymous.

Challenges for diversity and inclusion practitioners

The literature review (Young *et al.* 2018b) revealed little consensus as to what is effective. It also revealed the need for empirical evidence to understand this

better (Williams & O'Reilly 1998, Ely & Thomas 2000, Herring 2009, Piotrowski & Ansah 2010). The role of context emerged as a key factor that could influence organisational effectiveness (Williams & O'Reilly 1998, Joshi & Roh 2009). Literature specifically covering diversity and inclusion in the emergency services sector was sparse, focusing predominantly on gender, the cultures that exist within emergency management organisations and the barriers to participation, particularly in firefighting agencies (Beatson & McLennon 2005, Branch-Smith & Pooley 2010). Data related to this area was 'patchy' and demonstrated 'a lack of coordinated workforce planning across the industry as a whole' (Childs 2006, p.33).

There was little direct connection to the innovation and change management literature to guide practitioners, even though the implementation of diversity and inclusion is closely aligned to these areas. Although there were many frameworks and maturity matrices developed for diversity and inclusion, there was no process that could be used to guide practitioners to implement diversity and inclusion within organisations (i.e. they describe *what* to do, but not *how* to do it).

There was also no overarching definition of 'effective diversity' within the literature. The following is a working definition developed to guide this project:

Effective diversity is the result of interactions between organisations and individuals that leverage, value and build upon characteristics and attributes within and beyond their organisations to increase diversity and inclusion, resulting in benefits that support joint personal and organisational objectives and goals, over a sustained period of time.

(Young *et al.* 2018b).

The diversity and inclusion nexus

Diversity and inclusion are two sides of the same coin. Diversity is often characterised as what is visible (e.g. ethnicity, physical disability, gender, age) and inclusion as invisible (e.g. education, values, culture, experience). In terms of practice, it can be represented as a two-stage process, moving from a reactive phase of demographic representation to a proactive phase of management and inclusion (Mor Barak 2015). Taking in 'invisible' characteristics that consider the whole person is important. Inclusion signifies active engagement where individuals can contribute as their 'authentic selves' and feel a sense of belonging within the organisation.

Inclusion is a relatively new area of study. Practice and measurement in this area are still being developed. However, its importance for effective diversity was recognised, especially for service organisations (Mor Barak 2015).

Diversity and inclusion in case study organisations

Most emergency management organisations have civil defence beginnings and have evolved as emergency and response-based organisations that rely on tactical decision-making. The existing institutional, organisational and social systems that have subsequently developed have resulted in dominant characteristics. These can be at odds with those needed for effective diversity and inclusion. It has resulted in a culture where traditions are strong. There is frequently resistance to change and, in the case of firefighting agencies where employment is well rewarded, it can lead to the 'perfect storm' of continued occupational exclusion (Hulett *et al.* 2008, Baigent 2005, Bendick Jr & Egan 2000, Eriksen, Gill & Head 2010).

Each organisation had different approaches to implementing diversity and inclusion. QFES uses a top-down, bottom-up strategic approach; using values and appreciative inquiry to inform organisational change. FRNSW applies a primarily top-down programmatic approach. SA SES uses a bottom-up 'organic' approach shaped by the needs of their communities.

These organisations are at different stages of implementation. FRNSW has the longest application of targeted programs. QFES integrates diversity and inclusion as part of implementing wholesale organisational change as directed by the Queensland Government in 2014. SA SES is just starting their formal implementation journey. Each organisation has different strengths related to diversity and inclusion and these are strongly influenced by the organisation's history and specific context (e.g. governance structures, roles and resources).

A review of past and current public documents, such as annual reports, revealed that QFES and FRNSW had a longer history of diversity and inclusion programs than is reflected in current records. However, programs were not always continuous, especially in the QFES, suggesting that lessons may have been learnt but forgotten, or only existed in parts of the organisation.

Effective practice was found in each organisation. Initiatives of note were the QFES Transforms Leadership Program, the FRNSW Indigenous Fire and Rescue Employment Strategy and the SA SES lateral entry program to increase the representation of women in paid management roles.

Barriers and needs

Interviews identified 213 barriers across 11 categories and 221 needs across 8 categories (Figure 1). The high number of responses in relation to barriers and needs could indicate the increasing awareness of diversity and inclusion. It may also be the result of pre-existing barriers and needs being brought to the fore as part of the change process.

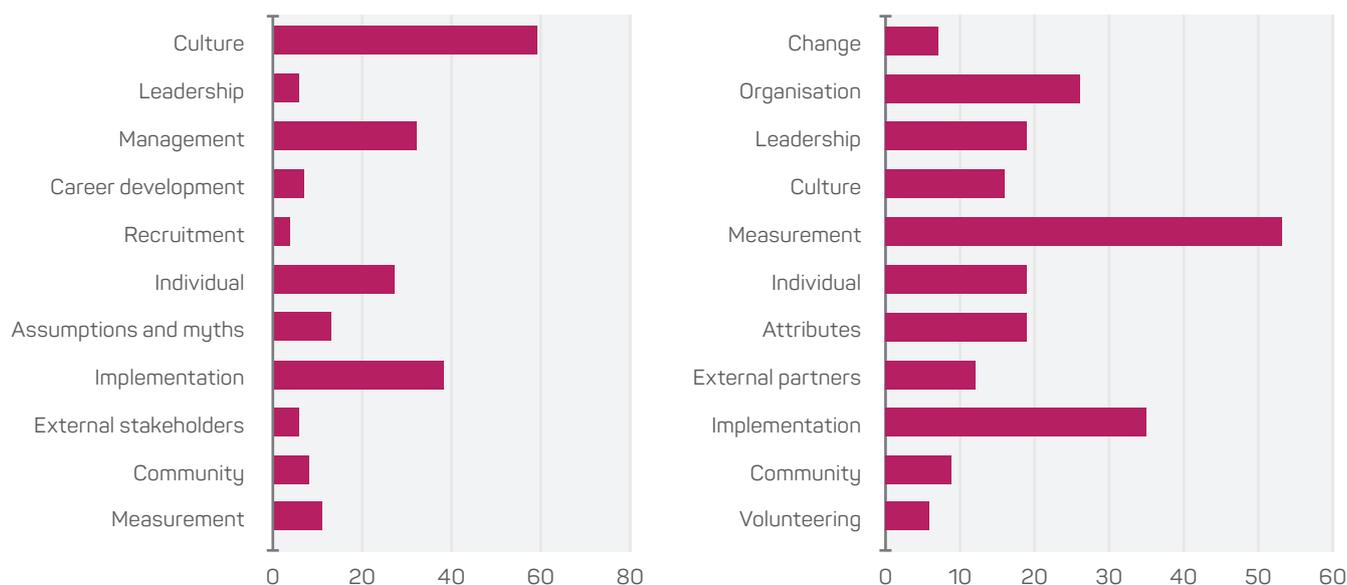


Figure 1: Numbers of barriers (left) and needs (right) for diversity and inclusion in the case study organisations.

Source: Young *et al.* 2018a

'Culture' within organisations was the largest barrier and 'Management' was identified as the largest need. The four smallest categories (Volunteering, Community, Partnerships and Change) are important issues for the emergency services sector that still requires work.

The theme of 'Culture' related primarily to aspects of organisational and institutional culture. The predominant barrier identified was the traditional, hierarchical, authoritative and predominantly male culture of organisations. This was reinforced by current structures, resulting in homogeneity that was the antithesis of diversity and a barrier to inclusion.

Important themes were facilitative management and leadership; being transparent and open, implementing actions that enable difference and empowering people to make good decisions. Managers also needed to differentiate between, and proactively manage, difficult and destructive behaviours. Many of the examples of difficult behaviours raised in the interviews were attributed to a lack of awareness where people 'wanted to do the right thing' but were unsure of what the right thing was. Needs identified were skills and training related to awareness and capability in areas such as conflict management, knowledge of different cultures, communication and language and the diverse needs of groups and individuals.

Benefits and opportunities

A total of 67 perceived benefits and 90 opportunities were identified during the interviews (Figure 2). Responses indicated a limited understanding of benefits and opportunities, which points to further development in this area.

Benefits fell into two categories: those to the organisation (85 per cent) and those to the communities they serve (15 per cent). Benefits to the organisation fell

into five categories (blue bars in the left-hand chart in Figure 2). The largest was 'Culture' and the smallest was 'Innovation'. These included monetary and non-monetary benefits.

Opportunities identified fell into eight areas (right-hand side of Figure 2). The largest categories were 'Community and volunteers', 'Culture', 'Monitoring and evaluation'. The smallest were 'Engagement and communication' and 'Education and learning'. If measures of effective diversity are to include opportunities taken and benefits realised, then knowledge of these areas within emergency management organisations could be improved.

The challenge of implementation

Implementation was prominent in the barriers and needs assessment (Figure 1). To date, many activities for diversity and inclusion have been reactive and, at times, counterproductive; focusing attention on 'achieving diversity' rather than the more complex implementation of inclusion. The use of quotas was particularly contentious. Participants also felt the 'stop-start' nature of programs eroded trust and resulted in a 'two-steps forward, two-steps backwards' outcome.

Participant reactions to diversity and inclusion included confusion, fear, resistance and difficult behaviours, particularly in units and brigades. This was exacerbated by the perpetuation of myths and assumptions related to diversity and inclusion as well as stereotyped views of diverse communities and individuals. The current lack of narratives and vision of what a diverse organisation looks like also contributed. Of the interviewees, those who performed operational roles found it difficult to visualise what their future organisations would look like. Without such vision, people are likely to anchor themselves to the past.

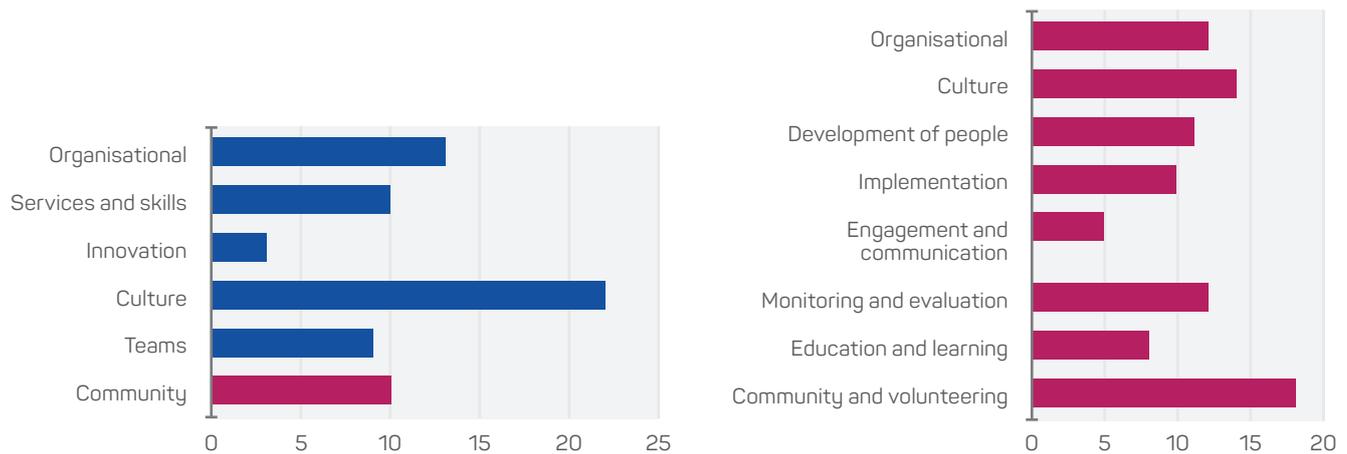


Figure 2: Number of perceived benefits of (left) and opportunities for (right) diversity and inclusion in the case study organisations.

Source: Young *et al.* 2018a

Socialisation and priming of diversity and inclusion activities before they were implemented to test target group receptiveness was considered important. The greatest need was a better understanding of the benefits of diversity and inclusion for the organisations, individuals and teams and how it relates to people's work and activities, particularly at brigade and unit levels.

Discomfort was expressed by people who were unsure about how to respond when a difficult situation arose with a person from a diverse cohort. This could result in 'action paralysis'. For example, one interviewee was concerned that they might be regarded as racist or sexist if they had to discipline someone who was from a diverse cohort. This highlights that good skills at all levels within organisations are needed so that people feel they can conduct conversations without the risk of the conversation becoming 'toxic'.

I think it doesn't matter who you deal with, you just have to be respectful and communicate.

(Firefighter)

Knowledge and understanding of what constituted appropriate communication and language (verbal and non-verbal) was a common theme. Communication needed to be framed appropriately for different areas of an organisation because language (interviewees reported) 'is different between operations and upper-level management'. It was also considered important to have common agreement on key words to enable consistent interpretation, particularly in relation to values. For example, 'respect' in an inclusion context means listening and responding mindfully to all people, whereas in a response context, it could mean being obedient to superiors and those in authority. The use of storytelling was also raised as a powerful tool to create connection to and understanding of diversity and inclusion.

Authentic actions, a diversity of people at leadership levels, long-term programs and trust were all seen as critical for effective diversity and inclusion.

If you see (only) one stereotype, then you may think twice about applying for a job here.

(Manager)

Overall, it is important that organisations provide environments that are 'culturally and emotionally safe' where people do not experience negative repercussions if they speak up.

Organisational characteristics

The characteristics of emergency management organisations that contribute to the status quo and those needed to implement effective diversity and inclusion are very different. This presents a challenge as organisations will need to change to allow for growth of these new characteristics while maintaining their current response capability:

We recruit a certain type of person to do a certain job, and at some point we ask them to do a very different job, which requires very different skills

(Manager)

Developing new organisational characteristics starts with understanding the attributes, capabilities and skills that currently exist as well as developing and integrating characteristics that effectively embrace diversity and inclusion.

Table 1 was extracted from interviews and the literature and compares dominant characteristics of traditional organisations with those of effective diversity and inclusion. The idea is not to replace characteristics in the left column with those on the right, but to identify where these characteristics may already exist in their organisations and communities so that the development and integration of these can be planned, to ensure consistency and enhancement of organisational activities. This can be used to plan transitions and identify where systems and processes may need adjustments.

Table 1: Comparison of typical characteristics with traditional emergency services organisations and those of effective diversity and inclusion.

Characteristics of emergency services organisations	Characteristics of effective diversity and inclusion
Hierarchal	Valuing everyone, equality
Tactical	Strategic
Primarily technical skills focused	Primarily soft skills focused
Authoritative leadership that directs areas of an organisation	Enabling leadership at all levels of the organisation
Shorter-term decisions	Long-term visions
Reactive	Reflexive
Resistant to change	Continuous change
Traditional - built on the past	Forward focus - embracing the future
People working for the organisation and communities	People working with the organisation and communities
Inward thinking with an organisational focus	Outward thinking across all of society
Directive communication	Interactive communication
Fixes things within a timeframe	Not fixable, requires ongoing management for the longer-term
Knowing and not making mistakes	Not knowing and learning from what doesn't work
Positional power	Empowerment of individuals

Source: Young *et al.* 2018a

Complexities

Emergency management organisations have a distinct organisational structure. They are directed and influenced by external agencies and institutions, such as government, and have limited ability to act in some areas. They often have competing priorities and some are highly resource-constrained, which can make it difficult to sustain programs.

The interviews revealed a number of 'double-edged swords' that were both enablers and disablers of diversity and inclusion:

- **Team culture** was considered a strength for organisations as it supported service delivery. However, the close-knit 'family' nature of teams, particularly at unit and brigade levels, could exclude

those 'not in the family'. This could lead to conflicts of loyalties and an 'us and them' attitude where individuals prioritise the team over the organisation. This could lead to inappropriate and covering-up behaviours.

- **Working conditions** in some organisations, particularly in the permanent firefighting cohort, provided a strong motivation for people to join and stay. This leads to low attrition rates that can make it difficult for organisations to change the composition of their workforce.
- **A strong sense of organisational identity** created a sense of pride but could also create barriers to change.
- **Diversity of thought** in the organisations was regarded as positive but can create conflict and confuse people if it was not well managed.
- **An established response narrative** engendered trust in the community and enhanced organisational reputation. However, it could reduce the community's ownership of disaster risk and create unrealistic expectations as to the level of service agencies can deliver. It could also entrench 'hero' narratives. This could reinforce a sense of entitlement, hierarchal approaches and notions of being special, which could be exclusionary.

Findings

Findings from the interviews reinforced conclusions from the literature review that effective inclusion is the critical component that enables effective diversity and that this is a long-term and, at times, difficult proposition.

Doing diversity without inclusion is like jumping out of plane without a parachute.

(Executive)

Key findings:

- Response-based and hierarchical structures, processes and decision-making with 'fix it' and 'fit in' cultures were predominant in the organisations. These are often considered of lesser value and are at odds with the strategic approach and people skills required for diversity and inclusion.
- There was a lack of awareness of appropriate language use and behaviours in relation to members from diverse cohorts and communities as well as the skills and capabilities they may have.
- Each organisation had different organisational cultures within them and there were cultural gaps, particularly between upper management and brigades and units.
- Interpretations of diversity and inclusion were varied. However, the predominant understanding was it being about 'men and women'. How different diversity intersects (e.g. a gay member of a culturally and linguistically diverse community in a rural area) and how specific needs arising from this could be managed were less well understood.

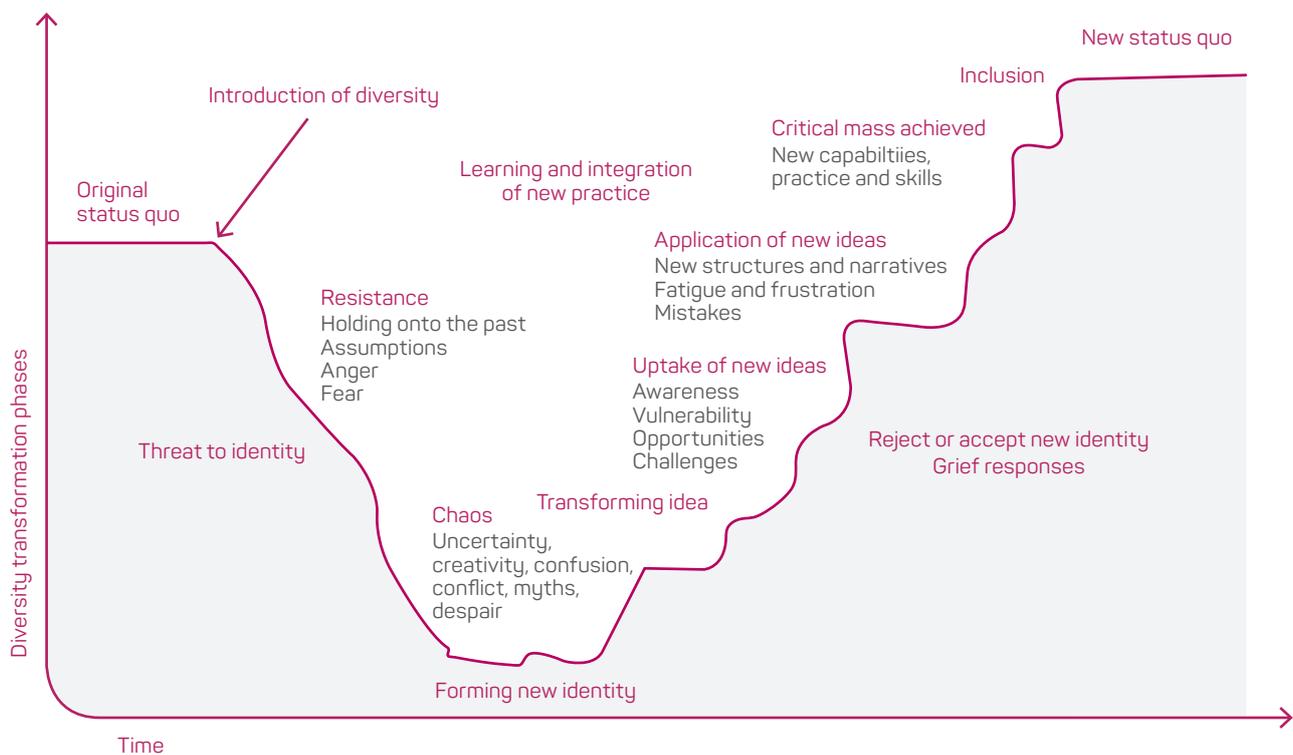


Figure 3: Phases of the diversity and inclusion transformation process.

Source: Young *et al.* 2018a (adapted from Satir *et al.* 1991, Kübler-Ross 1993, Gardenswartz & Rowe 2003, Rogers 2010)

- The diversification of skills and tasks in some organisations over the last ten years (Maharaj & Rasmussen 2018) is not fully represented in current public narratives.
- The visual audit of websites found the predominant visual narrative was of men of Anglo-Saxon appearance undertaking response-based activities. This limits the representation of employees and activities undertaken by organisations, which could discourage engagement of diverse cohorts.
- The greatest barrier to diversity and inclusion was culture and the greatest need was in the area of management.
- There was limited knowledge or valuing of the attributes and capabilities of diverse communities and individuals. This is an important component for communication that supports inclusive partnerships.
- Diversity and inclusion was not well integrated into organisational systems and processes nor connected to day-to-day decision-making.
- There are deeply entrenched organisational and personal identities that are linked to heroism and response in many organisations. These were reinforced by media and some communities.

Effective diversity and inclusion is a complex change process that requires innovation and a change in the status quo. Resistance and grief can be expected and are a natural part of change. Implementation is long-term and requires approaches that are strategic, programmatic and allow for bottom-up growth of initiatives and innovation. Figure 3 illustrates the strategic change process of a diversity and inclusion framework for practitioners.

Conclusion

Diversity and inclusion in the emergency services sector sits within a broader context of the overall change organisations are currently experiencing as they adopt more strategic roles in emergency planning and mitigation. To date, implementation has been largely reactive and focused on demographic representation, but organisations are rapidly moving into the proactive phase of developing inclusion.

There is still a tension between diversity as a positive and organisational imperative and diversity programs that divert resources from important priorities. This barrier is a sign that emergency management organisations have yet to embrace diversity and inclusion capabilities and skills as part of day-to-day business activities.

Right now, there is a real opportunity to make a difference and change things for the better.
(Director)

In the case study organisations, implementing diversity and inclusion is evolving. Although there is work to be done, existing strengths can be built upon and leveraged. Leaders are emerging and service delivery can be improved through greater understanding of diverse cohorts and their value to organisations. Developing attributes, skills, capabilities, structures and processes that support inclusiveness are critical to positive outcomes.

For emergency management organisations to realise the full potential of diversity and inclusion they must move beyond notions of good and bad to a better awareness and understanding of what works and what doesn't, and

why. It is important for organisations to understand and acknowledge the past and to develop tangible visions of the future where diversity and inclusion is integrated into people's roles. Being an inclusive organisation that is truly diverse is a long road. However, the rewards are being recognised and progress is already underway.

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ABSTRACT

Tropical Cyclone Debbie, a Category 4 cyclone, crossed Australia's coast in North Queensland on 28 March 2017. Over three days, the cyclone travelled south across Queensland weakening to a low-pressure weather system. The event caused significant flooding and damage to communities. Formal sources of information related to this event included the Bureau of Meteorology and emergency services providers as well as informal sources from state-based traditional media and social media sources of Twitter and websites. This paper is based on findings of a small study to identify the differences in weather prediction information between those formal and informal sources using the Cyclone Debbie major weather event, which invoked a disaster response. This paper identifies issues associated with the dissemination and reporting of weather-based information during emergencies. These include the language used in official sources that can confuse or downplay events, inconsistent reporting between authority and non-official sources and the lack of locally based information used by non-traditional information providers.

Comparing sources of weather prediction information in the aftermath of Cyclone Debbie

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Introduction

The use of social media and its efficacy as a means of communication is now well recognised in disaster research and management. In recent years, the Bureau of Meteorology (BOM) has been establishing a presence on social media after an acknowledged slow start using the technology (Zion 2017). While the BOM restricted initial forays into Twitter by delivering forecasts, Zion (2017) noted that BOM executives are using social media and real-time data during severe weather events to inform emergency response decisions. Despite efforts of official sources to engage with members of the public and within specific communities via social media, effective communication during emergency situations and disasters remains a challenge. A lack of preparedness emerged as an issue for residents of Queensland during and immediately after Tropical Cyclone Debbie in March 2017 (Office of the Inspector-General Emergency Management 2017, Cullinan 2017).

Tropical Cyclone Debbie crossed the coast near Airlie Beach in Queensland and took an inland track before heading back out to sea south of Brisbane. Rain from the cyclone created devastating floods in the Fitzroy River Basin in central Queensland and throughout South East Queensland and northern New South Wales. Interviews with people who were affected by Cyclone Debbie highlighted issues associated with disaster preparedness. Cullinan (2017) reported on resident responses:

She says even though she felt she was prepared and had been listening to the warnings about Cyclone Debbie's approach it wasn't until the river they live by burst its banks that it really hit her.

He says he didn't even see what was coming... 'Be over-prepared. We did a lot here to try and be prepared because in 1954 [the last flood] only barely came through here, and that was before the levy bank was put in, so we honestly never thought we'd get as high as it did,' he said.

(Cullinan 2017, p.16)

These comments raise many questions. If those affected thought they were prepared, why did it eventuate that they were not prepared well enough? What information was being provided to the public? What were the warnings?

How were they conveyed? What sort of system was Cyclone Debbie when it passed through Brisbane?

To answer these questions, this study explored the accuracy of information provided to inform the public during this event. Weather data, public warnings and emergency information provided by official weather sources were compared with unofficial weather-based sources that were popular on social media platforms.

Method

The aim of this study was to identify the differences in weather prediction information between formal and informal sources using Cyclone Debbie as a case study. This research was based on critical social enquiry, which underpins research to move beyond simple understanding and consider ways to influence action. The first step was to document and analyse weather warnings from the official sources. This information was compared with information disseminated by enthusiasts; those who communicated with one another via social media-based weather interest groups as well as media sources (traditional and non-traditional).

As defined by the BOM Severe Weather Warning Service (BOM 2017b), severe weather warnings are issued when there are expectations of:

- sustained winds of gale force (63 km per hour) or more
- wind gusts of 90 km per hour or more (100 km per hour or more in Tasmania)
- very heavy rain that may lead to flash flooding.

One of the typical weather patterns that can trigger a severe weather warning is 'a recently decayed tropical cyclone moving inland or into southern regions' (BOM 2017b).

Weather data provided by the BOM was used to construct graphs and diagrams to quantify the weather event of 30 March 2017. The illustrations were used to determine the accuracy of the weather warnings in hindsight. The Bureau provided one-minute average wind speed, maximum wind gust speed, wind direction, mean sea level pressure and accumulated rainfall from automatic weather stations. The Bureau also provided rain rate weather radar and geostationary satellite images for 30 March 2017. These were used to illustrate the extent of the weather event and to document vorticity components of the low-pressure system. The resultant graphs and diagrams provided the context for understanding prior official warnings for South East Queensland on 29 and 30 March 2017 as well as the news and social media reporting that followed.

Coverage of traditional media (print, radio, television and online news) and non-traditional (social media, blogs and social news) sources was collected. The ABC and *Courier-Mail* were selected as the major media outlets in Queensland; the ABC having a state-wide focus with

local bulletins and the *Courier-Mail* being focused on Brisbane as the city's major metropolitan daily news outlet. An initial search was conducted using the Dow Jones Factiva database. Outlets were ABC (all sources) and *Courier-Mail* (all sources). Date range of articles was 28 March to 30 March 2017. Search parameter was 'cyclone debbie'. This identified 50 *Courier-Mail* articles and 74 ABC articles. The search was refined and only articles mentioning 'south-east Queensland' or 'Brisbane' were retained for analysis. In total, 23 *Courier-Mail* articles and 31 ABC articles were analysed. The analytic method used was discourse analysis, which supports a critical approach and is a common analytic method in media studies (Gill 2018).

Coverage of social media included messages distributed via Twitter, which was the focus of analysis for non-traditional media sources. According to Bouvier (2019), Twitter is recognised for its role in disseminating information as it happens and journalists source and produce news from its content. For this study, search terms were #cyclonedebbie, #TCDebbie and #exTCdebbie. All tweets using these hashtags between 28 and 30 March 2017 were searched when referenced to South East Queensland or Brisbane to retain consistency with the traditional source data. In addition, Higgins Storm Chasing, the most followed non-official weather-based Facebook site in Australia, was also examined as a non-official information source. The same search terms were used.

Findings

Cyclone Debbie as a weather event

In its monthly weather report, the BOM noted that March 2017 was a warm month based on climate averages across Australia. It was the third warmest March since temperature records commenced (BOM 2017a). This scenario meant that atmospheric and sea surface conditions were conducive to the formation of Tropical Cyclone Debbie on 25 March 2017. After three days, the powerful Category 4 cyclone crossed the Whitsunday coast causing extensive damage to property and forest areas near Airlie Beach (Figure 1). Hamilton Island, off the coast from Airlie Beach, bore the brunt of the storm and experienced peak wind gusts of 263 km per hour (BOM 2017a).

Cyclone Debbie weakened as it tracked inland of the central Queensland coastal ranges (Figure 2) creating extensive flooding in the Fitzroy River Basin that affected multiple towns. By 29 March, Cyclone Debbie had weakened to below tropical cyclone strength, however, continued a gusty southerly path past Collinsville.

The mean sea level pressure chart shown at Figure 3 indicates the location of the weather system at around 10:00am 30 March 2017.

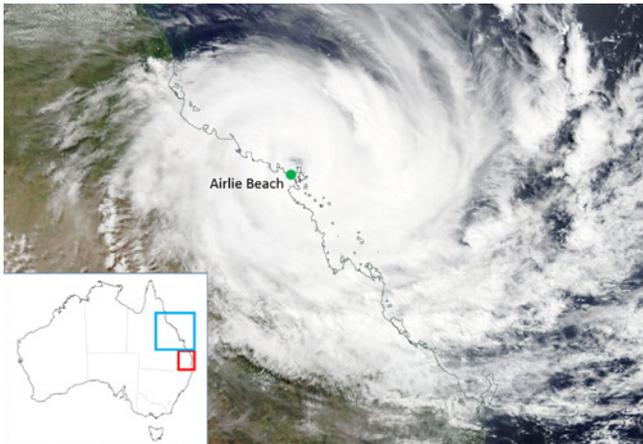


Figure 1: Tropical Cyclone Debbie crossed the coastline over Airlie Beach causing extensive damage to property and forest areas.

Source: NASA 2017



Figure 4: Mt Stapylton weather radar rain image exhibiting some vorticity structure over Brisbane.

Source: BOM 2017c

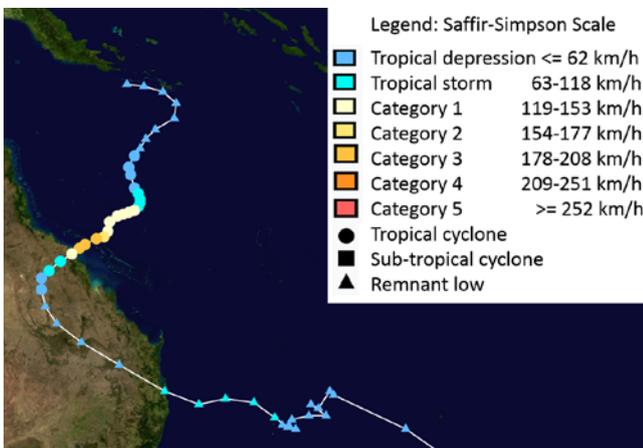


Figure 2: Cyclone Debbie tracked inland and caused significant flooding in the Fitzroy River Basin before heading south-east.

Source: NOAA 2017

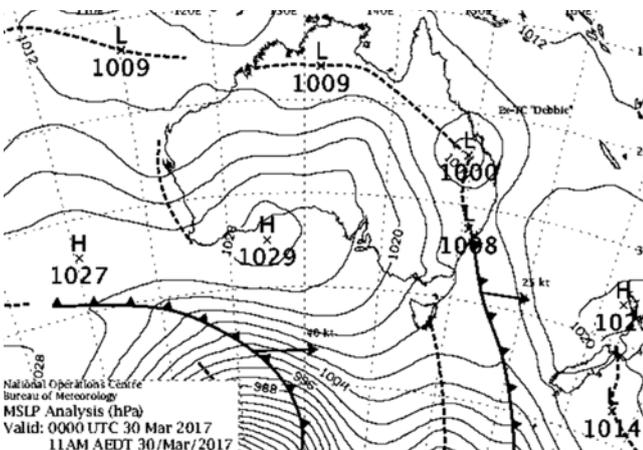


Figure 3: Mean Sea Level Pressure Chart at 10:00 am 30 March 2017.

Source: BOM 2017b

The extensive low-pressure structure turned south-east during 30 March 2017 and arrived through the north-west of Brisbane that evening. The remnant system and associated severe thunderstorms, lashed South East Queensland (BOM 2017a) with gale force winds (Figure 3) before passing out to sea south of the Gold Coast. In the following days, torrential rain led to extensive flooding in South East Queensland and north-east New South Wales.

According to the BOM cyclone classification standard based on wind speed values, Tropical Cyclone Debbie was a tropical low as it passed through South East Queensland with wind speeds less than that of a Category 1 tropical cyclone. However, measurements of wind gusts (Figure 5) show that unusually strong winds (or gales) struck the region. The weather system also exhibited some vorticity structure usually associated with a cyclone. A cyclone-like 'eye' feature was evident in the Mt Stapylton rain radar images (Figure 4) as the system passed through South East Queensland that confounded weather observers.

Automatic weather station measurements (Figure 5) show that the wind direction changed 120 to 180 degrees in the proximity of peak wind gusts as ex-Tropical Cyclone Debbie made its transit through South East Queensland. Together with mean sea level pressure changes, the presence of local-scale weather system vorticity normally associated with deep low-pressure, high-speed wind systems was evident close to Brisbane. Analysis shows that a second low-pressure centre developed ahead of the original core of the cyclone (Turner 2017) passing over the Sunshine Coast as a rare Mesoscale Convective Vortex. The twin system interactions brought 'cyclone-like' severe wind gusts to South East Queensland to the surprise of residents and emergency services agencies and authorities.

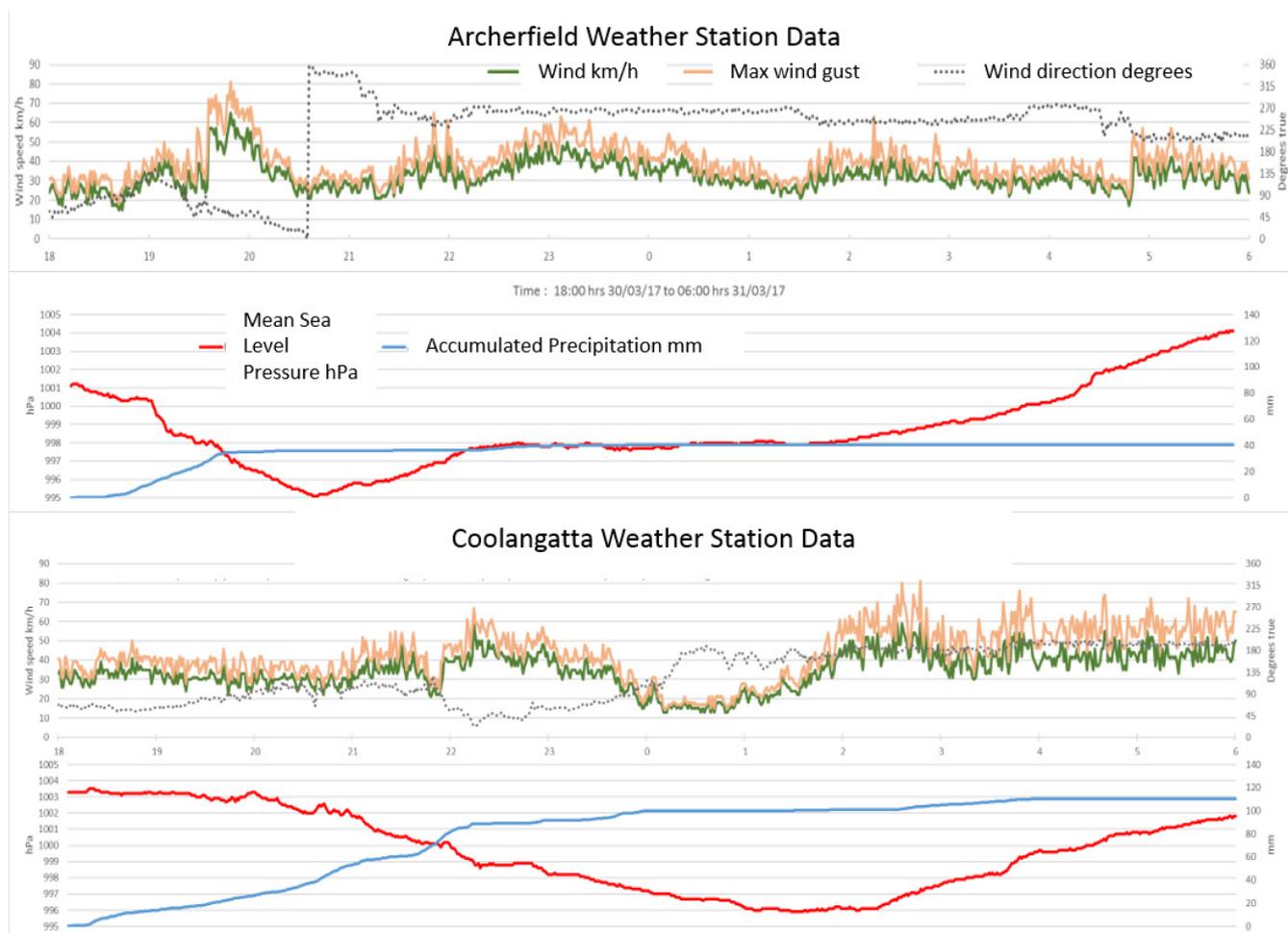


Figure 5: BOM Archerfield and Coolangatta weather station graphs for 30 March 2017.

Source: BOM 2017d

Weather warnings

Information provided by the BOM Climate Data Services show that the BOM Queensland Regional Office issued a severe weather warning for coastal and hinterland central Queensland regions at 2:58 am on 29 March 2017 noting damaging winds and heavy rain. This warning was the first indication that the severe weather system associated with a weakening Tropical Cyclone Debbie, would track south-eastwards during 30 March. At 5:16 am, the severe weather warning noted the possibility of flooding in the south-east corner of Queensland and damaging winds around Fraser Island for the next day. At 9:15 pm on 29 March, the severe weather warning advised that winds in excess of 125 km per hour would develop in South East Queensland coastal districts from the afternoon of 30 March. Multiple warnings and cancellations were issued by the BOM Queensland Regional Office on the morning of and during 30 March. At 5:15 am, a severe thunderstorm warning was issued followed by cancellation notices at 6:31 am, 6:33 am and 6:34 am. The next severe thunderstorm warnings for South East Queensland were issued at 11:33 am and 12:05 pm, followed by a cancellation at 12:24 pm. Further severe warnings throughout the afternoon of 30 March were issued by the BOM for areas ranging from the Gympie region to the southern coast. These indicated severe winds and heavy rainfall.

Warnings via traditional media

This study revealed three issues in the traditional media reporting that were worth further investigation. These were:

- the choice of language used
- the inconsistent reporting of the event
- the inconsistent use of hashtags in social media.

It was identified that language was 'softened' and, at times, inconsistent with official warnings. Reporting of technical forecast information was inconsistent and there was minimal mention of winds being potentially dangerous and wind information in forecasts and reporting was not prioritised. This study did not delve into how journalists determine what to report, however, it did raise questions as to what emergency services organisations might do to influence reporting to maintain quality and consistent information.

Analysis of social media reporting showed that local information was blurred by the state-wide approach to coverage and there was a lack of coordination between agencies associated with coordination and management. This resulted in inconsistency when using hashtags and disseminating information.

'Soft' and inconsistent use of language

Language used by official sources reported in traditional media potentially represented a 'hedging bets' approach despite being accurate. An example from an ABC report (Agius 2017) follows (underlining for emphasis):

BOM forecaster ((name removed)) said ex-Cyclone Debbie was continuing to weaken and would move fairly quickly to the south-east by Thursday.

Brisbane and surrounds could receive up to 200mm in 24 hours, with the worst of it on Thursday night. The monthly March average is 138mm.

The falls will not be enough for a repeat of the 2011 Brisbane River flood.

"We have had quite a dry summer, so there isn't a build-up of moisture in the catchments to allow that," he said.

"It is quite a different set-up.

"We don't have an upper trough which sat above us [in 2010–2011] for a couple of days which provided a lot of rain.

"This one is quick moving and will clear up by the weekend, there will not be a repeat of the 2011 weather event."

In this example, the forecaster is not only predicting the weather but comparing the event to past events, possibly in response to questions from a journalist that attempts to make sense of the event for the public. While the statements were technically correct, it was not a repeat of the 2011 weather event and is problematic if it influences public expectations. Other examples of this language include:

Authorities also warn that the remnants of Cyclone Debbie may cause flooding and torrential rain around the Wide Bay and South East Queensland regions next week.

(*Courier-Mail*, 28 March 2017 (Honnerly 2017))

We will have a lot of moisture coming down with the remnants of Debbie and that's what will be driving most of those showers,' he said. (The flood watch) is just a preliminary product to give people a heads up.'

(*Courier-Mail*, 29 March 2017 (Honnerly & Akers 2017b))

The use of superlative language was also identified as potentially problematic. For example:

Meteorologists said a month's worth of rain could be dumped on some areas, including Brisbane, which averages 109.77mm for March.

(*Courier-Mail*, 29 March 2017 (Honnerly & Akers 2017b))

While descriptive, a 'month's worth of rain' is not a well-defined amount. A lay audience would most likely not be familiar with what 'a month's worth of rain' might look like. As a result, the use of such terms can prove meaningless

and not have the desired effect on audiences. This phrase was also reported in ABC coverage the same day (Agius 2017).

Inconsistent technical information

The study showed that technical information was inconsistent. For example, the ABC and the *Courier-Mail* reported on 29 March 2017:

Courier-Mail: 'Up to 150mm of rain is forecast to hit the region as early as tonight, lasting until the weekend.'

(Honnerly & Akers 2017a)

ABC: 'South-east Queensland is set for a drenching today with rainfall in excess of 200 millimetres possible in some localised areas, the Bureau of Meteorology warns.'

(Agius 2017)

Wind gusts were reported as up to 60 km per hour in the *Courier-Mail* and 100 km per hour in ABC reporting on the same day. Wind forecasts were downplayed and qualifiers were used to soften language. For example:

Meteorologist ((name removed)) said strong winds of up to 60km/h would hit the South East.

'It will be windy, maybe 20–40km/h and possible gusts up to 60km/h but that's not going to cause any major damage,' he said.

(*Courier-Mail*, 29 March 2017 (Honnerly & Akers 2017b))

Alternatively, mention of wind gusts occurred later in the body of the story, where less important information is usually found in news reporting:

'At this stage we're looking at 100kph wind gusts particularly around exposed coastal areas and coastal ranges.'

(ABC 2017)

Social media warnings and inconsistent hashtags

The study showed use of inconsistent hashtags in social media messaging. Variants included #TCDebbie (used by Queensland Police Service and Higgins Storm Chasing), #CycloneDebbie (used by the BOM and Queensland Police Service), #exTCdebbie and #TCDebbie. The hashtags #TCDebbie and exTCDebbie were used by state politicians (George Christensen MP and Jacki Trad MP), news organisations (Sky News and ABC Brisbane), emergency services organisations (Brisbane City SES) and local councils and councillors (e.g. Luke Smith). Some provided very specific local information.

Analysis of Twitter-based reporting showed it was difficult to ascertain the relationship between a message and to whom it was relevant. Tweets did not indicate where flooding may occur nor for whom the flood would be hazardous, for example:

@ABCEmergency: 'We've had reports of over 300mm since 9 am yesterday ... so there is a real risk of flooding.' - @BOM_Qld's Adam Blazak on #CycloneDebbie

@jessvanvonderen: @BOM_Qld says #CycloneDebbie will be a hazardous system for the next 24 hours @ABCNewsBrisbane

Such a state-wide and generalised nature of information could be problematic given the localised flooding. Overall, the study showed citizens used #TCDebbie, which is consistent with the approach taken by state politicians.

Discussion

Findings in this study address questions raised in the report into preparedness for Cyclone Debbie (Office of the Inspector-General Emergency Management 2017). The report identified a difference in preparedness between northern and south-eastern Queensland communities. It noted that the impact of Cyclone Debbie on South East Queensland was greatest in the peri-urban rim, where council boundaries of Scenic Rim, Logan City, Redland and Gold Coast abut the Brisbane City Council boundary. The report identified centralised media and confusing and incorrect reporting as problematic (p.87), and that media campaigns using social media and radio were effective means for communicating with the public (p.58).

The report noted:

- community members sought information from local councils
- there is potential for councils to partner with the ABC
- there were issues associated with inconsistent and misunderstood terminology and news media coverage.

The report identified opportunities to link the sources of information communities use most (BOM and traditional media) more closely with official information from local and state governments as well as emergency services agencies. The report noted that 'interviews or media conferences by mayors and elected officials were a successful way of engaging the public, and ensured that the information provided was seen as authoritative' (p.85). However, authoritative information that is inconsistent or confusing has potential to be more dangerous than messages from unofficial sources.

This research illustrates some of the issues referred to by sources cited in the report. It suggests that work is required in the areas of message delivery and language choice, consistency in message content and hashtag address use as well as improved localisation of information.

News media training, which has been a 'go-to' solution in the past, needs other approaches to improve emergency communication in all its phases. Community members are bypassing traditional news media for official

information from the source. Training for staff who post to social media and in public forums may address some of the problems identified in this study. To illustrate, a hashtag cue promulgated by the Crisis Communication Network in the preparatory and emerging stages of an event, could promote consistent use of hashtags across all levels of government, news media and emergency services organisations' social media information. This may address recommendations for public information management that: 'information should be searchable, more specific, timely and allow stakeholders to find what they want.' (Office of the Inspector-General Emergency Management 2017).

This study identified the benefit of examining messages using discourse analysis more holistically and in detail. It is not enough to simply explore the use of social media platforms. Examining broader interaction between media sources may provide clarity as to how responsible organisations can improve warnings and preparedness messages before, during and after an emergency. For example, the *Digital Media Report 2018* produced by the University of Canberra identified that news consumers in regional areas rely more on offline platforms, particularly television news, and almost twice as much on local and regional newspapers for news than urban consumers (Park et al. 2018, p.9). The report also noted that news consumption via mobiles is lower among regional news consumers, indicating that internet connectivity is potentially a factor when accessing online news. Contextual factors therefore influence the way people seek and access information they believe to be important to them. What happens when local and regional newspapers are accessible only by subscription and disaster-related information is not immediately available? What are the implications when the only accessible news-based information for regional communities is via state-wide coverage by offline platforms, such as ABC radio? What happens when access to offline platforms is limited and the easiest way to access information is via social media? In this context, there is a need to consider how people use information, particularly as media information is centralised despite the need for localised information (Office of the Inspector-General Emergency Management 2017). Addressing this would allow for human factors to be considered, such as the way people use social media collectively, during information dissemination (see Palen & Hughes 2018).

Conclusion

Researching inconsistencies that occur when disseminating accurate information via official weather sources has the potential to improve analysis and communication processes. The information assists continuous improvement undertaken by governments and emergency services organisations as well as the Queensland Inspector-General of Emergency Management's Lessons Management Plan. This is increasingly important when centralisation of media

and government reduces the frequency and specificity of local information. This can impact on regional and peri-urban communities who may be at greater exposure to disaster events; these communities often have limited (or no) locally based media or immediate source of information aside platforms such as Facebook. This is particularly problematic when weather systems are likely to be large, fast-moving and complex as was the case with Tropical Cyclone Debbie. In the absence of information, people will look for information from multiple sources. Maintaining consistency of messaging and preparedness information would be of interest for future research.

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ABSTRACT

Utility of Virtual Operation Support Teams: an international survey

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Introduction

Adapting to a highly dynamic, polycentric information environment is increasingly resource-intensive. Unlike in the past, as events occur, the number of eyewitness reports, videos and opinions uploaded and shared on social media can quickly overwhelm the resources of authorities. The risk exists that important information may be missed (Paris & Wan 2011). Disaster risk managers face difficulties when managing information from social media channels especially in large-scale incidents. For example, during Hurricane Sandy, extensive resources of people, technologies and time were diverted from traditional emergency management activities to deal with misinformation during the incident (Hughes *et al.* 2014). Virtual Operation Support Teams (VOSTs) have been established in many countries to help authorities manage information in high-pressure information environments. These teams monitor social media, support situational awareness, counter rumours and disseminate official communication (Reutter 2012).

VOSTs are highly interesting organisations for study, as their recent emergence reflects some pressing and most debated challenges in disaster management. First, VOSTs are a prime example of the effects of digitalisation on emergency management. The broad socio-technological trend of digitalisation is changing all aspects of emergency and disaster management from risk analysis to resource planning (Meier 2015). Secondly, VOSTs represent a new form of civic engagement driven by the desire to help in non-bureaucratic ways (Whittaker, McLennan & Handmer 2015). The downside of this is that the rise of VOSTs may exemplify the slow decline of traditional forms of volunteerism that has been observed in many countries. Reasons for this decline have been analysed in much depth (Putnam 2000, Hustinx & Meijs 2011, McLennan, Whittaker & Handmer 2016). Finally, VOSTs are an example of the ongoing and fundamental transformation in emergency and disaster management practices, from hierarchical and static organisation forms to dynamic, network-based arrangements (Cobb *et al.* 2014). This explains why established disaster managers express a level of suspicion towards these new organisational forms, even though most observers generally agree that 'digital volunteers' are an asset for disaster risk management, especially for communication.

The VOST movement originated out of perceived gaps between civil society and emergency management professionals in the United States. It started as a volunteer movement by people formally employed by emergency agencies and governments. On a typology of top-down versus bottom-up participation

No other disaster management practice has undergone as much change than has emergency communication. The components of emergency communication, from situational awareness, to response coordination and public information provision are influenced by factors that are fundamentally different from 20 or even ten years ago. It is a fast-evolving environment, involving new technologies and changing communication preferences. Adapting to a highly dynamic and demanding information environment takes up resources from other activities. One response to this rapid change has been the establishment of Virtual Operation Support Teams to monitor social media, support situational awareness, counter rumours and disseminate official communication. To date, the establishment, utility and added value of these teams has not been the subject of research. This paper examines the evolution of Virtual Operation Support Teams across the globe and how they are being used in seven countries. The paper suggests ways that governments and emergency management authorities can support similar teams and how integration with formal operations might be managed. This may assist countries where Virtual Operation Support Teams are not yet established or where teams are only activated during an emergency event.

in disaster engagement (Turner & Dynes 1975), VOSTs fall somewhere in the middle. They are largely self-organised, but also seek formal recognition from the emergency management sector. Importantly, teams are typically activated only on request by authorities. Many VOST members are participants in emergency management organisations and these connections are often what distinguishes VOSTs from other digital volunteer organisations (Starbald & Palen 2011, McLennan, Whittaker & Handmer 2016).

To date, there has been little research on the conditions under which VOSTs have flourished nor on the ways these teams might be best used. This paper examines the evolution of VOSTs at an international scale and presents results of a survey of VOST teams responded to by seven countries. The paper identifies ways to encourage authorities to support VOSTs and how teams can be integrated with more formal operations. This work aims to build understanding of the characteristics, historical development, relationships and advantages of these teams and their contribution to emergency management and response.

Emergence of Virtual Operation Support Teams

The first occurrence of VOSTs appeared in 2011 when Jeff Phillips (an emergency management coordinator from Los Ranchos de Albuquerque, New Mexico) introduced the VOST concept at the annual conference of the National Emergency Management Association. Phillips envisioned the VOST as a resource-efficient means of monitoring social media, collecting, aggregating and verifying crisis-related information; similar to existing forms of local citizen engagement in the offline world, like the Community Emergency Response Teams (CERTs).

In 2011, organised groups of virtual volunteers were nothing new. Employing new technologies and new media to distribute emergency communication and receive information had been debated since the early 2000s (Palen & Liu 2007). Grassroots groups had most prominently demonstrated the practical value of virtual collaborations in the wake of the devastating 2010 earthquake in Haiti. The value of this work lay largely in the virtual execution of local community needs assessments and developing 'crisis maps' illustrating real-time, on-the-ground necessities (Meier 2010, Heinzelman & Waters 2010, Ziemke 2012).

Emergency and disaster managers were unsure as to what they could expect from the volunteers and how reliable their information was. Consequently they found it difficult to estimate the potential added value of the crisis mappers' potential contributions (Waldman & Kaminska 2016). To overcome this, VOSTs were designed to stand on the shoulders of 'trusted agents' (Reutter 2012); people with backgrounds in emergency or disaster management who could coordinate the support actions undertaken by the virtual teams.

In recent years, the VOST concept has spread quickly, first within the United States and now to other regions including South America, Europe and Oceania (VOSG 2018). As the VOST idea has spread, a lively and international community has grown. While this growth has been accompanied by a wealth of anecdotal evidence concerning the benefit of VOSTs, little systematic research has been conducted to examine the growth and formal utility the movement presents to emergency and disaster management.



The VOST in Germany during a deployment for the Tour de France cycling race in 2017.

Image: THW, Nicolas Hefner

Methodology

A survey consisting of 16 open-ended questions was distributed to all active VOSTs around the world. The survey examined the personal backgrounds of VOST members, the history of the VOST in the region, including the possible trigger events, deployments and exercises. The survey collected information on the operational processes of the VOST (activation, personnel development) and how the VOST was connected to other virtual teams, local and international disaster management authorities and academia. VOST coordinators were asked to indicate how the future development of the VOST was planned. The survey was distributed in English and Spanish. The Virtual Operation Support Group database was used to inform the case selection process. The Virtual Operation Support Group is the international association of VOSTs and, in 2018, listed 49 VOSTs across 14 countries.

VOSTs with no contact information or with inactive online accounts were excluded from the study. Thus, 27 teams were contacted via email, Facebook and Twitter during February and March 2018. Eleven responses were received (40 per cent). Figure 1 gives the location of the 27 contacted teams with green dots highlighting teams that participated in the survey. Most surveys were completed by the primary VOST organiser, whose anonymity is maintained in the presentation of the results. Responses received in Spanish and French,

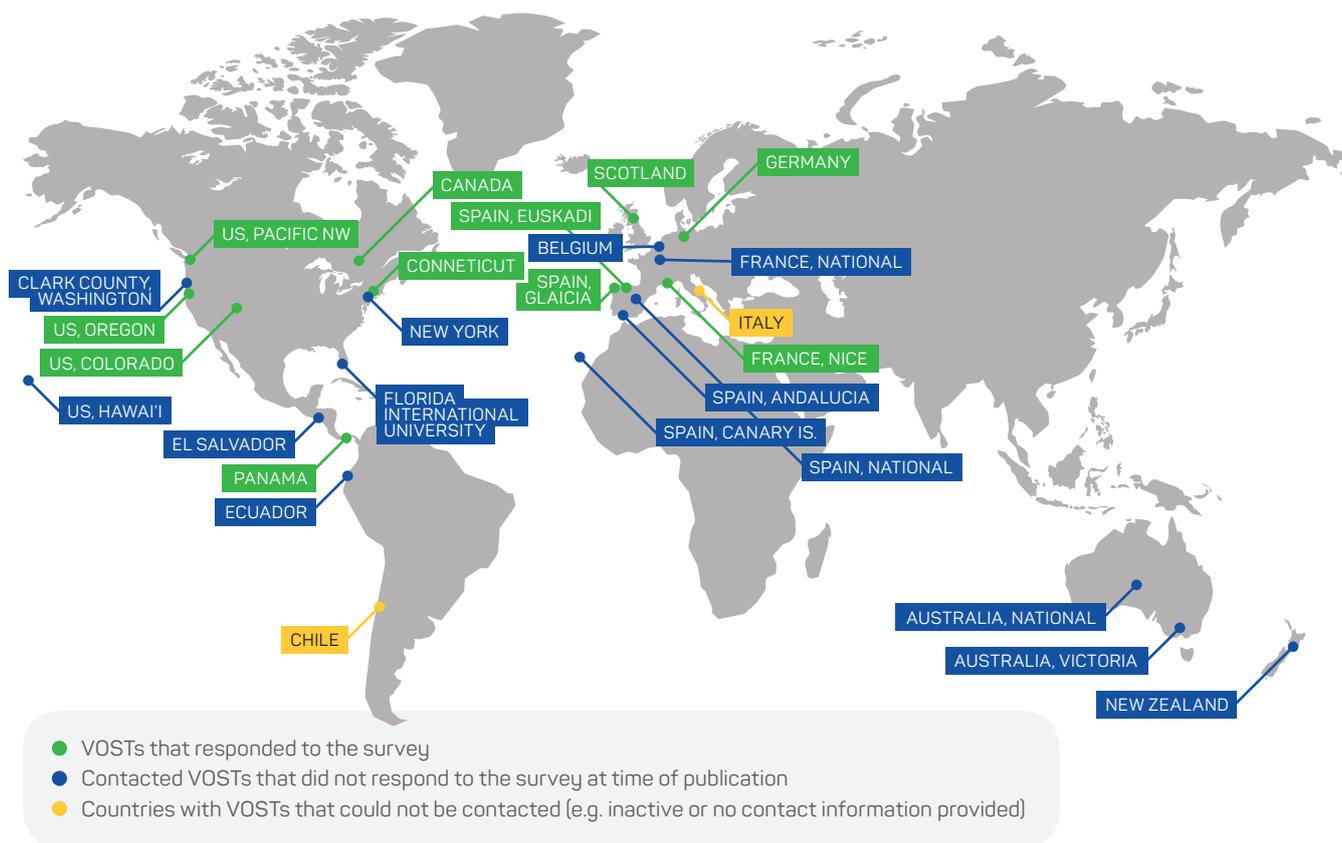


Figure 1: Locations of the teams contacted and their participation in the survey.

including any extra material or documents about the organisation, were translated into English. All information was analysed qualitatively using MaxQDA data analysis software. Ethics approval for the research was covered under the Swiss Federal Institute of Technology's blanket ethics arrangement for low risk research.

Results and discussion

Results show that the development of the VOST movement has occurred in a fundamentally practical way, driven by local groups and individuals who are connected through virtual networks. Since 2011 and across a broad range of deployments, VOSTs have proven to add valuable capabilities to authorities' communications and to the amount of information available to the public during disasters. Even so, the utility of VOSTs as sources of complementary information remains underestimated.

Three important challenges identified by the survey respondents were:

- a lack of buy-in from formal disaster management organisations
- delayed granting of political legitimacy
- challenges recruiting respected VOST contributors or members.

The results also provide a better understanding of the organisational characteristics, historical developments

and the relationships between VOSTs and other disaster management actors.

VOSTs have evolved as a practical solution to problems recognised by emergency managers. Since the first VOST was established, the concept has quickly spread. In some cases, the formation of teams was in direct response to a recent disaster event. More often, however, it was the motivation of individual emergency management practitioners, with experience of the ways authorities had been overwhelmed by the increasingly challenging communication environment during their operations (either in response to disasters or in the context of other large public events, such as sport tournaments, public appearances of political and religious leaders), who have initiated VOSTs. In these cases, the individuals identified the potential of the idea beyond its original setting, sparking the establishment and adaptation of new VOSTs to the specific geographical, social and political contexts they were operating. For the respondents, the specific value of the VOST concept lies in four main areas.

Unburdening authorities

Many VOST organisers had first-hand experience of how authorities could be overwhelmed by the amount of information exchanged on new media networks such as Facebook, Twitter and YouTube. They recognised the advantages to authorities of establishing ways to monitor social media that could support active and credible responses to situations or redirect misinformation. Respondents explained:

[Our VOST] was created after a series of wildfires that created a high impact on social media. During these wildfires, many people shared hoaxes that complicated the work of emergency services.

(Respondent 03)

Being able to provide real-time information from a trusted source, on platforms the public are comfortable with was the key driver for the foundation of [the] VOST.

(Respondent 08)

The [VOST] is specifically designed to be a resource that will be available to the state and any local agency that wishes to fully experience the dual benefits of engaging with, and listening and responding to, the modern virtual landscape.

(Respondent 07)

The early proponents of the VOST idea saw that while new ICTs might pose some challenges for disaster management authorities, the very same technologies also provided great opportunities to support crisis communication professionals. The principle of employing volunteers with an emergency management background, functioning as 'trusted agents' on the side of public information officers, has been a central characteristic of VOSTs that sets the movement apart from other forms of digital volunteerism (like crisis mapping, for example).

Integration of volunteers

Involvement in incident response strongly influenced the development and organisation of VOSTs. A VOST structure that mirrors that of the local emergency management authority can optimise integration of the VOST in formal emergency management activities. The survey responses showed that many VOSTs have well-established partnerships with local agencies, which provides important support for the team's activities. As one respondent indicated:

Nowadays we support the administration. We are considered like another civil protection entity and we help in the management of information on social media, monitoring, detecting critical information and stopping hoaxes. All the relevant information is passed to the competent authorities and we generally have regular contact.

(Respondent 03)

VOST volunteers benefit from relevant training and feedback from emergency services organisations. A few teams receive some financial support that allows them to conduct training and exercising for volunteers or to buy computer software and equipment. A number of law enforcement authorities support local VOSTs with free background checks for new volunteers.

Skill set and motivation

Survey results showed that VOSTs draw on the skills of volunteers who have backgrounds in computer science,

journalism, law enforcement, public health and other fields. In addition, most VOST members were involved in volunteer fire brigades, community organisations like CERTs or other emergency-related organisations and they had skills that were desirable. In countries where VOSTs were most numerous and well integrated into civil protection practices, like Spain, team organisation is largely driven by middle management officials with a personal interest in achieving high-level capabilities to effectively manage disaster communication. In these cases, official support for teams is positive.

Networks of networks

The majority of VOSTs had participated in deployments and disaster exercises that provided valuable experiences. The types of deployments vary between countries and between teams. Most frequent were activations of VOSTs by local or regional authorities in response to natural hazard-related events including wildfires, floods and tornados. In the US, VOSTs have also been activated in response to security incidences, such as school shootings. This latter role was not the original intent of the VOST movement and one team explicitly stated that it would not support law enforcement activities. VOSTs have also been activated in preparedness operations to support local authorities prior to a potential emergency. Table 1 provides a summary of when countries have used a VOST.

National and international VOSTs are generally well connected with each other, either through bilateral collaborations or through regional associations such as VOST Europe or the global Virtual Operation Support Group. These connections allow teams to learn from other teams operating in diverse geographical and political contexts. Also, many VOST members are active in more than one team, which facilitates the expansion and exchange of experiences. These benefits play out during larger emergencies when these relationships allow access to skills, experience and additional volunteers. Collaboration is heavily reliant on online tools such as Slack, GoogleDocs and Noysi. These platforms allow easy sharing of skill matrices to manage human resources, organise and document activities in specific VOST workbooks, and to enable virtual meetings and training.

The survey demonstrated that several teams had been formally recognised as resources within official emergency management response systems. France and Spain, in particular, have established formal associations between the local emergency management authorities and the VOST. Such formal integration allows team members to participate in emergency exercising and receive training, and to add capabilities in official emergency responses. Most survey respondents stressed the importance of integration of their team into formal emergency management structures as an important step.

Table 1: VOST deployments as reported by survey respondents.

Event	Country	Year	Type
Shadow Lake Fire	United States	2011	Natural hazard response
Santiago de Compostela train accident	Spain	2013	Technical hazard response
Calgary Floods	Canada	2013	Natural hazard response
Ebola scare	United States	2014	Public health preparedness
Umpqua Community College shooting	United States	2015	Security incidence response
Storm Frank	United Kingdom	2015	Natural hazard response
Fandicosta industrial fire	Spain	2016	Technical hazard response
Nice terrorist attack	France	2016	Security incidence response
Fort McMurray Fire	Canada	2016	Natural hazard response
Hurricane Harvey	United States	2017	Natural hazard response
Tour de France cycling race	Germany	2017	Public event preparedness
G 20 Summit	Germany	2017	Public event preparedness

Challenges

Respondents indicated that positive developments had occurred in most countries, but challenges remain. In general, the VOST community contends that the VOST concept lacks the attention it deserves. As a consequence, many social media users have trouble understanding how VOSTs function during crises, and emergency managers remain unsure of the VOSTs' trustworthiness as information brokers. The survey revealed several obstacles that many VOSTs struggle with. Three main areas stand out in this regard being:

- coordination and integration
- legitimacy and visibility
- recruiting and motivation.

Coordination and integration

Coordination with, and integration in, the formal emergency management method remains a challenge for most of the responding teams. At first glance, this appears surprising, given that VOSTs have been established mostly by people actively employed by, or with backgrounds in emergency management organisations. According to respondents, even though VOSTs are recognised as a resource, actual integration has been largely *ad hoc*. For example, few teams have been included in official exercises. Most respondents identified that involvement in emergency exercises is a route to formal integration and a way VOSTs could improve their processes and practices. One respondent indicated:

Volunteers who are outside of official purview are still looked on with suspicion and we are building policies for verification and background checks. Building trust is critical.

(Respondent 04)

In France and Spain, integration of a VOST has been smoothest at the lowest jurisdiction level (municipal or local government level). Local governments in Spain, France and the UK appear well organised to integrate VOSTs. However, several respondents remarked that effective integration of VOSTs necessitates support from the authorities that is more than symbolic.

Eventually, agencies need to add funding and more resources to support teams. Some agencies - especially in states that are known to have lots of natural disasters - should consider hiring VOST experts and team leads and also some team members in order to have reliable resources available when needed.

(Respondent 04)

Respondents emphasised that the contribution VOSTs make is not cost-free. Transferring emergency-related knowledge and building capacity of volunteers requires an investment from professionals. This investment is not just financial, but a contribution by governments for activities with volunteers should be considered.

Legitimacy and visibility

Largely a consequence of non-systematic integration into emergency management practices, many VOSTs

lack visibility and legitimacy. Survey respondents raised the problem of official 'buy-in' and that officials lack confidence that VOSTs contribute additional and important capability. Respondents acknowledged that having the chance to demonstrate the way in which VOSTs could act as mediators between the public and emergency management information providers would help to raise awareness of their during crises and crisis response. To gain official recognition, it is important that VOSTs provide situational awareness analytics that complement the type and style of information that authorities are already using and disseminating to the public.

The [VOST] is not meant to replace or substitute any social media response or plan. The [VOST] is a resource that can be activated to supplement or enhance a community's existing social media for emergency management plan.

(Respondent 07)

Survey respondents provided information about how their teams could support two-way information flow between the public and emergency management agencies. For example, team members could compile public information, analyse it and provide relevant information to help decision-making. VOSTs could also distribute updated and accurate information to the public through the same channels. Finally, and significantly for the legitimacy of the VOSTs, VOST volunteers have typically not received training by emergency managers. Without formal training or experience, volunteers without a background in emergency management or related fields are unlikely to be recognised as suitable partners.

Recruiting, training and motivation

Like any volunteer organisation, VOSTs rely on the contribution of citizens' time and skills to support a cause. Demanding jobs, family life and other obligations limit the capacity of people to volunteer. One respondent noted:

Recruitment was and continues to be a major challenge for our VOST. Since the team is volunteer only, time commitments from members can be hard to schedule around.

(Respondent 01)

Local VOSTs rely on a relatively small pool of people who have the skills and training to fulfil their roles. In addition, some deployments are very time-consuming, often lasting several days or weeks. Such engagements can be physically and psychologically stressful. Since the teams are organised online, team members can experience isolation and require ways to maintain team spirit and motivation over longer periods. To unburden local VOSTs during emergencies, volunteers from other teams jump in and provide assistance. However, such collaboration among teams can be hampered by insufficient interoperability of structures and processes.

Conclusion

A central goal of this paper was to examine in how far online-based volunteer groups can support emergency and disaster managers cope with highly dynamic media environments. VOSTs were used as a case study because of their relatively recent appearance. The VOST concept reflects some of the key dynamics in emergency management practice, including the flattening of organisational hierarchies, changes in volunteerism and digitalisation. The challenges facing VOSTs include being accepted by and integrated into official emergency management communication activities. This highlights that although a body of research illustrates the how effective use of social media can benefit disaster management processes, communication by social media continues to be held at arm's length from traditional emergency communication practices. While the notion of collecting, analysing and disseminating information obtained through social media information channels is a potential game-changer in disaster communications, it remains a peripheral activity from a formal disaster management perspective.

VOSTs have successfully supported emergency managers in handling an increasingly challenging media environment during incident deployments. Drawing on individual skill sets and capabilities, teams have helped to filter relevant information from the abundance of social media content, improve situational awareness of emergency managers and engage actively with the public. However, recruitment and training remain a challenge for many VOSTs, and the organisation of most teams continues to rest on the shoulders of a few engaged individuals. Notwithstanding the value of the efforts these individuals take, this hardly represents a sustainable organisational solution that would match the importance of the digital information space in today's emergency management environment.

At the international level, VOSTs could become a central element of collaboration for emergency management organisations and could actively communicate with the public. However, this is unlikely to happen without a clear commitment from governmental agencies to support and integrate volunteer organisations like the VOSTs into existing emergency management structures. Integration of volunteers should be considered as an investment in improved emergency management, acknowledging that volunteers can make a significant contribution to how societies prepare for and respond to disasters. In the best case, they can unburden professional disaster managers and help to safeguard sufficient protection levels in times of changing hazards and tight budgets.

However, this voluntary contribution is not cost-free. Volunteers require instruction and training. Without sufficient planning they may pose more of a hindrance than help. Emergency services agencies could include a minimal budget for activities with VOSTs, including non-financial investments. Budgeting should be sufficient to cover training expenses, software and equipment and after-care (e.g. counselling, professional psychological

support). Optimally, volunteers should also receive at least partial compensation for travel, unpaid leave from work and minor personal expenses related to their volunteer work. Arguably and more important than financial investment, is the time emergency managers are ready to spend engaging with VOSTs. Getting to know volunteers, understanding their motivations, capabilities and requirements is a long-term prospect that takes time and energy. This investment is essential for building strong partnerships.

In a world characterised by advanced information and communication technologies, VOSTs could become a central element of collaboration between emergency management authorities and the actively communicating public. These organisations create information resources that provide practical value for communities struggling to cope with hazards.

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ABSTRACT

Natural disasters are growing in intensity and frequency worldwide, effecting over 1.5 billion people in the past decade. Individuals with a disability are at greater risk of injury and death than are other populations. Individuals with disabilities often have specific needs leading to difficulties when seeking shelter during disaster events. Emergency shelters are generally not purposefully built to accommodate such requirements. To assess the extent of this, a review was undertaken to synthesise current literature on the experience of individuals with disabilities in emergency shelters and to identify gaps to inform future research. Initial searches identified 185 articles and six studies were included in the review. Synthesis of study findings highlighted context-specific factors of emergency shelter experiences on individuals with disabilities during natural disasters. These factors were the physical, social and attitudinal environments. Quail and colleagues (2018) reported the need for meaningful engagement with individuals with disabilities in disaster planning broadly. This paper identifies the importance disability inclusive risk reduction specific to shelter planning to allow for safety and maintenance of independence. The small body of research identified indicates that this aspect is underresearched in Australia as well as internationally. This has implications for the understanding of disaster risk reduction requirements for individuals with a disability.

Experiences of individuals with disabilities sheltering during natural disasters: an integrative review

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Introduction

Natural disasters are increasing in intensity and frequency (Thomas & López 2015). Individuals with a disability make up approximately 15 per cent of the world's population and are at greater risk and experience higher mortality rates and poorer disaster recovery outcomes after disasters (Quail, Barker & West 2018, World Health Organization 2011). This is exacerbated by increased strain on support networks during natural disasters and social stigma towards vulnerable populations. These factors influence their access to evacuation, shelter and relief supplies (Howard *et al.* 2017, Gorman-Murray *et al.* 2018).

Emergency shelters are established in a variety of settings, including public buildings and temporary structures. The term 'emergency shelter' refers to temporary places of refuge during all phases of an emergency event. In Queensland, emergency shelter definitions include immediate shelters (used for 1–18 hours), temporary shelters (used in excess of 18 hours and up to several weeks) and temporary housing (longer-term temporary accommodation that facilitates transition to permanent living situations) (Queensland Government 2018). This study revealed that there is no internationally standardised terminology for shelter types and shelter definitions differ across regions and countries.

During all phases of a disaster, people evacuating their homes should be in a safe and accessible environment that is equipped to meet their needs. Individuals with disabilities often have specific needs including accessibility, specialised equipment, medication storage and support from trained health care workers (Gorman-Murray *et al.* 2018, Twigg *et al.* 2011, Ochi, Murray & Hodgson 2013). However, emergency shelters are often not purposefully planned or built to accommodate these requirements.

The *Sendai Framework for Disaster Risk Reduction 2015–2030* (United Nations Office for Disaster Risk Reduction 2015) is the first international disaster risk reduction agreement to address the needs of individuals with disabilities. Understanding of disaster risk, including vulnerability and environmental impacts, is one of the four priorities for action outlined in the framework. In addition, the framework identifies that engagement with individuals with a disability is pivotal to the formulation of inclusive and effective disaster planning. The framework acknowledges the context-specific needs of individuals with disabilities during disasters and promotes universal access to evacuation vehicles, resources and emergency shelters.

Aim

Globally, few studies have examined the experiences of individuals with disabilities in emergency shelters. The aim of this review was to synthesise current literature in this area and to identify gaps in current knowledge to inform future research.

The specific research question was: 'What factors have influenced the experience of individuals with disabilities in emergency shelters during natural disasters?'

Method

The literature review was conducted using an integrative approach to facilitate synthesis of diverse research methodologies (Whittemore & Knaf 2005). A systematic search was conducted using keyword terms and phrases of 'natural disasters', 'disaster planning', 'disability', 'disabled', 'evacuation centre', 'shelters', 'rest centres' and 'emergency shelter' in various combinations. Databases searched included Medline (Ovid), CINAHL, PsycINFO and Scopus. The search was limited to peer-reviewed publications between 1998 and 2018. This period was selected as it represents an era during which significant disaster management reforms occurred, particularly in response to Hurricane Katrina in 2005 (Brodie *et al.* 2006, Centers for Disease and Prevention 2006). Articles included relate to the experience of individuals with a disability in emergency shelters prior to, during and following a natural disaster.

A total of 185 articles was identified during the initial search. These were screened for inclusion according

to the PRISMA¹ flow diagram (see Figure 1) by two independent reviewers (Moher *et al.* 2009). Six studies were included for review and were appraised for quality using the Critical Appraisal Skills Programme appraisal tool (2017).

Results

The six studies comprised four qualitative studies, one mixed-methods study and one narrative review. Data collection methods of these publications included semi-structured interviews (n=4), a survey questionnaire (n=1) and a synthesis of grey and published literature (n=1). Included studies investigated emergency shelter experiences from a range of natural disasters (earthquakes, floods, tsunamis and cyclones) and shelter structures (health care centres, schools, shipping containers, leisure centres, tents and shrines). Examples were from Japan, Iran, the USA and the United Kingdom. Participants included individuals with physical, psychosocial and age-related disabilities (Aryankhesal, Pakjoui & Kamali 2017, Maeda, Shamoto & Furuya 2017, Missildine *et al.* 2009). Four studies did not specify the disability of participants but did detail the functional impact of the participants' disability, for example wheelchair use and reduced mobility (Brittingham & Wachtendorf, 2013, Kipling *et al.* 2011, Maeda, Shamoto & Furuya 2017, Twigg *et al.* 2011).

¹ A PRISMA flow diagram is a graphical representation of the flow of citations reviewed in the course of a systematic review.

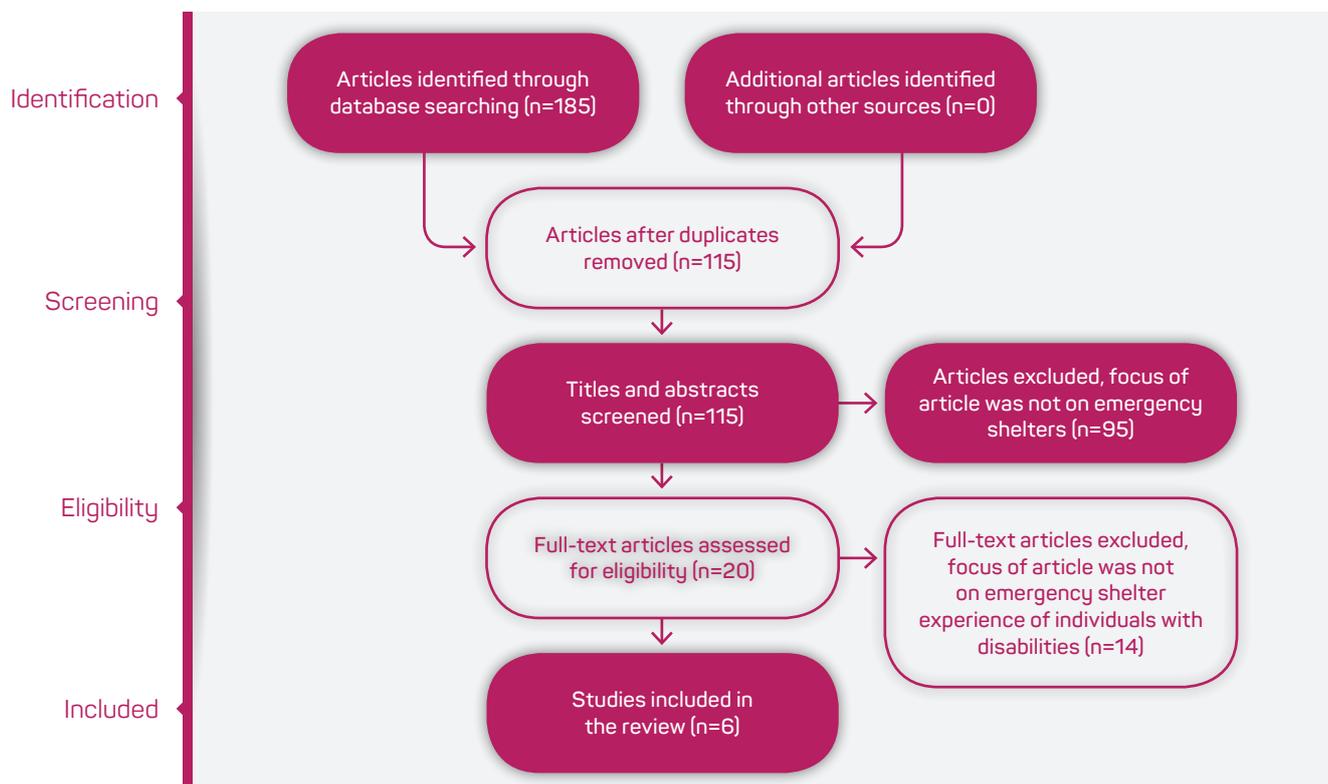


Figure 1: PRISMA flow diagram of papers selected for this study.

Source: Adapted from Moher *et al.* 2009

Methodological quality varied across the studies. Five studies used observational and narrative designs, often with broad research questions, limiting the generalisation of findings to the wider population. Three studies did not specify participant numbers or demographics, limiting the contextualisation of data collected (Brittingham & Wachtendorf 2013, Maeda, Shamoto & Furuya 2017, Twigg *et al.* 2011). Four of the studies involved interviewing participants after six months and up to 25 years following the disaster event. This raises the possibility of recall bias (Aryankhesal, Pakjouei & Kamali 2017, Brittingham & Wachtendorf 2013, Kipling, Newton & Ormerod 2011, Twigg *et al.* 2011). Conversely, the findings of two studies, conducted with evacuees shortly after or during the disaster by shelter staff who continued to support their needs, may have led to respondent bias or perceived coercion (Missildine *et al.* 2009, Maeda, Shamoto & Furuya 2017).

A summary of the articles reviewed is presented in Table 1.

People's experiences of emergency shelters varied according to the context of the disaster (e.g. Japan versus USA) and type of disaster (earthquake versus hurricane). Across the six studies, three themes emerged as factors influencing the experiences of emergency shelters for individuals with a disability:

- Physical environment (e.g. natural environment, human-made environmental changes and technology).
- Social environment (e.g. support, communication, relationships and social services).
- Attitudinal environment (e.g. culture, norms and ideology).

These themes are consistent with the definitions of 'Environmental Factors' within the World Health Organization International Classification of Functioning, Disability and Health² framework for measuring health and disability.

Influence of the physical environment

Individuals with a disability can have an enhanced or worsened experience of an emergency shelter depending on the physical environment. Newer and public buildings constructed to building codes were more disability inclusive and facilitated the independence of evacuees and reduced their risk of poor health outcomes (Kipling, Newton & Ormerod 2011, Twigg *et al.* 2011). Temporary structures such as tents increased the risk of injury and death for individuals with a disability; secondary to extreme temperatures, vermin infestation and fire (Aryankhesal, Pakjouei & Kamali 2017).

Emergency shelters with accessible toilets supported the independence for individuals with reduced mobility. Shelters with no toilet facilities or disability exclusive toilet facilities (e.g. tents, older buildings with unmodified bathrooms, Japanese-style toilets) resulted in perceptions of loss of dignity for individuals with disabilities (Aryankhesal, Pakjouei & Kamali 2017,

Brittingham & Wachtendorf 2013, Kipling, Newton & Ormerod 2011, Maeda, Shamoto & Furuya 2017, Twigg *et al.* 2011). The risk of poor health outcomes due to a lack of appropriate bathroom facilities was exacerbated by extended periods using temporary shelters and housing, with some used by evacuees for many months.

Sleep was significantly affected with five studies reporting that the lack of appropriate bedding could disturb sleep and threaten the health and independence of individuals with a disability. Cots or mattresses on the floor did not provide adequate body pressure relief for individuals who are unable to move independently. This increased the need for physical assistance to get in and out of bed. Consequently, poor recovery health outcomes resulted for some individuals, including pressure injuries (Missildine *et al.* 2009, Brittingham & Wachtendorf 2013, Maeda, Shamoto & Furuya 2017, Twigg *et al.* 2011, Aryankhesal, Pakjouei & Kamali 2017).

Space limitations in a crowded shelter environment presented significant threats to the independence of individuals using specialised equipment such as wheelchairs (Brittingham & Wachtendorf 2013, Maeda, Shamoto & Furuya 2017, Missildine *et al.* 2009). Restricted space meant evacuees with a disability were unable to move about without physical assistance from family or carers. Where emergency shelters had been specifically designated for use by individuals with disabilities, often a larger space was allocated to facilitate use of specialist equipment. Three studies identified that demarcation of allocated space using screens or floor outlining enhanced privacy, facilitated use of mobility devices and reduced the risk of space being encroached upon by others (Brittingham & Wachtendorf 2013, Missildine *et al.* 2009, Kipling, Newton & Ormerod 2011).

Influence of the social environment

Providing up-to-date information in emergency shelters is important for the safety, health and independence of evacuees who have augmented communication needs. Lack of accessible communication methods (e.g. hearing loops, braille) could result in safety warnings being missed and shelter services not being accessed. In shelters without these communication options, evacuees with a disability reported being unaware of the availability of supplies such as food and blankets (Brittingham & Wachtendorf 2013, Kipling, Newton & Ormerod 2011). Inaccessibility of information was not limited to individuals with visual or hearing impairments. Individuals with reduced mobility reported being unaware of information displayed in communal areas where they could not use walking aids in confined spaces (Brittingham & Wachtendorf 2013, Maeda, Shamoto & Furuya 2017).

Training of staff and volunteers varied significantly across the included studies depending on geographical

² International Classification of Functioning, Disability and Health at: www.who.int/classifications/icf/en/.

Table 1: Characteristics of the studies selected.

Title/Author/Year	Research design	Participants	Summary of findings
<i>Safety Needs of People With Disabilities During Earthquakes.</i> Aryankhesal, Pakjoui & Kamali 2017.	Qualitative semi-structured interviews.	Twelve people with disabilities and experience of earthquakes in Iran (Roodbar-Manjil in 1990, Avaj in 2002, Bam in 2003 Firoozabad-Kojour in 2004, Varzeq-Ahar in 2012).	Shipping containers with basic amenities were more suitable shelters for individuals with disabilities than tents due to better accessibility and temperature control. Tent shelters exposed evacuees to extreme temperature changes, vermin and insect infestation, vulnerability to fire and lack of bathroom amenities.
<i>The Effect of Situated Access on People with Disabilities: An Examination of Sheltering and Temporary Housing after the 2011 Japan Earthquake and Tsunami.</i> Brittingham & Wachtendorf 2013.	Qualitative interviews 3–6 months post-disaster.	Shelter users with a disability after the 2011 Tohoku-oki earthquake and tsunami in Japan. Sample size and demographics not specified.	Japanese-style toilets were unsuitable for individuals with a disability due to the physical assistance required. The lack of training for volunteers and shelter staff in 'social welfare' shelters (for individuals with special needs) impacted on the quality of care. In Japan, the stigma associated with having a disability affects planning and resourcing of 'social welfare' shelters. It also influences the behaviour of other shelter residents towards evacuees with disabilities in shelters.
<i>Accessing emergency rest centres in the UK-lessons learnt.</i> Kipling, Newton & Ormerod 2011.	Qualitative, semi-structured interviews 5–6 months post-disaster.	Nine members of a shelter administration team during the flooding of the Yorkshire and Humber regions of the United Kingdom in 2007, including managers, volunteers (one volunteer with a disability).	Heritage listed buildings had limited bathroom accessibility and wheelchair users had to get physical assistance to access them. Recently refurbished buildings had accessible toilets, lowered counters and automated doors. Showers had no seating nor rails installed, impacting on the personal hygiene of wheelchair users living in the shelter for many weeks. Shelters had limited enhancements to assist individuals who were deaf or hearing impaired and had no braille information. The limited training of shelter volunteers impacted on the care of evacuees with mental health conditions.
<i>Feeding Support Team for Frail, Disabled, or Elderly People during the Early Phase of a Disaster.</i> Maeda, Shamoto & Furuya 2017.	Mixed-method study comprising qualitative, semi-structured interviews and statistical analysis of quantitative health outcome data.	Shelter users following the Kumamoto earthquake in 2016 in Japan who identified as frail, disabled or elderly. Sample size and demographics not specified.	Evacuees reported a reluctance to use bathrooms due to overcrowding and poor bathroom facilities. Discrimination towards individuals with a disability in Japan impacted on the equity of resources. Shelter users with a disability were susceptible to dehydration due to reduced water consumption secondary to mobility and staffing levels.
<i>Comfort in the Eye of the Storm: A Survey of Evacuees with Special Medical Needs.</i> Missildine, Varnell, Williams, Grover, Ballard & Stanley-Hermanns 2009.	Descriptive study using qualitative surveys on day four of evacuation.	Eighty-two participants in 'special medical needs' shelter in Texas, USA following Hurricane Gustav in 2008.	Evacuees felt reassured by the presence of medically trained staff. Improvements suggested were better access to bathroom facilities, greater variety of food and increased provision of activity programs and exercise.
<i>Disability and public shelter in emergencies.</i> Twigg, Kett, Bottomley, Tan & Nasreddin 2011.	Narrative review of peer-reviewed, grey and policy literature on experiences of people with disabilities in public shelters during emergencies.	Review of government reports (n=26), policy documents (n=14), peer-reviewed studies (n=9) and unpublished works (n=4) following Hurricane Katrina in the USA in 2005, the West Bengal cyclone in Bangladesh in 2002 and the Indian Ocean tsunami in 2004.	Registration and assessment procedures failed to identify individuals with disabilities and special needs; particularly functional needs. Evacuees with a disability experienced refusal of admission to shelters on grounds that shelters cannot manage a person's disability, particularly mental health conditions. Family members and carers of individuals with a disability were discouraged from accompanying them due to overcrowding. Communication methods were problematic due to a lack of hearing loops and systems or braille. Cultural constraints restricted women with a disability from using bathroom facilities.

location, natural disaster and shelter type. Personnel working in shelters specifically designated for use by individuals with special needs were more likely to have received training to support the independence of people with disabilities (Brittingham & Wachtendorf 2013, Maeda, Shamoto & Furuya 2017, Missildine *et al.* 2009). However, one study from Japan identified that training and enthusiasm varied across shelter staff, even within dedicated special-needs shelters (Brittingham & Wachtendorf 2013). Lack of appropriate training in the provision of physical assistance and management of mental health conditions increased the risk of injury to both evacuees with disabilities and to shelter personnel (Brittingham & Wachtendorf 2013, Kipling, Newton & Ormerod 2011). The burden of care on shelter personnel was amplified by evacuees being separated from their carers, families or assistance animals (e.g. guide dogs). This was due to overcrowding and implementation of disability exclusive emergency shelter policy (Brittingham & Wachtendorf 2013, Twigg *et al.* 2011).

Influence of the attitudinal environment

Attitudes of community members and people in positions of authority can significantly impact on the experiences of individuals with disabilities requiring shelter during and in the aftermath of disasters. Stigma associated with disability in the Japanese context was perceived to create inequity of access to shelter supplies and services. In shelters for the general population, individuals with a disability reported experiencing hostility from other evacuees related to the additional space allocated for the use of mobility devices (Brittingham & Wachtendorf 2013, Maeda, Shamoto & Furuya 2017). A thorough understanding of context-specific attitudinal and cultural environment to inform disaster risk reduction for individuals with disabilities is required.

Cultural practices in relation to physical assistance could result in increased risk to the safety of individuals with disabilities in some cultures. In Japan, evacuees were likely to refuse assistance for activities involving the removal of clothing to go to the toilet. This increased the risks of falls and affected personal hygiene (Brittingham & Wachtendorf 2013). This reluctance to accept assistance resulted in people voluntarily restricting their food and water intake to reduce the need for toileting and avoid the feelings of shame and loss of dignity (Brittingham & Wachtendorf 2013, Maeda, Shamoto & Furuya 2017). In Bangladesh, cultural and religious practices restricted the use of bathrooms by women with a disability. These restrictions increased the likelihood of these women leaving shelters prematurely and being exposed to greater risk of injury or death (Twigg *et al.* 2011).

Discussion

These findings indicate that experiences of individuals with a disability using emergency shelters are influenced

by the physical, social and attitudinal factors that can affect health, safety and independence. Individuals with a disability are the most appropriate source of advice regarding the potential threats to their safety and independence in the event of a natural disaster (Kipling, Newton & Ormerod 2011, Twigg *et al.* 2011). Despite the promotion of the involvement of individuals with disabilities in disaster risk reduction by the United Nations Office for Disaster Risk Reduction, this review showed there is limited research documenting this. Experiences of individuals with a disability accessing and using emergency shelters is limited compared with reports from service providers such as shelter personnel, non-government organisation workers and local government officials.

Variation in experiences in different countries and different types of disasters suggests that context-specific emergency shelter planning is essential for the health and functional needs of individuals with disabilities. For example, cyclones, bushfires and floods occur frequently in Australia and often necessitate evacuation of community members to emergency shelters. To date, no studies have been undertaken in Australia to investigate factors influencing emergency shelter experiences from the perspective of individuals with disabilities. Future research needs to include meaningful engagement with individuals with a disability at the local level to address any barriers to safety and independence. Exploration of such experiences will allow a strong voice for individuals with disabilities to advocate for culturally appropriate, disability inclusive emergency shelter facilities by local governments and service providers.

Individuals with disabilities comprise up to 15 per cent of the world's population. However, in the event of natural disaster there are limited physical and human resources dedicated to meeting their specific needs (World Health Organization 2011, Quail, Baker & West 2018). The experiences of individuals with a disability in disaster situations are varied and disparity is influenced by diagnoses, support networks available and the application of a one-size-fits-all approach to establish special-needs emergency shelters (Kipling, Newton & Ormerod 2011). A functional and needs-based strategy by emergency management planners, rather than a disability focused approach, may be more appropriate to meet the needs of individuals with disabilities in emergency shelters (Twigg *et al.* 2011, Fannin *et al.* 2015).

Limitations

This review comprised a small number of studies from a wide variety of disciplines including heterogeneity of population, disaster types and cultural contexts. It is possible that studies related to this field were missed despite extensive and systematic search. Studies used in this review were assessed as being of low to moderate methodological quality and, while relevant to include, findings should be interpreted with caution.

Conclusion

The experience of individuals with a disability using emergency shelters is underresearched. This limits the understanding of their requirements and the strategies needed for this population from government agencies, disaster planners and the wider community. This review reveals the context-specific nature of the shelter experience and the added effects of the physical, social and attitudinal environments. This complexity reinforces the need for meaningful engagement with individuals with a disability in emergency management planning to meet the range of functional needs and reduce risk for this population. In Australia, the narrative is yet to be explored of the experiences of individuals with disabilities who use emergency shelters, including personal factors, barriers and enablers. Further research in this area will assist emergency management policy and protocol formulation that is truly inclusive and is informed by the needs of individuals with a disability in emergency shelter environments.

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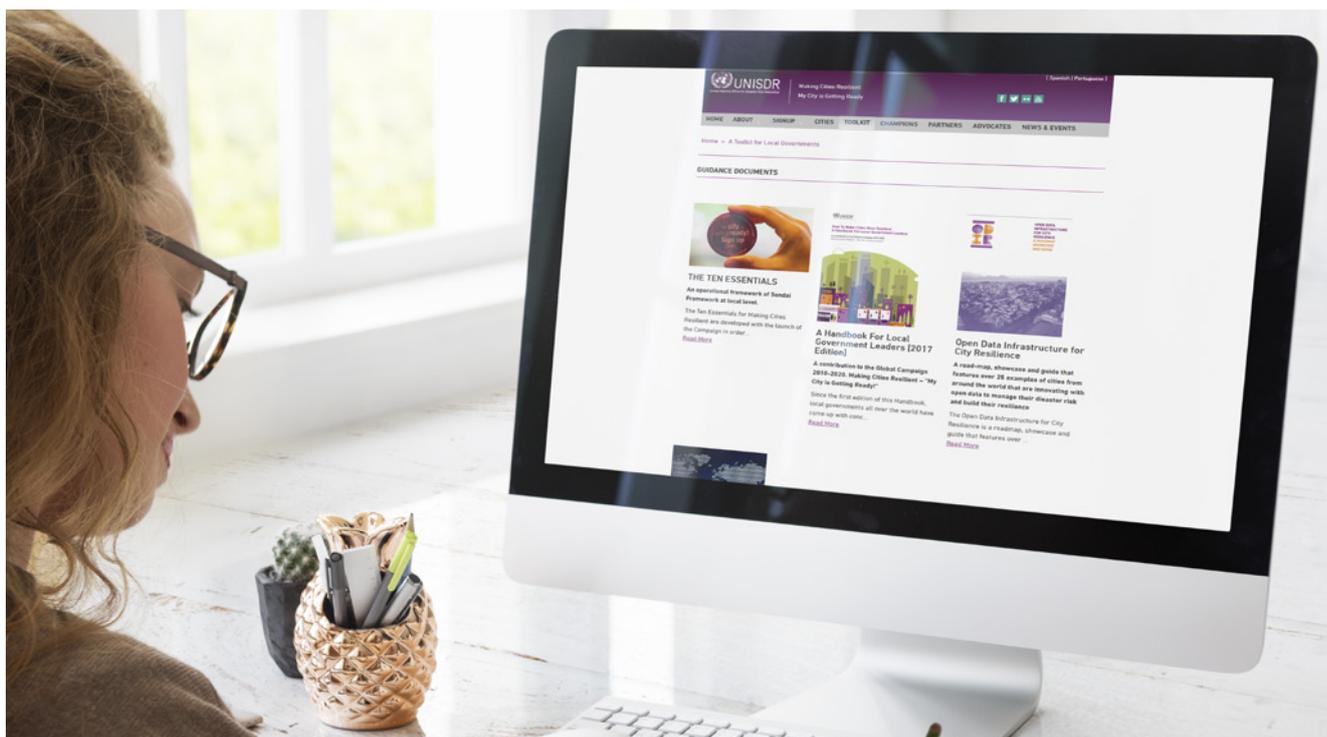
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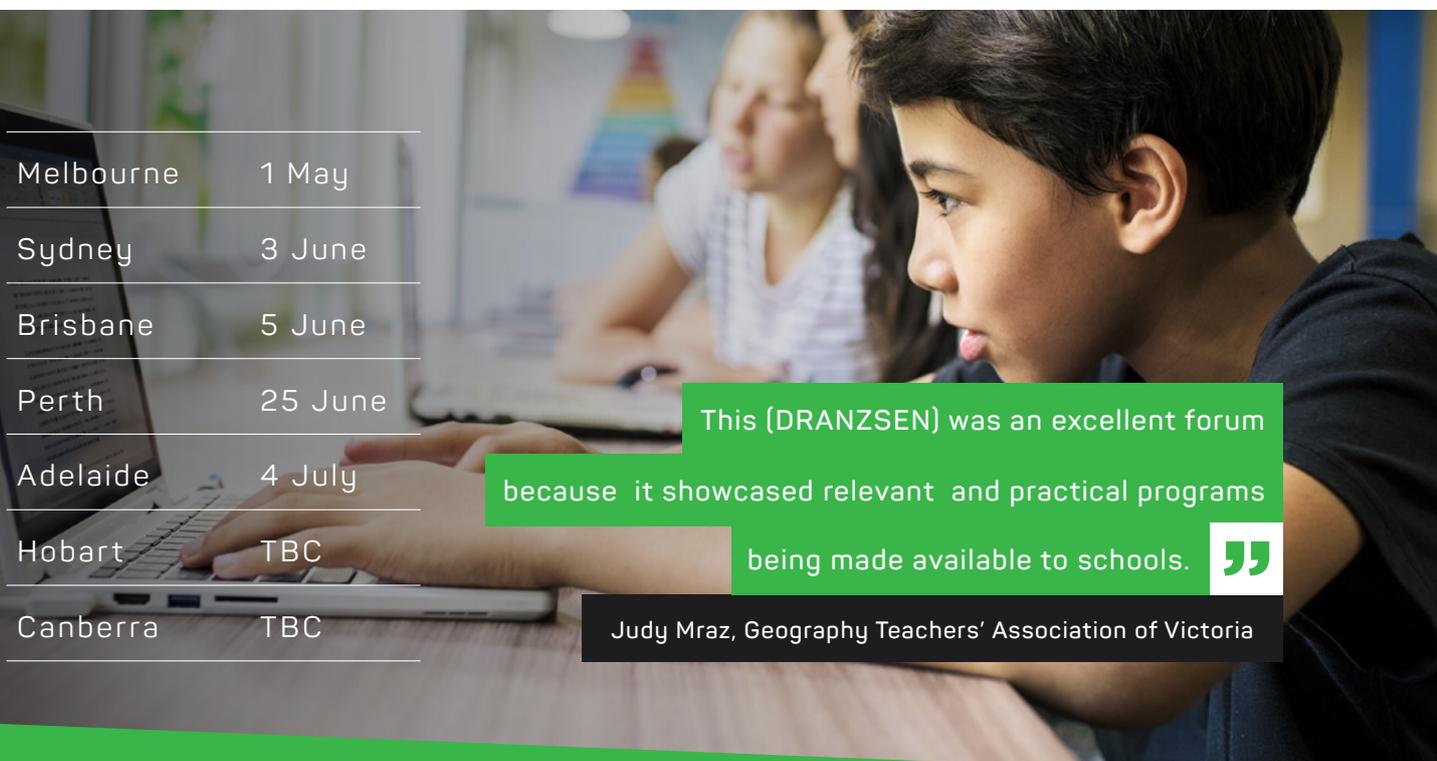
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