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Building resilience for children and households Page 49

Australian Institute for Disaster Resilience

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 is 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 and 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 (AIDR), 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, AIDR or AIDR's partners.

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Cover image A four-year-old boy sits in a street during clean-up following floods in Brisbane, Queensland in January 2011. Image: Craig Borrow, Newspix, 14 January 2011.

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Research

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

This edition of the *Australian Journal of Emergency Management* introduces the Journal's new design and format. This change reflects AJEM's new home under the Australian Institute for Disaster Resilience. We hope you like it and continue to find the Journal's content informative and engaging.

Foreword

By David Johnston, Principal Scientist, Risk and Society, GNS Science, New Zealand

In January this year, the first international conference for the post-2015 United Nations landmark agreements (Sendai Framework for Disaster Risk Reduction 2015–2030, Sustainable Development Goals, and Paris Agreement on Climate Change) was held in Geneva to discuss the role of science and technology in implementing the Sendai Framework.

The conference highlighted the absolute importance of partnerships and networks to more effectively bring together the science, policy, and practice communities. These partnerships are key to making better use of the evidence base that science and technology can provide, but they also highlight the opportunities in which practice-informed evidence can enhance our knowledge base and improve our practice.

Effective partnerships speak to new ways for co-produced knowledge to be generated, shared and used. They also call for individuals and communities at-risk to the effects of hazards to have a more active role in the risk management processes. In the preparatory work for the *Sendai Framework for Disaster Risk Reduction 2015–2030*, the Major Group on Science and Technology identified six scientific functions that the science community can implement to strengthen and enhance their contribution.

These are:

1. assessment of the current state of data, scientific knowledge, and technical knowledge on disaster risks and resilience (i.e. what is known, what is needed, identify uncertainties, and so on)
2. synthesis of scientific evidence in a timely, accessible and policy-relevant manner
3. scientific advice to decision-makers through close collaboration and dialogue
4. monitoring and review of new scientific information and progress towards disaster risk reduction (DRR) and resilience building
5. communication and engagement with policymakers, stakeholders in all sectors, and in the science and technology domains themselves to ensure that useful knowledge is identified and needs are met, and scientists are better equipped to provide evidence and advice
6. capacity development to ensure that all countries (and communities) can produce, access, and effectively use scientific information.

Enhancing partnerships across the science, policy, and practice communities for disaster risk reduction in the 21st century will improve how disaster risk is understood and assessed, lead to improved early warning systems, improve governance around risk management, and enhance capacity and capability across all parts of the disaster risk reduction system.

This issue of the *Australian Journal of Emergency Management* has a special focus on child-centred disaster risk management, in particular in schools and in community education programs. These papers, along with others on reducing the impacts of hazards in the general community, are an important contribution to strengthening knowledge in the science, policy and practice communities.

David Johnston
Principal Scientist, Risk and Society, GNS Science, New Zealand and Professor of Disaster Management, Massey University, New Zealand.

Remote-sensing flood data is filling the gaps

By Freya Jones, Bushfire and Natural Hazards CRC

Floods account for some of the worst natural disasters in Australia, costing millions of dollars in damage each year, and devastating communities. Research is testing a new approach to flood forecasting using satellite technology, which could help communities prepare for and deal with floods.

Predicting water depth and its velocity is vital for timely and accurate flood forecasting. The Bushfire and Natural Hazards CRC is undertaking research along the Clarence River in northern New South Wales using a hydrological survey to improve flood forecasting in the area.

The research team has built a three-dimensional map of the river bed that can be maintained as conditions change. This has been done using a HydroSurveyor, including an echo sounder, Doppler velocity profiler and GPS antenna.

Associate Professor Valentijn Pauwels leads the CRC project, 'Improving flood forecast skill using remote-sensing data'. He said the research offers significant benefit for communities in the Clarence Valley as it will be used to calculate the capacity of the river channel to deal with incoming flows.

'With this information we can predict water depth and velocity at any point in the river valley.

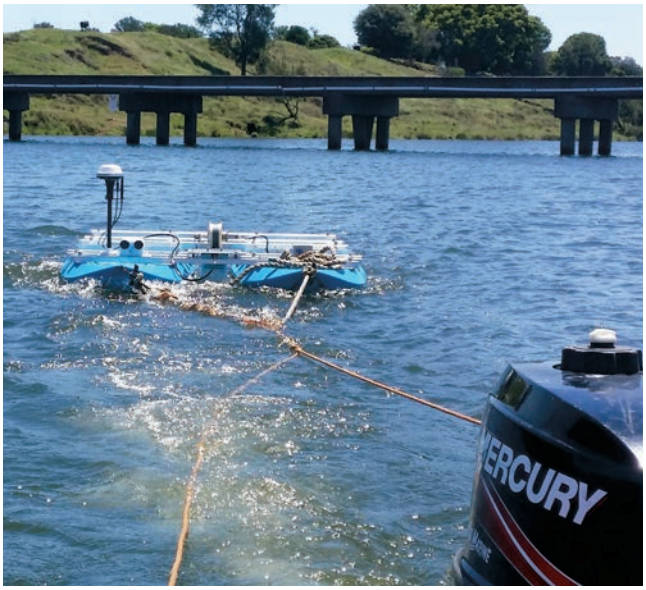
'The availability of timely and accurate flood forecasts allows for time-effective warnings and the implementation of evacuation plans. It also helps the set-up of safe recovery and storage areas,' he said.

This forecasting relies on the data to predict the arrival time, water depth and speed of a flood using two main models, hydrologic and hydraulic. Associate Professor Pauwels said the models predict different aspects of a flood that are then applied together.

'The hydrologic model determines the flow of water that is entering a river network using rainfall and catchment conditions, while the hydraulic model predicts how that water will travel downstream along the river system,' he said.

Although these models have come a long way in terms of capabilities, they do not yet provide all the answers.

'It is challenging to provide accurate flood warnings because of errors or uncertainties in the model structure and the model parameters,' said Associate Professor Pauwels.



Measuring the bed of the Clarence River using a HydroSurveyor near Rogan's Bridge. *Image: Stefania Grimaldi.*

Combining satellite remote-sensing data

The research is looking at how remotely-sensed data can be assimilated operationally within existing models to improve the accuracy of flood forecasting. Remote sensing involves using satellite technology to capture information about a particular area from far afield. This means regions that are dangerous or inaccessible at ground level can have aerial data collected and used to fill in the gaps and assist with predictions.

Behind flood forecasting is a complex science that is constantly adapting to new technologies. The current models rely on rainfall stations to measure the amount of rain on particular catchments. The hydrologic model then calculates how much of that rainfall will be absorbed by the soil depending on current soil moisture levels.

The Clarence River has flooded areas around Grafton, NSW, four times since 2009, significantly affecting many rural properties, such as this one in February 2013. *Image: NSW State Emergency Service – Clarence Nambucca Region*

The Bureau of Meteorology Manager of Policy and Strategy Unit, Soori Sooriyakumaran, is one of the project's lead end-users and explains that there are particular limitations with existing methods.

'There are parts of Australia where our rainfall station coverage is quite sparse due to the area being large and remote. Remotely-sensed rainfall data helps us understand the rainfall variability across such areas.

'Remotely-sensed data also has its problems. But even with those it can add value to the input that goes into the modelling,' he said.

Remotely-sensed soil moisture products have a great potential for calibrating and updating hydrologic models. The remote observations of flood extent and water levels can be used to correct and constrain, in real time, the prediction of the flooded area and depth generated by the hydraulic model.

A challenge to the project lies in combining the satellite data with data collected on the ground in a way that will minimise errors.

'The spatial and temporal resolutions with which the on-ground and remotely-sensed data are observed are different so there are some challenges in bringing them together,' Mr Sooriyakumaran said.

To overcome this and to minimise overall errors when combining the data sets, error characteristics of the data are analysed. The desired goal is to get precise and robust outcomes for flood forecasting and flood warnings.

'What we're trying to do with this research is to come up with the best combination of satellite and ground data so we can have as accurate as possible input and constraint information for the modelling', he said.

The application of remotely-sensed data can be compared to a missing piece of the puzzle for flood forecasting. This brings together information from different sources to form the bigger picture. Mr Sooriyakumaran said this technology will only improve over time.

'Satellite remote sensing is an expanding new field and we are going to have better and better data coming through in the future with higher resolution and higher frequency. This is one of the technologies that is going to keep improving flood forecasting into the future.

'This research will be beneficial to emergency management as it supplies a more comprehensive depiction of conditions.

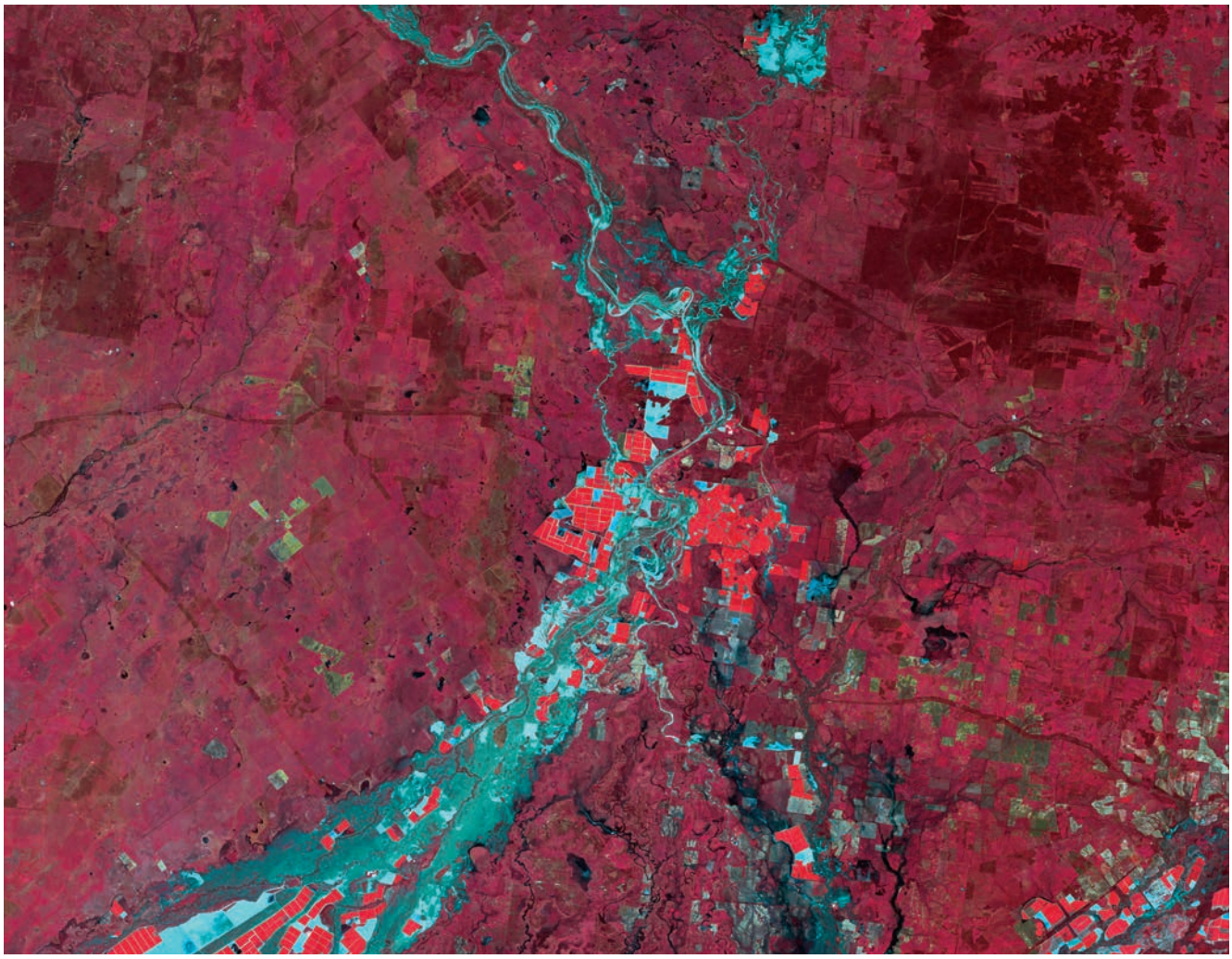
'[The satellite data] could give us better situational awareness by showing areas under inundation.

'To forecast future water levels we need good information on what is happening on the ground now, which we can present to the emergency services so they can plan their emergency response better,' he said.

Flood research in the Clarence Valley

Clarence Valley Council Local Emergency Management Officer, Kieran McAndrew, said the river is the heart of the council area, which has been affected significantly by flooding in recent years. In 2009, 2011, 2012 and 2013 the river experienced serious floods.

'The Clarence is the largest of all NSW coastal rivers in terms of catchment area and river discharge, which means flooding is part of life for the community of around 50,000 people,' he said.



The next stage of the research will take place in St George, Queensland. This satellite image shows the Balonne River in flood on 8 February 2012. Blue to dark blue is clean water, bright blue is water with high sediment load, bright red is healthy crops and dark red to maroon shows less healthy or different vegetation types. *Image: DEIMOS Imaging 2012, DEIMOS Imaging S.L., Spain, all rights reserved.*

The Monash University-based research team comprises Associate Professor Pauwels, Professor Jeffrey Walker, Dr Stefania Grimaldi, Dr Yuan Li and Ashley Wright. They believe the research will have positive impacts on warnings for floods and contribute to lessening the potential damage and costs to communities.

Associate Professor Pauwels said, 'It's estimated that floods in Australia cost an average $377 million per year.

'An improved flood forecasting system will add to the emergency management capability, thus reducing the flood-related financial costs and community distress'.

Mr McAndrew said the council wanted to support the research in any way they could.

'The Clarence Valley community relies on warnings to prepare for imminent flooding, so there is a real benefit to be gained from the research,' he added.

The next steps in the project will be to bring all the existing data together with the new satellite information and put it into operational use.

'Up until now we have focused on collecting the data. From here we will start improving the models,' said Associate Professor Pauwels.

This process will be made easier using the recently-upgraded platform for modelling, Hydrological Forecasting System, from the Bureau of Meteorology. This platform uses a framework that allows users to easily plug in new models said Mr Sooriyakumaran.

However, Mr Sooriyakumaran believes that the benefits of this research will not be immediate.

'We are not expecting dramatic changes to happen overnight. They will take time.

'But as technology advances and this research is applied to an operational setting, the true impact will be realised.

'The upgrade of our flood forecasting modelling system means we are able to bring research learnings into operations much more readily. This is a capability we did not have before,' he said.

Find out more about this research at www.bnhcrc.com.au.

People in Disasters Conference

By Penelope Burns, Western Sydney University

The People in Disasters Conference was held in Christchurch, New Zealand in February. The conference was about sharing people's journeys through disasters, including the role of healthcare workers and other professionals in providing the best care for individuals, families and communities.

> *'Without people there would be no disasters'.* (WHO/EHA[1])

The conference coincided with the five-year anniversary of the earthquakes in Christchurch, and was poignantly preceded by a destructive quake. The event was hosted by the Canterbury District Health Board and Researching the Health Implications of Seismic Events Group in Christchurch in a disaster-experienced community. A diverse range of local and international speakers spoke from the heart of their experiences and the lessons they learned.

It was a collaboration from the outset and, for visitors from overseas, the conference became a community, full of open sharing of the human experience of extreme situations.

Themes covered response, recovery and resilience and attendees heard from emergency services personnel, hospital staff, mental health teams, animal welfare groups, teachers, government leaders, engineers, community general practitioners and nurses, pharmacists, and the local clown doctors! These groups crossed cultures with a strong ongoing theme of the Maori experience.

The emphasis was on the need for disaster risk reduction (DRR) as promoted through the *Sendai Framework for Disaster Risk Reduction 2015-2030*.

Conference participants raised some key issues:

- Any efforts in DRR need to align with global efforts.
- Research and personal stories are needed to provide insight into how we manage disasters.
- Educating our youth in innovative ways will improve preparedness and understanding for the future.
- The focus should be on 'locals helping locals' to support the strengths and capabilities of the community in recovery rather than outsiders doing it for them.
- Leadership, partnership and trusted relationships across disciplines and cultures are crucial developments in the planning stages to support response and recovery.
- Post-disaster management is needed as well as the response plan during the emergency.
- After disasters people move to a new future not back to the same past; and we need to recognise that the time frame of recovery can span decades and generations.

The conference highlighted the need to work together across nations and disciplines, through sharing of knowledge and experience, to reduce risk and vulnerability.

Many of the conference sessions were recorded and are online at the University of Canterbury: https://quakestudies.canterbury.ac.nz/store/collection/925.

1 World Health Organization/Emergency and Humanitarian Action Training Programme.

The conference highlighted the need to work together across nations and disciplines. *Image: Sandra Richardson*

Australian and New Zealand Disaster and Emergency Management Conference

David Bruce, Bushfire and Natural Hazards CRC

Research from the Bushfire and Natural Hazards CRC and case studies from the emergency services, local government, education and health sectors, featured at the Australian and New Zealand Disaster and Emergency Management Conference on the Gold Coast in May.

Keynote presentations from Commissioner Katarina Carroll, Queensland Fire and Emergency Services, referenced disasters in Australia and in the United States to illustrate points on leadership in crisis situations.

Jonathan Coppel, Productivity Commissioner, presented an overview of the Productivity Commission's review of Australia's Natural Disaster Funding Arrangements.

Other presentations covered the topics of health and local government including building resilient cities, mental health of medics and first responders, training and higher education in emergency management, volunteer recruitment and management, and public communications.

There were discussion sessions around case studies on communities, recovery and collaboration following the 2013 New South Wales Blue Mountains fires, the 2015 Ravenshoe Café explosion, and other recent disaster incidents.

The conference is a joint initiative of four not-for-profit organisations, being the Bushfire and Natural Hazards CRC, the Australian Institute of Emergency Services, the Australian and New Zealand Mental Health Association Inc. and the Association for Sustainability in Business Inc.

Conference information is at www.anzdmc.com.au.

Fire Behaviour and Fuels Conference

David Bruce, Bushfire and Natural Hazards CRC

A joint panel discussion between experts in Australia and the United States on fuels management was a highlight of an International Association of Wildland Fire (IAWF) conference in April. The conference theme was 'Wicked Problems, new solutions: our fire, our problem'.

The program for the fifth Fire Behaviour and Fuels Melbourne conference was hosted in both Melbourne, Australia and Portland, Oregon, with the Bushfire and Natural Hazards CRC and its Victorian partners hosting the event.

Around 280 people attended in Melbourne, with a further 350 in Portland. The time difference between Melbourne and Portland allowed for some sessions overlapping with live presentations at one venue linked to the other by video. On Wednesday, keynote presentations by the IAWF's Ron Steffens (in Portland) and Dr Kevin Tolhurst (in Melbourne) were shared. On Thursday, the joint panel session discussed the international aspects of planned burning and took questions from the audiences at both venues. The full program featured 76 speakers, an international panel session, and three PhD 'Three Minute Thesis'.

The week started with two workshops at the Bureau of Meteorology on grassland fuels and fire weather. The conference ended with two field trips to assess bushfire risk in the Dandenong Ranges or to view the mountain ash forests hit by the 2009 Black Saturday bushfires.

Videos of the keynote speakers and the panel are on the conference website at www.firebehaviorandfuelsconference.com.

Field trips were important to help assess bushfire risk.

Emergency Media and Public Affairs Conference

By Vanessa Bartholomew

The Emergency Media and Public Affairs Conference in May connected executives, academics, industry leaders, practitioners and professionals of media and communications to share insights and canvass solutions.

With the sponsorship of Emergency Management Australia (EMA) and Emergency Management Victoria (EMV), EMPA produced a showcase of keynote speakers, workshops and panel discussions, punctuated with opportunities to meet and connect with others.

This year's focus of convergence between community engagement and disaster communications saw participants treated to thought-provoking and entertaining content, which has created meaningful change on a variety of scales.

Highlights of the event included presentations from international keynote speakers Chief Wrangler Desiree Matel-Anderson from the Field Innovation Team, Bob Jensen from DC-based Strat3, Head of UNICEF Communications Pacific Alice Clements, and Kaila Colbin from Christchurch's Ministry of Awesome.

Alternative perspectives that challenged normative theories were presented by EMA Director-General Mark Crosweller, EMV Commissioner Craig Lapsley, and the Queensland University of Technology Centre for Emergency and Disaster Management's Adjunct Professor David Parsons. Subjects included exponential technologies, neuropsychology, mythology and the power of narrative.

Of particular note was the workshop on 'The Power of Storytelling'. This remained a prominent discussion topic throughout the conference.

Many Australian achievements were featured, with special mention to Gaven Morris on behalf of the Australian Broadcasting Corporation, Christine Shaw on the success of the Wye River evacuations, Lucy Bell on the advances in social media integration in EMV, and Barbara Ryan on her research at the University of Southern Queensland, updating the statistics around the prominence in public communications in post-disaster reviews.

The EMPA conference provides a symposium for collaboration to promote sharing of expertise and resources, to develop resilience, both in operations and communities.

As a not-for-profit organisation, EMPA channels all residual funds into research that promotes sharing of lessons identified.

Next year's EMPA conference will be sponsored by EMA and will be held in Sydney.

Barbara Ryan

Bob Jensen

Attendee participation is encouraged in the conference.

Speakers line up for AFAC16, Brisbane: 30 August–2 September

The latest emergency management knowledge and research will be showcased in Brisbane from 30 August to 2 September at AFAC16 powered by INTERSCHUTZ, the annual AFAC and Bushfire and Natural Hazards CRC conference.

With the program now announced, more than 2000 delegates will come together to discuss the latest trends, innovations and challenges across all hazards. With some of the best international and national speakers, AFAC CEO Stuart Ellis believes AFAC16 will continue to develop Australia's collective knowledge.

AFAC16 will provide an opportunity to discuss and share new approaches in an all-hazard emergency management environment, and seek out innovative and engaging ways that we can partner with the community, business, all levels of government and researchers to understand how they can get the balance right, between mitigation, response and recovery,' Mr Ellis said.

The conference begins with a day dedicated to natural hazards science, with the Research Forum highlighting important discoveries from many CRC projects, as well as other scientists. It is a day to learn about the latest scientific developments that will benefit Australia's emergency services, and is not just for researchers, said CRC CEO Dr Richard Thornton.

'Research findings are starting to flow from the CRC in our third year, and the Research Forum presents a fantastic opportunity for all emergency management practitioners to learn about the range of ways CRC science will make a difference.

'Our research is diverse – from optimising remotely sensed flood data, to fire modelling, to cyclone resilience, to policy and fire law, to name just a few examples – and this variety will be showcased at the Research Forum, as well as right through the conference week,' Dr Thornton said.

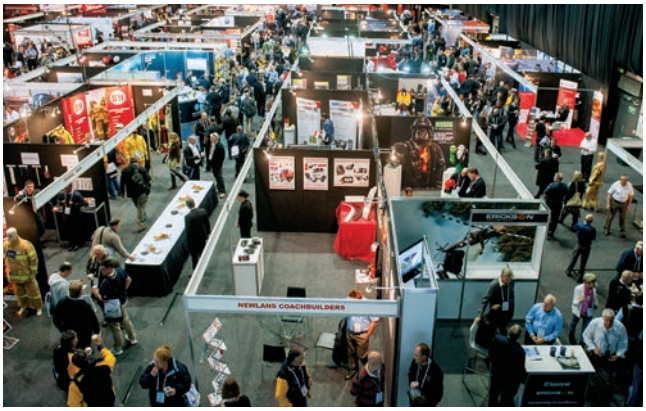
Confirmed keynote and invited speakers include:

- Katarina Carroll, Commissioner Queensland Fire and Emergency Services
- Rhoda Mae Kerr, Chief of the Austin Fire Department in the US and President of the Board of Directors of the International Association of Fire Chiefs
- Dr Jeff Kepert of the Centre for Australian Weather and Climate Research and CRC project leader
- Frankie Carroll, Director-General of Infrastructure, Local Government and Planning, Queensland
- Iain Mackenzie, Queensland's inaugural Inspector-General Emergency Management
- Jona Olsson, Founder and director of Cultural Bridges to Justice and Chief of the Latir Volunteer Fire Department, New Mexico, USA
- Dr David Henderson, Director of the Cyclone Testing Station at James Cook University and CRC project leader.

The conference will also feature an immersive trade exhibition, the biggest yet thanks to a new partnership with Hannover Fairs Australia. The conference will close with a series of post-conference development sessions.

This year also sees AFAC16 partner with the Women and Firefighting Australasia conference, with a stream dedicated specifically to women in firefighting.

View the full program and register at afacconference.com.au.



The 2016 trade show expo is expected to be bigger than 2015 (above), thanks to the new partnership with INTERSCHUTZ.

Case study: How a disaster simulation helped Red Cross prepare for *Cyclone Winston*

By Caragh Robinson, Catherine Harris, Steve Ray and Ian Morrison, Red Cross

In January 2016, Australian Red Cross conducted a simulation exercise to test organisational readiness for large-scale emergency responses. A month later, Fiji was hit by the strongest cyclone ever recorded in the southern hemisphere. The simulation exercise helped Australian Red Cross improve the speed and efficiency with which it was able to support its local partner, Fiji Red Cross Society, in responding to *Cyclone Winston*. In particular the exercise helped Australian Red Cross clarify contact points for operational and logistical matters, improve understanding of safety and security processes, and strengthen public messaging in emergencies.

Cyclone Winston destroyed or damaged more than 32,000 homes on its path through Fiji in February 2016. *Image: IFRC, Navneet Narayan.*

Introduction

On 20 February 2016, severe tropical *Cyclone Winston* made landfall in Fiji. The cyclone cut an erratic path, doubling back on itself after passing through Tonga before developing into a category five system as it tracked through the centre of Fiji.

While the most populous cities of Suva and Nadi avoided a direct impact, all Fiji's islands experienced highly-destructive winds, heavy rains, strong storm surges, flash flooding and landslides. At its peak, the cyclone caused wind gusts of 325 km per hour, making *Cyclone Winston* the strongest storm on record in the southern hemisphere.

The cyclone affected an estimated 350,000 people. The official death toll was 44, while a further 156 people were reported injured. Communications and power services were disrupted in many parts of the country; over 32,000 houses were damaged or destroyed, and 250,000 people were left in need of emergency water, sanitation and hygiene assistance.[1]

The International Red Cross Red Crescent Movement mobilised resources in the days prior to the storm making landfall. As the cyclone approached, Australian Red Cross was closely involved in planning and preparation with Fiji Red Cross and the IFRC.

Fiji Red Cross was one of the first local agencies to respond to the cyclone, sending out assessment teams as soon as it was safe to do so, and distributing tarpaulins and other relief supplies from its storehouses across the country. Australian Red Cross launched a public appeal and worked with the Australian Government Department of Foreign Affairs and Trade to identify ways to fund and support the relief operation.

Australian Red Cross had been preparing for this emergency long before *Cyclone Winston* formed. With a history of supporting the Red Cross Red Crescent Movement in disasters and crises all over the world, the organisation continually reviews and improves its response capacity.

In January 2016, Australian Red Cross conducted a day-long disaster response simulation exercise, facilitated by Thinkspace Emergency Management and involving Australian-based and offshore staff from its International Programs division. The exercise tested organisational readiness for a large-scale international emergency response.

The Pacific area is highly prone to disasters such as cyclone, floods and drought; and the geographic isolation of many Pacific islands can make disaster response challenging. Hence, the Australian Red Cross simulation involved a category five cyclone approaching the fictional Pacific Island nation of Palinga. The exercise tested:

- internal processes involved in tracking the emergency, alerting teams and planning a response
- collaboration between internal teams and with external stakeholders
- delivery of responses that met the needs of affected communities.

Lessons from the exercise

Lessons from the simulation directly contributed to the speed and efficiency the Australian Red Cross was able to respond to *Cyclone Winston*. These include:

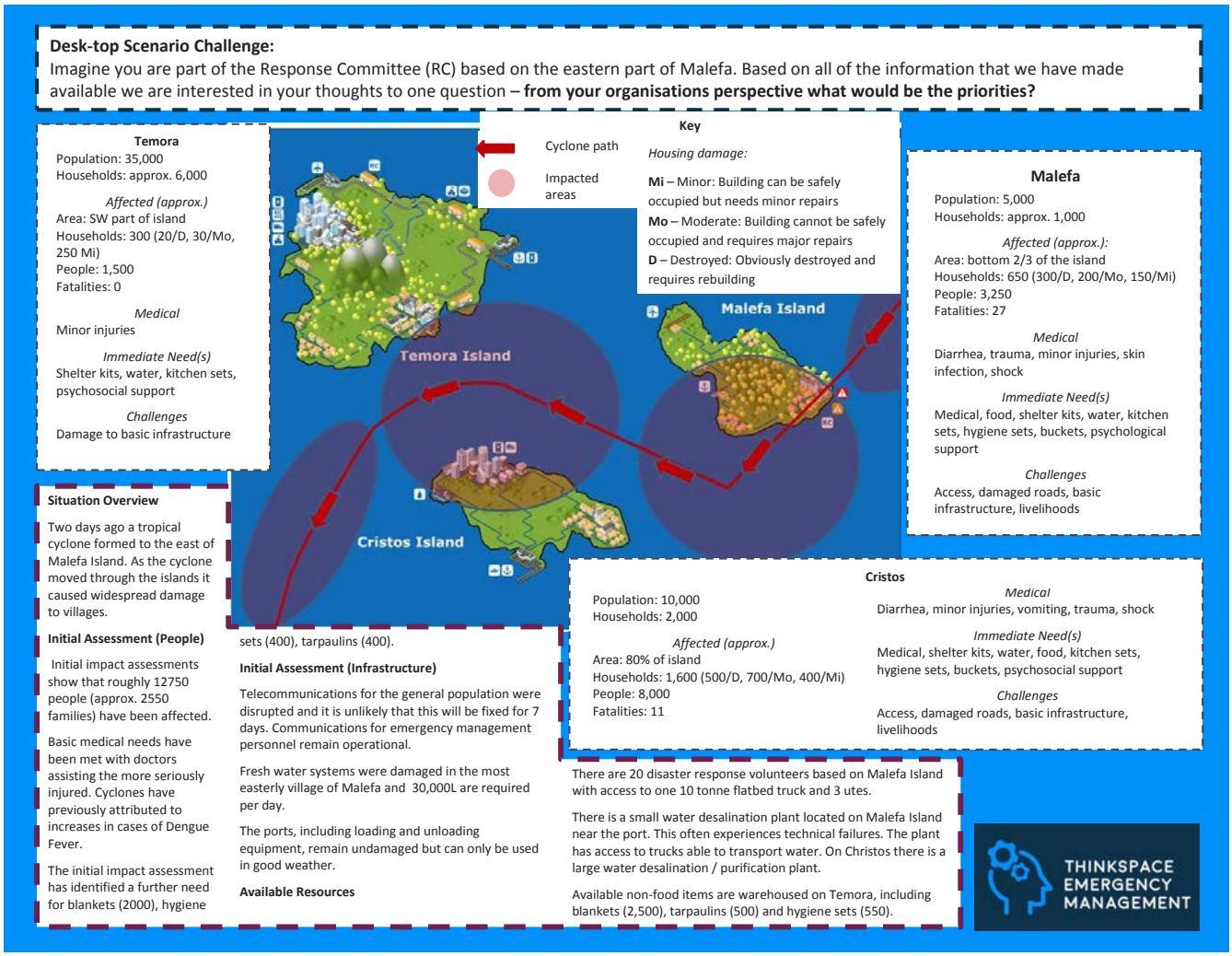
Stakeholder relationships

The simulation revealed a need to clarify the process for communicating with other Red Cross Red Crescent Movement partners. Australian Red Cross quickly identified appropriate internal and external contact points for safety and security issues, operations, logistics and surge human resources. Thus, as soon as *Cyclone Winston* was identified as a threat, the International Programs team could involve all relevant people in key decisions about the response.

Immediately following the cyclone, Australian Red Cross was able to work with Fiji Red Cross and other partners to determine needs and priorities on the ground. This informed the launch of a public fundraising appeal and discussions with the Australian Government Department of Foreign Affairs and Trade. Funds could therefore be quickly allocated to dispatch necessary relief items and the deployment of aid workers with specific technical skills.

Australian Red Cross and the Australian Government worked together to replenish relief supplies that were being distributed by Fiji Red Cross teams in the *Cyclone Winston* response. *Image: IFRC, Navneet Narayan.*

1 UNOCHA 2016, Humanitarian Bulletin Cyclone Winston – Fiji, 22 April 2016. *http://reliefweb.int/sites/reliefweb.int/files/resources/220416_humanitarian_bulletin.pdf.*



The simulation exercise created by Thinkspace Emergency Management was based on a fictional Pacific Island nation of Palinga.

Internal process improvement

The simulation was not only a valuable introduction or refresher for staff members, but also a means to evaluate the internal processes that underpin emergency response. As a result of the simulation, the team had a greater awareness of the safety and security processes involved in ensuring the wellbeing of Red Cross personnel in Fiji. Staff also demonstrated a greater understanding of their roles and responsibilities, including how to prepare for key meetings, produce reports and document decisions, as well as important finance and business processes.

Public messaging

The simulation highlighted areas where information could be quickly shared to strengthen public messaging during a crisis. This led to media training for Australian Red Cross staff based offshore. This helped secure a significant amount of media coverage of the Red Cross appeal and response to *Cyclone Winston*, including a partnership with the Australian Broadcasting Corporation that raised over $1 million for the appeal. When staff in Fiji expressed concerns about unsolicited goods being sent to the country, the communications team quickly created media articles[2], social media posts[3] and public enquiry messaging to encourage people to donate money or redirect second-hand goods to charity shops in Australia.

Investing in preparedness for response

The simulation highlighted the important link between investing in disaster preparedness and improving response capacity. With positive outcomes apparent in a real-life disaster response, Australian Red Cross will continue to hold regular disaster simulations to further strengthen its ability to respond to crises. Future exercises will seek greater involvement from external key stakeholders.

2 Walton, P 2016, *Fiji in need of monetary donations following Cyclone Winston*, Courier-Mail, 23 February 2016. At: www.couriermail.com.au/news/opinion/fiji-in-need-of-monetary-donations-following-cyclone-winston/news-story/e32cbefce02bceaf6bec48db29e4b0bd.

3 Facebook post, Australian Red Cross, 23 February 2016. At: www.facebook.com/245602512221/posts/10154627112047222.

AIIMS Health check

Stephen Luke continues his Emergency Services Foundation scholarship project with discussion to better integrate Health and mainstream incident management systems.

Australia's medical services are a complex functional grouping of planners, practitioners, health professionals, service organisations and government agencies (generically referred to in this paper as 'Health') that share many similarities with mainstream emergency management. Despite this, Health remains at the periphery of incident management frameworks, including the Australasian Inter-service Incident Management System (AIIMS). Many opportunities exist to increase the inclusion of Health in mainstream incident management. This paper considers a range of aspects including mass gatherings and recommendations from reviews of previous events like the Boston Marathon bombing.

Introduction

Primacy of life is the fundamental motivator and a universally accepted core value of emergency management agencies and personnel. The number of injuries sustained and lives lost are a significant determinant of a disaster's impact. Despite this, Health, as a complex functional agency, is strangely absent from many facets of mainstream incident management practice. This is illustrated by the lack of prominence Health has in the AIIMS framework.

Disasters of national significance in Australasia have increased fivefold over the past 25 years (Bradt *et al.* 2015). Significant emergency management reform is underway as a result of the findings and recommendations from reviews into high-profile disasters, with many themes common to Royal Commission reports dating back over 100 years. Despite being integral to emergency management planning and response, Health continues to languish as a support unit within the logistics arm of the AIIMS Functional Management model (see Figure 1).

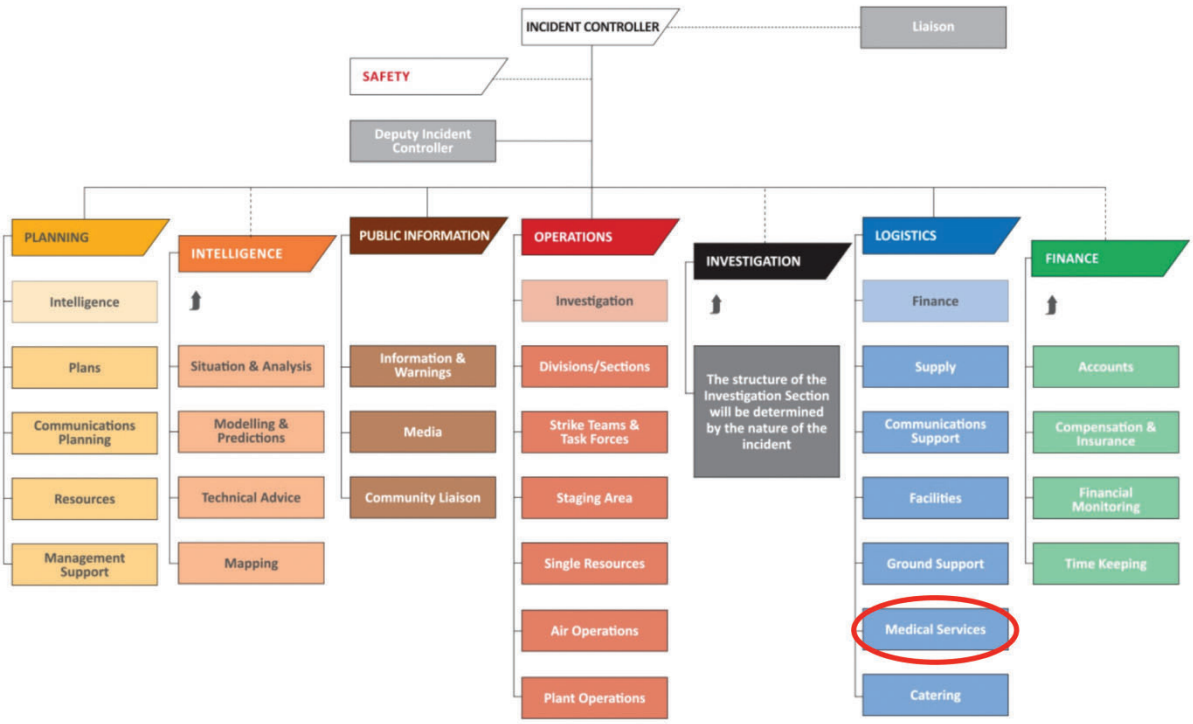
Health is not an agency in the traditional emergency management sense. There is no single uniform or identity, yet in many ways Health typifies the challenges of multi-agency command. Health culture is confronting to outsiders and variants of different languages are spoken. Health is a complex and, at times, loosely bound network of organisations. Health includes a wide range of skilled practitioners from government, commercial and non-government organisations, spanning the hospital, pre-hospital, community, academic and bureaucratic domains.

Those working within Health manage many of the challenges in emergency management on a daily basis. These include:

- demand management
- balancing core service delivery needs with surge requirements and resource limitations
- maintaining standards
- minimising expense
- providing public emergency information and media management
- staff safety, rostering and fatigue management.

In Health, these manifest as an apolitical necessity to balance limited resources when managing ambulance services demand and emergency department and hospital capacity, balancing elective surgery with emergency hospital admissions, and coordinating in-patient and community rehabilitation, aged care services and mental health services. Health networks and systems are, and must be, inherently scalable and responsive to periods of increased demand, due to either daily workload changes or an emergency. This is a fundamental reality of modern healthcare delivery and the meeting of community expectations.

Despite numerous similarities and inherent structural synergy, the involvement of Health in mainstream emergency planning and incident response is often peripheral. This reflects Health agencies as playing a support role in an integrated incident response, for example providing the face of public health broadcasts, providing emergency care to the sick and injured, or providing first aid at community relief centres and fire staging grounds. Throughout this, there remains a



Source: Australasian Inter-Service Incident Management System (AFAC 2013).

Figure 1: Medical Services (Health) location within the AIIMS4 Incident Control Structure.

strong parallel focus on the need for hospitals, health and ambulance services to continue 'normal business' operations. It is important to realise and be constantly aware that this might involve ambulance and mobile community health services, for example, responding into and providing 'normal business' services in disaster-affected areas, separate from resources tasked to the incident and potentially unknown to the controlling Incident Management Team.

Hospital Incident Management Teams

Hospital Incident Management Teams are often established to manage a Hospital and Health Service's response to internal (Code Yellow) and external (Code Brown) emergencies. This is often done with limited direct interaction with non-health stakeholders. Furthermore, emergency incidents may appear minor to attending emergency services personnel but may have a significant impact on local health services. For example the need to evacuate a small rural health facility due to flood or fire (as occurred in the Charlton and Numurkah health facilities during the 2011 Victorian floods) or the loss of road access for ambulances due to road or bridge damage (e.g. loss of the Angellala Creek Bridge in south-west Queensland).

Hospitals are designed to be resilient and self-sufficient but remain susceptible to natural disasters and critical infrastructure failure. Examples include loss of power or telephone services, elevated demand on ambulance workload and patient acuity during heat wave, and the full evacuation of over 300 patients from the Cairns Base and Private hospitals, 1700 km to Brisbane in the lead up to *Cyclone Yasi* (Little *et al.* 2012, PricewaterhouseCoopers (PWC) 2011).

Isolated health emergencies occur less frequently. Infectious diseases outbreaks such as Pandemic Influenza and Ebola Viral Disease provide good clinical case studies and demonstrate how quickly critical infrastructure and other services can be directly affected. There is growing recognition of the health, social and economic importance of 'Heat Health'. It is sobering to note that twice the number of people died in Victoria during the heat wave preceding the Black Saturday bushfires in February 2009 than the 173 lives lost during the fire event.

Vulnerable groups in communities

Heatwave is a long-standing and under-recognised global problem. Heatwave claimed 1500 lives in New York in 1896 and over 50,000 lives were lost in Europe in 2003 with 15,000 in France alone (Kohn 2010, PWC 2011). The vulnerability of individuals and communities to heat wave (and consequently temperature thresholds) vary widely and it is important that planning identify people and groups who are at highest risk of heat-related illness (Victorian Government 2014).

The complexity of Health and its interaction with emergency management is illustrated by work considering vulnerable people. Defining vulnerability is difficult and is contextually dependent on health and social determinants. For example, a person's

vulnerability may vary based on their exposure to temperature extremes, geographic or social isolation, transport limitations, or their dependence on power for life-support medical equipment. Even after the identification of vulnerabilities, the challenge continues for health providers, state-based health services, and local governments to maintain current lists and 'lists of lists', independent of Centrelink, Medicare and other government databases (Garlick 2015). These challenges continue throughout incident response and recovery phases.

Public health environments

Public health may quickly become a priority as a direct consequence of natural disasters. The health implications of air pollution during the Hazelwood coal mine fire in Gippsland in 2014 remain an active area of interest in a Victorian Government-commissioned inquiry. Food security and health services require reliable energy supplies and intact delivery mechanisms to support communities. Water and vector-borne diseases are a major health concern after destructive flood and storm events, especially where drinking water supplies and sewage treatment facilities are compromised. Emergency responses by Australian Medical Assistance Teams to assist islanders in the Pacific over the last decade (e.g. Banda Aceh, Haiti, Vanuatu, Tahiti, Fiji) have provided urgent primary care and public health interventions to treat and prevent disease, particularly in tropical and low socio-economic communities (NCCTRC 2015).

The health response 'tail'

The health implications of a relatively short duration incident response may be protracted and consume significant resources long after emergency services responders clear the scene, as demonstrated by the Ravenshoe Café explosion in 2015 (see Dean 2015). The fire was extinguished quickly and the challenge became the treatment and medical evacuation of 21 injured patients to nearby hospitals, with 11 of these requiring aero-medical retrieval over 1500 km from north Queensland to the specialist burns unit in Brisbane (Queensland Government 2016). Burns patients require specialist and ongoing intensive treatment and additional capacity is readily available through the national AUSBURNPLAN and its parent document, AUSTRAUMAPLAN. These plans facilitate the distribution of patients throughout the Australian hospital system and have evolved in response to lessons learned from local and international mass casualty incidents, including the Bali, Madrid and London bombings (Australian Government 2011).

Existing Health emergency management

While highlighting the need for improved integration between mainstream and Health incident management, it is important to acknowledge the well-established frameworks, resources and training already in place to varying degrees around Australia. These are:

- Major Incident Medical Management and Support training courses
- development of national, state and territory health emergency plans, including AUSBURNPLAN and AUSTRAUMAPLAN
- the growth of the ambulance service as a profession and pre-hospital lead health agency
- establishment of a pre-hospital 'Health Commander' role in the Victorian Health Emergency Response Plan
- implementation of ambulance and hospital demand management practices
- development of Hospital External Emergency (Code Brown) plans in accordance with Australian Standards
- emergency management training for hospital management
- joint hospital, ambulance and emergency services Emergotrain System™ and field exercises
- continuing work on the definition and management of 'vulnerable people' across a range of different emergencies.

Health emergency management systems and resources have improved greatly with the development of dedicated Health Disaster Management Teams, triggered initially by responses to disasters like *Cyclone Tracy* (1974), the Granville train disaster (1977), and Ash Wednesday (1983) (Bradt *et al.* 2015). More recently, the Health responses to the Victorian Black Saturday bushfires in 2009 and the Brisbane floods in 2011 demonstrate the need for prolonged Health involvement in relief and recovery operations. This is particularly in areas of the management of chronic medical conditions, loss of medications, and monitoring the mental health of affected and displaced persons (Luke 2013). With climate change expected to increase the frequency and impact of heat wave and other natural disasters, improved and integrated planning is required to increase response capacity and build resilience.

Health resilience is promoted throughout the United Nations-endorsed *Sendai Framework for Disaster Risk Reduction 2015-2030*, successor to the *The Hyogo Framework for Action 2005-2015*. These frameworks promote disaster risk reduction as a proven, cost-efficient means of reducing loss of life and social, economic and environmental assets (UNISDR 2005, 2015). This global framework is acutely relevant in Australasia with a recent epidemiological evaluation showing a fivefold increase in disasters of national significance over the last 25 years (Bradt *et al.* 2015).

The Boston marathon bombing demonstrates the importance of active Health involvement in all phases of mass gathering and emergency management. *Image: Aaron Tang, Wikimedia Commons*

Response scalability and mass gatherings

Successful emergency management systems rely heavily on professional networks, efficient communication, and response capacity with inherent scalability. Small incidents can escalate quickly and with little notice, reinforcing the importance of the 'train as you fight, fight as you train' principle. The Boston Marathon bombing in 2013 is an excellent example of how quickly a planned event can escalate to an emergency and mass casualty incident. In their review, *Why Was Boston Strong? Lessons from the Boston Marathon Bombing,* Leonard and colleagues (2014) highlight the importance of established plans and relationships in the success of the response. The presence of the on-site medical team at the finish line and the planned activation of the city coordination centre to oversee the distribution of patients across its hospitals were critical to the success of the emergency health response and the number of lives saved.

Leonard and colleagues (2014) identified the value of mass gatherings for emergency management training:

> *"Fixed" or planned events can be effective platforms for practicing incident management skills even when no emergency occurs, and they are highly useful if emergency contingencies materialize at a fixed event as happened at and after the 2013 Boston Marathon. Skills honed at such events can also prepare responders and response organizations to perform more effectively even in "no notice" emergencies that may occur at other times.*

Furthermore, they recommend that emergency management agencies:

> *Identify and use every significant fixed event (such as parades, conventions, sporting events, and Fourth of July celebrations) as an opportunity to conduct joint planning and coordinated action involving all relevant agencies and disciplines. Engagement in these recurrent processes are a way to build mutual respect across agencies and disciplines by giving them the opportunity to see their colleagues' professionalism and complementary skills and capabilities.*

The inherent link between emergency management and mass gatherings is reflected in the Victorian State Health Emergency Response Plan (SHERP):

> *SHERP provides a planning and management structure for public events and gatherings where there is potential for immediate mass casualties – and possibly increasing numbers of casualties over time. Involving health response agencies in pre-event planning may contribute to a safer, and therefore more successful, event. To this end it is recommended that events engage with health and medical providers that meet the requirements outlined in SHERP.* (Victorian Government 2013)

Mass gatherings are common in Australia. Events commonly coincide with peaks in natural hazard seasons and some of these events are held within high-risk geographic areas. In the absence of legislation and established systems there is no guarantee that emergency services and event organisers are aware of the others' plans, operations and contact details. The impact of these events on local health, ambulance and emergency services is compounded further in rural and remote areas with limited pre-existing resources and inherently long transport times. This impact can often be safely and efficiently mitigated through planned health promotion, provision and protection strategies (Luke 2013, Luke & Dutch 2014, Dutch & Austin 2012). Herein lies a growing field of research, examining event characteristics, clinical presentations, public health implications and the development of predictive modelling and mitigation strategies (Arbon, Cusack & Verdonk 2013).

Large-scale Health deployments are inherently complex and should be managed with a whole-of-Health operational plan. Equipment, processes and skills can be built and refined through experience with mass gatherings and maintained in readiness for emergency response. Mass gatherings also provide an excellent and (usually) more controlled environment in which to gain operational and multi-agency command experience. Large international events such as the Olympic Games (2000), Commonwealth Games (2006, 2018), and World Youth Day (2008) provide additional cultural, language, security and public health challenges.

Health Department medical teams in Australia's states and territories deployed for mass gatherings simultaneously exercise systems and provide hospital staff with pre-hospital clinical and multi-agency experience. Health involvement in large-scale events reduces the number of patients presenting to hospitals after the City 2 Surf run (NSW) and the Gold Coast Marathon and Schoolies Festival (QLD). Deploying additional, dedicated ambulance resources to events and

Figure 2: Proposed Health functional agency structure and component teams.

emergency incidents reduces the use of local community ambulance resources while expediting patient stabilisation and transfer to hospital. Victorian Medical Assistance Teams were deployed during the 2009 bushfires and 2011 floods to support and augment rural health services. The New Zealand Territorial Services (military reserve) provide the medical team for Ironman New Zealand, giving clinicians valuable experience managing endurance illnesses also seen during military deployments. AusMAT medical teams use the gruelling Tour de Timor bike ride as a logistical and clinical training deployment (Luke 2013).

The way ahead

The introduction of a dedicated and elevated Health function within incident management structures would better acknowledge the importance and complexity of Health as a functional agency (Figure 2). Increased Health engagement in mainstream emergency management would drive the improvement of information-sharing systems, build stronger working relationships and improve insight into priorities, plans and systems. Mutual benefits would be expected to follow from increased collaboration in conference programming, shared training, and the development, maintenance and exercising of strategic plans.

The adoption of established incident management principles and structure by Health emergency management would streamline inter-agency planning and operations. This would facilitate greater use of mass gatherings for exercising systems and gaining operational experience. The enforcement of these principles would also provide a solid foundation for greater regulation of event management. Elevating Health within incident management structures could provide stimulus to exercise, review and integrate government, health and hospital emergency management plans.

The question of Health functional agency leadership will inevitably arise and its solution is complex and the details beyond the scope of this discussion. Health command requires operational command experience and the ability to 'speak emergency management'. But it is bigger than any one agency and requires specialist training, well-established professional networks and a working knowledge of hospital and health services. The fundamental principles of 'All Hazards Incident Command' and *AIIMS Doctrine* (Conway 2012) are equally applicable to everyday and disaster health management. It is important that the complexity of Health systems and command be included in mainstream command training.

For all their differences, mainstream and Health emergency management share many similarities, as evidenced by the parallel development of the 'all hazards, all agencies' and 'whole-of-health' response doctrines respectively. The elevation and integration of Health as an equal partner in incident management frameworks and resultant structures would have rapid

The integration of Health as an equal partner in incident management frameworks has obvious benefits for event planning. *Image: Stephen Luke*

and ongoing benefits in emergency and event planning and management.

As future reviews of our emergency management arrangements occur and in the spirit of Conway's *AIIMS Doctrine: have we got the fundamentals right?* (Conway 2012), it is time to reflect on the benefits of making AIIMS and other incident management systems healthier.

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About the author

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The Australian public health response to the H1N1 pandemic

Kristen Overton, Royal Darwin Hospital

This paper critically analyses the Australian public health response to the H1N1 influenza pandemic in 2009. The aim is to analyse the response in respect to the core public health leadership and management skills of preparation, crisis management, media management, and risk communication. Aspects of ethical and legal considerations are also explored.

Introduction

In early 2009, a novel influenza virus first emerged with reports of large numbers of young adults with serious respiratory illness in Mexico. Shortly after, the new influenza A H1N1 virus was isolated in California and subsequently linked to the earlier cases in Mexico (Center for Disease Control 2009). On 24 April 2009, the World Health Organization (WHO) reported more than 882 cases in Mexico and seven cases in the United States of America, with 62 deaths caused by the H1N1 influenza virus. The situation was defined as 'a public health emergency of international concern' (WHO 2009). Worldwide, H1N1 spread rapidly by person-to-person transmission, and from one country to another. On 11 June 2009 the WHO declared the infection at pandemic levels reporting more than 30,000 cases in 74 countries (WHO 2009).

While initial predictions may have overestimated the morbidity and mortality of the H1N1 influenza strain, its impact was significant. By 2011 approximately 1.5 million people were believed to have been infected in 214 countries, with over 25,000 confirmed deaths (Gable *et al.* 2011). The spectrum of illness varied greatly but the majority of cases were mild. However, more serious illness was noted within particular groups including pregnant women, Indigenous peoples, the morbidly obese, and those with significant medical co-morbidities (Western Australia Department of Health 2012). The lower-than-expected morbidity and mortality has been attributed to a successful public health response and the fact that the H1N1 virus was less virulent than predicted.

Method

Given the complexities of these topics, a broad selection of information was reviewed. Literature searches were undertaken within PubMed, MEDLINE and CINAHL. Key word searches were undertaken using the terms influenza OR H1N1 OR swine flu, AND public health response AND Australia. The search was limited to the English language and articles from 2009 onwards, when available. The database searches yielded 80, 58 and two articles respectively. Abstracts of these papers were reviewed and appropriate papers were selected. References used in the selected articles were explored for further information. In total 17 peer-reviewed articles were included. The majority of papers that were reviewed but not included were deemed more medically technical (i.e. focusing on treatment, seroprevalence, vaccination or management of high-risk patients) rather than public health.

In addition to the peer-reviewed journals from database searches, state and Commonwealth government websites were examined for relevant policy and review documents, for example, the health websites of the New South Wales, Queensland, Western Australia and Commonwealth governments. The website for the US Centers for Disease Control was searched for relevant documentation, as well as non-government organisation websites, including the WHO.

The literature selected was reviewed to elicit information about the role of the Australian public health response during the H1N1 influenza pandemic. The focus of the review was to critique the public health response in terms of the core leadership and management skills required. The review specifically looked at aspects of preparedness, public health leadership, crisis management, media management, communication, and ethical and legal considerations.

Results and discussion

The literature showed that significant public health action was required to help control the spread of H1N1 influenza in the Australian community. The public health response followed the framework described in the Australian Health Management Plan for Pandemic Influenza [AHMPPI] 2008 (Spokes, Cretikos & Ward 2010).

The AHMPPI identifies six possible phases for pandemic response:

- ALERT
- DELAY
- CONTAIN
- SUSTAIN
- CONTROL
- RECOVER.

The DELAY phase was activated on 28 April 2009 with the objective of preventing or slowing the entry of the virus into Australia using border control measures and increased vigilance. Numerous cases were identified and, on 22 May, Australia moved to the CONTAIN phase. The CONTAIN phase is designed to prevent community transmission from becoming established (Spokes, Cretikos & Ward 2010). On 17 June 2009 Australia moved to a new PROTECT phase in recognition of widespread community transmission and generally mild clinical disease (Spokes, Cretikos & Ward 2010). This phase identified high-risk groups and aimed to protect those most at risk of severe illness. Neuraminidase inhibitors, such as oseltamivir, were provided prophylactically and the largest public vaccination program undertaken in Australia commenced on 30 September 2009 (Australian Government Department of Health and Ageing 2010).

The H1N1 virus was a significant burden to the Australian public health system. By the end of 2009 there had been more than 37,000 laboratory-confirmed cases of H1N1, including 191 deaths and 5000 people requiring hospital admission (Australian Government Department of Health and Ageing 2010). Based on laboratory-confirmed cases, the median age of those infected was 21 years and 31 years for those hospitalised. The median age for those receiving intensive care treatment was 44 years and 53 years for those who died (Dowse *et al.* 2011). Of note, these were comparatively younger ages than usually seen with seasonal influenza.

Preparedness

Pre-pandemic planning was instituted in Australia before the appearance of the H1N1 virus. This had been largely stimulated by previous outbreaks in the Asia-Pacific region of SARS in 2003 and H5N3 avian influenza from 2004 onwards (Weeramanthri *et al.* 2010). Planning documents included the AHMPPI. This is a comprehensive document providing background to influenza pandemic planning and outlines strategies for responding (Waterer, Hui & Jenkins 2010). Key actions of forward planning and forecasting, communication, surveillance, reducing transmission and optimising health services are detailed in the document (Waterer, Hui & Jenkins 2010). The AHMPPI was the result of extensive collaborative work by all levels of government and multiple other stakeholders over several years (Bishop, Murnane & Owen 2009). Arrangements were trialled in large-scale pandemic exercises in 2006 *Exercise Cumpston* and in 2008 *Exercise Sustain* (Weeramanthri *et al.* 2010).

The H1N1 public health response in Australia was well-planned and the feedback generated has confirmed the value of planning and preparedness. Importantly the shortfalls identified through critical analysis of the H1N1 response have since been incorporated into future pandemic planning, including an update to the AHMPPI in 2014.

Public health leadership

The scale of the Australian public health response is difficult to describe in words and the number of personnel involved was significant. Numerous tasks were carried out by the teams involved including developing operational guidelines, communicating with professionals and the public, tracking patients and tracing contacts, running laboratory tests, creating supply chains for medications and vaccines, collecting and analysing data, and actually caring for the 'worried well', the 'mildly symptomatic' and the seriously ill (Weeramanthri *et al.* 2010). Successful leadership was vital during the H1N1 pandemic to coordinate the public health response and, therefore, minimise the extent to which people were affected by the crisis (Demiroz & Kapucu 2012). The then Minister for Health and Ageing, Nicola Roxon, and the then Commonwealth Chief Medical Officer, Professor Jim Bishop, received commendations for their leadership during the H1N1 pandemic (see Professor Jim Bishop to leave post in May 2011). They worked together with the Chief Health Officers of the states and territories and with a range of experts. Their leadership and management was a great example of inter-jurisdictional cooperation (Bishop 2009).

Crisis management

It is without a doubt that good prior planning aided the public health response in Australia, but flexibility in the face of an emerging crisis was also invaluable. A series of discussions, involving the Commonwealth and all states and territories ultimately resulted in the creation and implementation of an entirely new pandemic phase. The PROTECT phase was instituted on 17 June 2009 (Dowse *et al.* 2011) and allowed for a refocussing of resources, including the use of antiviral drugs, for those at highest risk (Waterer, Hui & Jenkins 2010). Adapting plans as understanding of the disease developed and re-targeting efforts and resources as more information became available was a crucial and efficacious public health response (Australian Government Department of Health and Ageing 2010).

The previous framework phases of DELAY and CONTAIN needed reconsideration after the public health response had failed to prevent H1N1 from spreading (Hamilton, Crocket & Skippen 2010). Some criticism was voiced over a decision to allow the cruise ship, *Pacific Dawn*, to embark new passengers in Sydney while there remained the possibility of infected crew and a contaminated environment. This, predictably, led to further infection and dissemination of the H1N1 infection into Victoria (Waterer, Hui & Jenkins 2010). The management of cruise ships during a pandemic was not an issue that had been anticipated (Australian Government Department of Health and Ageing 2010). This will have to be addressed in future pandemic planning given this is a possible port of entry into Australia. Also the spread of the H1N1 virus may have been hastened by the decision to allow national sporting events for some schools to continue in Victoria despite sustained transmission being evident in the community. Evidence showed that school children then brought back the novel influenza virus to their home states and established infection there (Australian Government Department of Health and Ageing 2010).

Criticism of the H1N1 public health response has also focused on the virus being declared a pandemic when data had shown little variation from seasonal influenza (Kelly 2010). Many critiques have suggested that the different phases of a pandemic plan should only be adopted when a new influenza strain looks likely to arrive in Australia that is both hyper-virulent and spreads easily (Collignon 2009). Worldwide, criticism has focused on a lack of transparency, with the WHO declaring a pandemic despite data being available to suggest that the associated mortality rate was low. The controversy was further compounded by revelations that expert advisors had undisclosed financial links to pharmaceutical companies responsible for making antivirals (Davis, Flowers & Stephenson 2014).

The public health workforce was stretched to capacity by the H1N1 pandemic. Hospitals and their intensive care units, as well as general practices, were overextended. This is due to a chronic lack of surge capacity in the Australian health system. There is concern that an increase in hospital activity of less than 0.1 per cent of yearly admissions and bed days managed to strain hospitals (Collignon 2009). If H1N1 had been a more virulent virus, the lack of surge capacity in Australia's health service would have left communities seriously exposed. Future pandemic planning needs to include strategies for appropriate surge capacity in the health system, including alternative options to the traditional hospital system.

Media management

It is well recognised that the media plays an influential role in the public's response to health issues. The mass media (television, radio, print and the internet) has significant potential to influence health-related behaviours and perceptions (Leask, Hooker & King 2010). Media attention in Australia and worldwide was intense during the initial stages of the H1N1 pandemic. This coverage, as well as government press releases, caused undue fear in the population. Panic and fear caused many people to present to their general practitioner or to emergency departments when they were not unwell (Collignon 2011). This placed further unnecessary pressure on an already overburdened health system. In contrast, in the later stages, the media portrayed H1N1 as a mild illness declaring the official response an overreaction (Hilton & Smith 2010). This new portrayal affected public response and lead to a decrease in compliance with community-based mitigation measures (Waterer, Hui & Jenkins 2010). These included measures such as infection control, hygiene, the use of masks, and alcohol hand rubs, all of which are required to reduce transmission of respiratory infections (Lo *et al.* 2005).

The Australian Government review of the H1N1 response noted the difficulties in managing the intense media demand. In addition, they recommended a media strategy for future potential outbreaks that included principles and protocols of media engagement (Australian Government Department of Health and Ageing 2010).

Communication

Communication was, in general, efficient during the H1N1 pandemic in Australia. This was definitely guided by the strong communication flavour and prior planning in the AHMPPI (Weeramanthri *et al.* 2010). Mechanisms of public communication used during the public health response included public service announcements, press conferences, call centre hotlines, H1N1 dedicated websites, and media reporting and commentary (Spokes, Cretikos & Ward 2010). In terms of press conferences, the use of a consistent and credible health spokespeople was commended in helping to build rapport and trust in the community (Waterer, Hui & Jenkins 2010). Wisely, the information and questions coming into call centres was used to inform further outgoing information and health messaging (New South Wales Department of Health 2010).

Communication with general practitioners during the H1N1 pandemic was primarily via faxes, the Healthlink pathology system, and the H1N1 website (New South Wales Department of Health 2010). Criticism was voiced at the often duplicated and conflicting information provided. General practice plays a vital role in the front-line delivery of health services. Therefore there is a strong need for communication channels to be credible and up to date to avoid duplication and confusion (Weeramanthri *et al.* 2010). The issue of duplication of information was also a concern within the different levels of government. Despite best efforts there will always be issues with communication when multiple layers of bureaucracy are in place. Staff involved in the H1N1 public health response were critical of having to attend multiple meetings with different areas of the health system to discuss the same agenda (Waterer, Hui & Jenkins 2010). While communication during the H1N1 public health response was reasonably good, these experiences highlighted that improvements can still be made.

Legal and ethical issues during crisis management

Responding to pandemic influenza raises a number of legal, social equality and ethical dilemmas. Legal framework issues can arise due to different levels of government if there is not a coordinated approach. This was briefly evident during the H1N1 pandemic when the Queensland Government encouraged food stockpiling, before falling into line with the national view that this would unsettle the public (Bennett & Carney 2010). Legal frameworks are required to outline roles and responsibilities and to support the required public health response.

A number of ethical issues also arise in pandemic planning, as people's individual rights need to be balanced against public safety. These include priority setting and equitable access to antiviral medications and vaccines. When using isolation, quarantine, border control and social distancing measures, public health officials should be mindful of people's human rights, as well as protecting the public. Australia also has an international ethical obligation to provide assistance to countries in need during pandemic events (WHO 2007).

Conclusion

There are important lessons that can be learnt from the public health response in Australia to the H1N1 pandemic. Exemplary aspects of the response included pre-planning, public health leadership and communication with the public. The pandemic also served to highlight issues that need to be addressed, including media management, surge capacity, and inter-agency communication. It should also be noted that the apparent success of the response in 2009 is, in part, due to the low virulence of the H1N1 virus. Therefore we must not become complacent, but use the H1N1 experience to prepare for the future possibility of a more virulent virus pandemic and public health crisis.

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Monitoring the performance of incident management teams

Geoff Conway AFSM, reflects on the last ten years of incident management team evolution.

In 2006, I described an initiative developed by fire services in Victoria to monitor the performance of incident management teams in real time. The initiative was part of the response to coronial recommendations for monitoring firefighter safety. This was extended to include monitoring of broader issues around incident management effectiveness. A key outcome from this initiative was the building of an evidence base for the development of training and briefing materials for incident management team (IMT) members. It was also intended to provide case studies that would inform the design of exercises for development and practicing of incident management skills. What became apparent during the early stages of the program was that watching incident managers as they went through the decision-making process was of much greater value when compared to the analysis of the decision-making process after the event.

The Real Time Performance Monitoring Program is still operating in Victoria. It has since been supplemented by a broader initiative developed by Victoria Police who have a coordination role in emergency management. The Strategic Emergency Management Assessment Teams (SEMATs) were commissioned following the 2008–2009 summer to monitor wider emergency management preparedness and response activities. SEMATs operate on similar principles to Real Time Performance Monitoring and model some aspects of their assessments on Real Time Performance Monitoring case studies.

The observations made in 2006 on the need to prepare IMTs for more frequent 'out of scale' events has been shown to be valid. Australian and New Zealand incident managers have been called on to respond to a number of extreme weather events and natural disasters since then, ranging from earthquake, floods, cyclones, major fires, to locust plague and major blue-green algal blooms. Some of these events have generated intense public and political scrutiny. In all these cases the performance of incident managers at all levels has been a major component of inquiry and coronial considerations. In their 2012 Noetic Note, Peter Murphy and Peter Dunn reflected on the challenges facing incident managers. They suggested that 'The failure [of incident management] is seldom one of character, but inevitably a lack of preparation and understanding. Leaders, and their teams, are unable to effectively apply their knowledge and skills to a situation that is either so novel, or of a scale that is beyond their experience and conception.'

The response to scrutiny and subsequent critiques of incident management performance has given added impetus to the efforts agencies make to prepare incident managers for their role. At a national level, the AFAC Emergency Management Certification Scheme establishes formal certification of incident managers. Many jurisdictions have developed more robust training and endorsement programs for incident managers to identify those personnel who have demonstrated their capacity to perform incident management roles with confidence.

This is a positive outcome of the scrutiny. The dilemma is that scrutiny through hindsight is problematic and has limitations. In particular it tends to dissect the detailed decision making of IMT in isolation from the context in which those decisions are made. Graham Dwyer (2015) suggests that we need a better way of learning from our experience of managing major emergencies.

Real Time Performance Monitoring remains one of the few tools available to agency leaders to understand the performance of their incident managers based on the context in which incident analysis and decision making occurs. It is a stronger indicator of capability and skills in leadership than post event reviews.

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ABSTRACT

This paper describes the approach, findings and lessons learned from a collaborative resilience project between Melton City Council and Wyndham City Council in Victoria. The project sought to educate community leaders about disaster resilience through participation in an 'Emergency Ready Communities' forum. As part of the forum, members participated in a workshop to assess the resilience capacity of their communities using the Torrens Resilience Institute Community Disaster Resilience Scorecard. This was a valuable exercise in community engagement as well as in resilience. The exercise highlighted key areas for future improvement.

Developing 'Emergency Ready Communities': a tale of two Victorian councils

Andrew Mason and Eleanor Crofts, Melton and Wyndham city councils, and Dr Malinda Steenkamp and Imogen Ramsey, Torrens Resilience Institute, describe a workshop to assess resilience in two local council areas.

Introduction

> *Application of a resilience-based approach is not solely the domain of emergency management agencies; rather, it is a shared responsibility between governments, communities, businesses and individuals.... communities need to be empowered to take shared responsibility for coping with disasters.* (Council of Australian Governments 2011)

Being 'emergency ready' is a shared responsibility between emergency services and everyone in the community. Being 'emergency ready' enhances disaster resilience. This entails having the information, knowledge, tools and social connections to be better able to prevent, prepare for, respond to and recover from all types of emergencies (COAG 2011). Empowering communities is a fundamental step in resilience-building, which is discussed prominently in theory but is often viewed as a herculean task in practice because of the perceived scale of community engagement and resources required. Although all members of communities cannot be identified all of the time, communities often have existing formal and informal leaders, respected elders and trusted informants who can be relied on to convey information and link their communities into the wider community (Haddow & Haddow 2013). By identifying existing networks and group leaders, connections and support can be given to their leadership and they can be provided with the skills and tools to understand the risks to their communities from hazards and help them implement initiatives for long-term resilience.

'Emergency Ready Communities' is a collaborative resilience project between Melton and Wyndham City Councils in Melbourne's outer west. These council areas are two of the fastest growing municipalities in Australia (Newton & Glackin 2014). With 89 km of peri-urban interface (54.5 km Melton, 34.5 km Wyndham), rapid population growth and residential development in fire-prone environments (Foster *et al.* 2013), bushfire and grass fire threats are a concern. Other hazards of concern to Melton and Wyndham include hazardous material release from major industrial facilities as well as storms and flooding, extreme weather, and heatwave (City of Melton 2014, City of Wyndham 2015). The identification of these hazards highlights the need for communities to be active and ready for such events.

The aim of the 'Emergency Ready Communities' project is to strengthen partnerships among communities by fostering ongoing collaboration with and between community groups, and embedding long-term emergency

management engagement structure. By creating inclusive and connected leadership, the project builds an active group who are capable of helping their communities prevent, prepare for, respond to, and recover from emergencies.

This paper describes an important step in the initiative: the 'Emergency Ready Communities Forum'. The forum bought together community leaders and representatives (collectively referred to as community members in this paper) from the cities of Melton and Wyndham to hear from extraordinary leaders and emergency management professionals, and participate in a workshop to assess their community's resilience to disasters. The activity used the Torrens Resilience Institute (TRI) Community Disaster Resilience Scorecard. These assessments established a baseline community resilience score while connecting and fostering future collaborations among key stakeholders from the various communities with a focus on continued community resilience.

Assessing resilience

All Australian communities have a degree of vulnerability to large-scale emergencies and it is widely recognised that recovery is a difficult and complex process (Alesch, Arendt & Holly 2009, Aldrich 2012). A component of building community resilience involves building the capacity of local networks to reduce the effects of disasters and emergency events in the response and recovery phases (Pommerening 2011, COAG 2011). To identify gaps in resilience across the municipalities and develop appropriate approaches for building resilience, a baseline assessment of resilience was conducted. Communities of various sizes and geographic locations were included in the assessment, which was undertaken using the TRI Community Disaster Resilience Scorecard. The Scorecard is specifically designed for use by communities to understand the likely level of risk and the community's resilience in emergency events at a specific point in time (see Box 1 for a description, Arbon *et al.* 2012). The objective for applying the Scorecard was to obtain information specific to each community to inform and direct the councils' emergency management and disaster planning.

The Forum

The forum was a leadership development opportunity for community members to better understand disaster resilience. During the morning session, a range of speakers provided emergency management and leadership information. The workshop using the Scorecard was held in the afternoon.

The forum and workshop were an opportunity to test the Municipal Community Profile and Engagement Framework (MCPEF) (Mason & Crofts 2015), which incorporates a modified version of the Community Engagement Framework outlined in the *National Strategy for Disaster Resilience* (COAG 2011). The MCPEF provides a conceptual model for identifying new and emerging, community groups with a social connection or a responsibility to one or more neighbourhoods in a municipality. Using the framework was helpful to identify and contact leaders of these groups and involve them in emergency management activities and events.

A total of 124 people attended the forum, including community members, emergency management professionals, facilitators and special guests. Personal data was collected from attendees during the online event registration. A number of groups were represented including youth, Aboriginal and Torres Strait Islander people, business owners, and people from culturally and linguistically different backgrounds. A small number of people who registered did not attend the event and sent representatives where possible. Of the community members who did attend, there was a reasonable gender cross-section represented, with 44 males (59 per cent) and 31 females (41 per cent) attending (the gender balance of each municipality is 50 per cent male and 50 per cent female (Profile.id.com.au 2016)). The age range for the sample was 14 to 79 years with 34 attendees (45 per cent) aged between 50 and 79 years. Community group representation was diverse.

The number of participants who identified as belonging to specified groups are shown in Table 1.

Box 1: The TRI Community Disaster Resilience Scorecard

The TRI Scorecard assesses four dimensions of community resilience, being:

1. connectedness within a community
2. the level of risk and vulnerability
3. the procedures that support planning, response and recovery (PRR)
4. the emergency PPR resources available (Arbon *et al.* 2012).

Three to seven items are used to assess each of the four dimensions. A score from 1-5 is given for each item and scores are added for a subtotal for each dimension. The four subtotal scores are combined for an overall resilience score. For each dimension, as well as for the overall score, a community can identify whether a particular dimension falls in a 'Red zone', a yellow 'Caution zone', or a green 'Going well' zone.

The Scorecard and the process of completing it are available at www.flinders.edu.au/tri/toolkits/community-resilience-toolkit.cfm.

Table 1: Participants identifying as belonging to specific groups

Group	Number of participants
Culturally and Linguistically Diverse	10
Environment and Heritage	4
Cultural	3
Interfaith and Ecumenical	3
Local emergency services	15
Residents' associations	7
Service/Social clubs	7
Women's groups	2
Youth	8
Animal/Agriculture	1
Neighbourhood houses	1
Schools	2
Other group leaders	12

Thirty-eight participants (51 per cent) belonged to more than one group, and 13 (17 per cent) were in one group only. No data was available for 24 participants (32 per cent).

The Scorecard workshop

The workshop commenced with a presentation by TRI staff on the Scorecard to 72 community members who participated in the workshop. The presentations included instructions on how to score across four resilience dimensions. The participants were organised into seven groups with broad and diverse community representation related to age, gender, background, social connection, life experience, knowledge about resilience, and local government experience. Group sizes ranged from 6 to 13 members and were decided by the number of attendees from the specific suburban regions. There were three groups from Melton (two from Melton and Melton south, and one that represented smaller communities within the municipality including Burnside, Caroline Springs, Hillside, Taylors Hill, Eynesbury, Exford, Rockbank, Diggers Rest and Toolern Vale). There were four groups from Wyndham (two representing Werribee and Wyndham Vale, one representing the smaller communities of Laverton North, Point Cook, Truganina and Williams Landing, and one representing Hoppers Crossing and Tarneit).

Eighteen volunteers from local community groups (Red Cross, Victorian Council of Churches, Victorian State Emergency Service, and local government) facilitated the small group discussions and the assessment. These facilitators had attended a Scorecard training session a week prior to the workshop. At the training session they were briefed on the Scorecard exercise, provided with facilitator skills training, and participated in a hazard identification exercise. This same exercise was used as an icebreaker for the workshop prior to commencing the Scorecard component. The hazard exercise incorporated identification of important community assets and the point of impact on the community for each identified hazard. During the workshop, 17 emergency management professionals from Wyndham and Melton Municipal Emergency Management Planning Committees were on hand as subject matter experts and answered questions in relation to emergency response planning.

The assessment process

The process described by the Scorecard developers involves the working groups to meet three times over a period of four to six weeks (Torrens Research Institute 2012). Previous feedback on the Scorecard process showed that meeting more than once was unrealistic to some, while others who met three times found it difficult to get all participants to attend. The first

Resources were provided to help participation in the exercise and gather the relevant information from participants. *Images: Torrens Resilience Institute, Flinders University*

meeting is designed to establish a group leader and for the participants to conduct research and collect data. The researchers of that assessment concluded that the groups had an inability to gather the required data to undertake the assessment (Singh-Peterson *et al.* 2014).

For these reasons a different approach was adopted to that prescribed by the Scorecard developers. Only one meeting was conducted and all the data and resources required for the assessment was provided at each workshop table. This included a copy of the relevant *Municipal Emergency Management Plan* with all relevant sub-plans, a history of events in the region, large-scale maps of the municipality, the municipality's Municipal Risk Register, and a community profile handout that had been developed specifically for the activity using public data available from the website http://home.id.com.au/. This website provides demographic information for local governments. A benefit in providing this information was that each group had the same resources to complete the assessment thus limiting any bias related to access to materials. A copy of the Scorecard was available that contained pre-populated data about the community sourced from the Australian Bureau of Statistics. These resources fast-tracked the process of completing the Scorecard as participants could quickly identify and refer to the relevant information required.

Observations of the workshop process

The group dynamics of the workshop participants was diverse. Most people found it easy to get along, but for some, circumstances seemed more challenging. What appeared to draw people together was being previously acquainted with others in the group, coming from a similar background, and sharing ideas and experiences. The positive aspects of inter-group cooperation were the robust discussion stimulated by the questions, active listening, accepting new or different viewpoints, contributing experiences and opinions, and working with others to reach consensus. There were groups where members appeared disconnected, divided or disengaged. This may have been due to clashing personalities, different backgrounds (e.g. a significant age difference), opposing perspectives, or an incomplete understanding of the purpose of the task.

Some groups appeared to find the Scorecard exercise more challenging than others and took more time to complete the questions. One group adopted a pragmatic approach, whereby members paired up to score the items. They completed all four sections of the Scorecard ahead of schedule. Another group experienced problems with understanding and interpreting some of the questions and content and were observed to have difficulty making progress beyond that point.

The facilitation style influenced each group's approach to responding to the items. There was little consistency in terms of whether groups followed a formal order or structure when completing each item, whether everyone was expected to contribute, and how disagreement was resolved. Some groups had people take it in turns to explain the score they had allocated to a question, while others led a group discussion and then asked for a show of hands for each score allocated at the end. Other groups took an unstructured approach preferring to allow people to speak up whenever they had something to say. On the whole, the facilitators were able to start conversations, encourage contributions from all group members, and oversee the scoring of the Scorecard.

Resilience scores

Table 1 shows the scores for each of the Scorecard components, as well as the overall resilience scores for each of the seven workshop groups. Due to the range of risks of each municipality and because most of the community members and the interest groups they represent had not previously been involved in the process of developing emergency management plans, it was expected that no community would score in the 'green' zone for overall resilience. Three scored within the 'yellow' zone and four in the 'red', highlighting the importance of ongoing initiatives and collaboration aimed at building community resilience across the municipality. The area that received the lowest scores on average was 'Procedures'. Many participants voiced uncertainty about emergency management practices in their community. This lack of knowledge suggests that comprehensive, community-based education about emergency management processes and municipal risks should be adopted. An integrated approach to involve the public in this process of developing emergency management practices in planning, response and recovery is required.

These preliminary scores provide a good baseline assessment that can be a benchmark for future scores and foster a cycle of continuous improvement. The communities are extremely well positioned to build upon their scores, given the proactive nature of the councils involved (as evidenced by their support for the current project) and the high level of on-the-ground support from community members.

Evaluation results

Of the 52 participants who completed the forum evaluation, 37 (71 per cent) filled in paper forms and 15 (29 per cent) completed the evaluation online. Overall, the results indicate that the forum was well received, with 98 per cent of participants agreeing they had an improved understanding of emergency preparedness as a result of attending the forum. Similarly, 94 per cent reported they felt better able to work in their community to encourage others to accept a sense of shared responsibility in emergency management. The same number indicated they felt better able to help their community understand emergency risks. A total of 90 per cent of participants said they would discuss what they had learned at the forum with others in their

Table 1. Community resilience scores from the forum.

	Group (number of participants)						
Resilience component	**Wyn-1 (10)**	**Wyn-2 (11)**	**Wyn-3 (13)**	**Wyn-4 (6)**	**Mel-1 (12)**	**Mel-2 (9)**	**Mel-3 (12)**
Connectedness	6	6	8	10	11	10	8
Risk/Vulnerability	9	9	10	17	15	14	8
Procedures	4	4	5	6	4	4	5
Resources	8	7	9	11	12	12	9
Total Score	27	26	32	44	42	40	30
Score range	22-33	22-33	22-33	34-98	34-98	34-98	22-33

community. The same proportion agreed they would help their community to implement emergency-ready initiatives in the future. A high proportion of respondents (89 per cent) agreed they had developed a better understanding of the level of risk and vulnerability in their community. Approximately 85 per cent indicated they had developed a better understanding of the procedures that support disaster planning, response and recovery, with the same proportion agreeing they had developed a better understanding of the degree of connectedness in their community. Finally, more than 84 per cent of participants felt they had improved their understanding of the emergency planning, response and recovery resources available in their community.

Lessons learned

The Emergency Ready Communities Forum was an excellent platform from which to engage community members in conversations about resilience. Incorporating the Scorecard exercise into the forum showed that people had a sound understanding of community resilience, having listened to presenters speak about its application in various contexts. People also understood its relevance and importance, after being able to personally relate to and connect with the speakers. A number of valuable lessons from the forum were documented and will be useful to future groups seeking to implement the Scorecard process.

Firstly, it is important to have a diverse cross-section representation of community members to encourage discussion and improve the accuracy of responses. Some groups noted that there were often very different perceptions about Scorecard items. Having representation from diverse groups yielded many benefits, including robust discussion, highlighting knowledge gaps and perceptions between groups, and minimising biased responses. After each discussion, where there remained a difference in the score, the lowest number to score was used as prescribed by the Scorecard instructions.

Secondly, the role of the facilitator is critical. Although there is no one-size-fits-all approach, a few aspects of successful facilitation stood out as important. These were confidence, previous experience, effective listening and communication skills, preparation style, and a good understanding of the Scorecard. Although there was a training and discussion session on the Scorecard beforehand, this aspect could have been strengthened with a second training session to better prepare facilitators.

Finally, if completing the Scorecard in a single workshop, preparation to ensure that participants are equipped with the relevant information is important. Providing participants with the information required to answer the Scorecard questions ensures they give informed responses and that they leave the workshop with an improved understanding of their community's resilience.

Conclusion

The workshop allowed community members to explore and interact with the concept of resilience, build their knowledge and understanding, and identify areas for improvement. It was important to have a diverse representation from the community to encourage discussion and improve the accuracy of responses.

From the evaluation, it was evident that participants found the exercise worthwhile and useful. The observations of the process will feed into planning for future workshops and resilience-building-based initiatives. With a baseline assessment now complete, future scores can be benchmarked against this starting point and promote ongoing development. Melton and Wyndham city councils will conduct a similar Scorecard workshop with their Municipal Emergency Management Planning Committees to assess the perceptions of community resilience for each of the same geographical

locations. Community members will attend as observers. The results provide a comparison of the perceptions of resilience held within the communities with those of emergency management professionals.

Attendees at the forum were asked if they would like to take on a resilience activity, task or initiative for themself, their family, group or community. Within eight weeks following the forum, 54 (60 per cent) of participants had commenced a resilience initiative. This includes a community group researching how to conduct a township emergency management plan and two groups forming a working group to conduct a community emergency risk assessment.

With 90 per cent of participants saying they would implement emergency-ready initiatives in the future, the councils will continue work in this area and introduce new and emerging community leaders to the process to enhance the community's resilience and improve their disaster resilience score. Both councils plan to adopt community-based education processes in emergency management and municipal risks to ensure public involvement in the process of developing emergency management, response and recovery plans and practices.

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Towards effective mitigation strategies for severe wind events

Dr Daniel J. Smith, Dr Connar McShane, Dr Anne Swinbourne and Dr David J. Henderson, James Cook University, examine the losses from severe wind events by reviewing literature and existing mitigation programs.

Introduction

Australia's annual insured losses due to natural disasters exceed $480 million on average (Insurance Council of Australia 2014), highlighting the need for stronger homes and infrastructure. In Queensland, there were eight natural disasters between November 2014 and May 2015 resulting in government funding assistance activations (Queensland Government 2015). Increasing population densities in Queensland coastal regions also increase exposure of built environments, particularly to severe wind events (Middelmann 2007). For example, *Cyclone Yasi* in 2011 required $800 million to rebuild assets and provide community support (Queensland Government 2011), despite making landfall outside of major northern Queensland cities.

A preliminary analysis of claims data (Figure 1 and Figure 2) from *Cyclone Yasi* (Smith & Henderson 2015a) shows that both legacy and contemporary housing have vulnerabilities that modulate the extent of loss during a cyclone. Building science research consistently shows that losses induced by severe wind events can be minimised if appropriate mitigation activities are employed

ABSTRACT

The need to mitigate the losses from severe wind events in Australia has been highlighted repeatedly over the last decade, paralleling that of the hurricane-prone south east United States of America. The Northern Australia Insurance Premiums Taskforce final report[1] released in 2015, along with numerous other studies and reports, emphasised that mitigation is the only rational solution to reducing loss and improving the current insurance affordability situation. Engineering solutions exist to prevent failures, however post-event observations highlight their lack of implementation. It follows that the current level of community engagement in mitigation activities in cyclone-prone regions of Australia must be improved if losses are to be reduced. This paper discusses issues of engagement and reviews literature and existing mitigation programs as background for a smartphone mitigation tool being developed in Queensland, Australia, and Florida, USA.

1 Northern Australia Insurance Premiums Taskforce final report. At: www.treasury.gov.au/ConsultationsandReviews/Reviews/2015/NAIP-Taskforce/Final-Report.

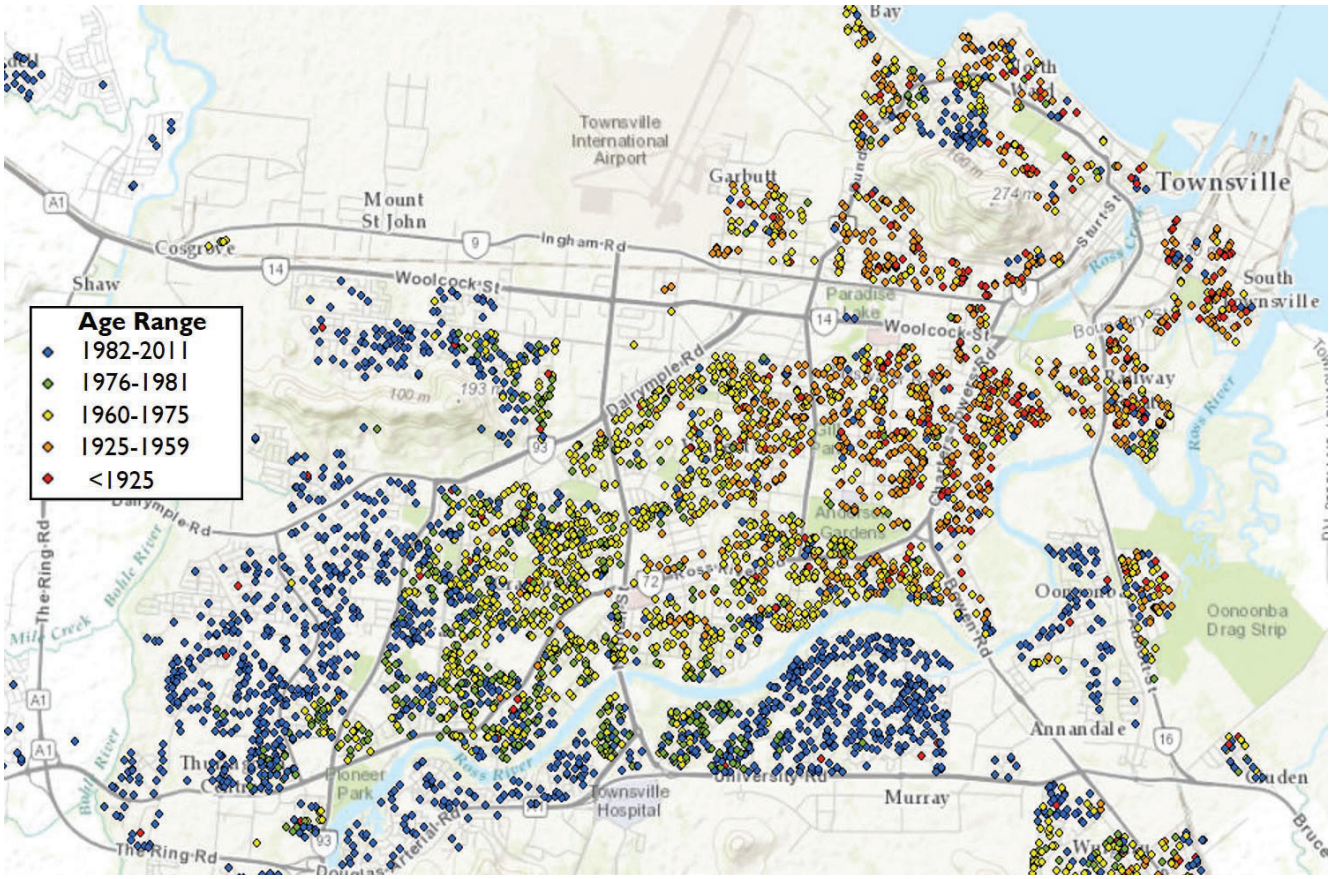

Figure 1: Distribution of construction ages for housing in Townsville, Australia for policies from one insurer (Smith & Henderson 2015a).

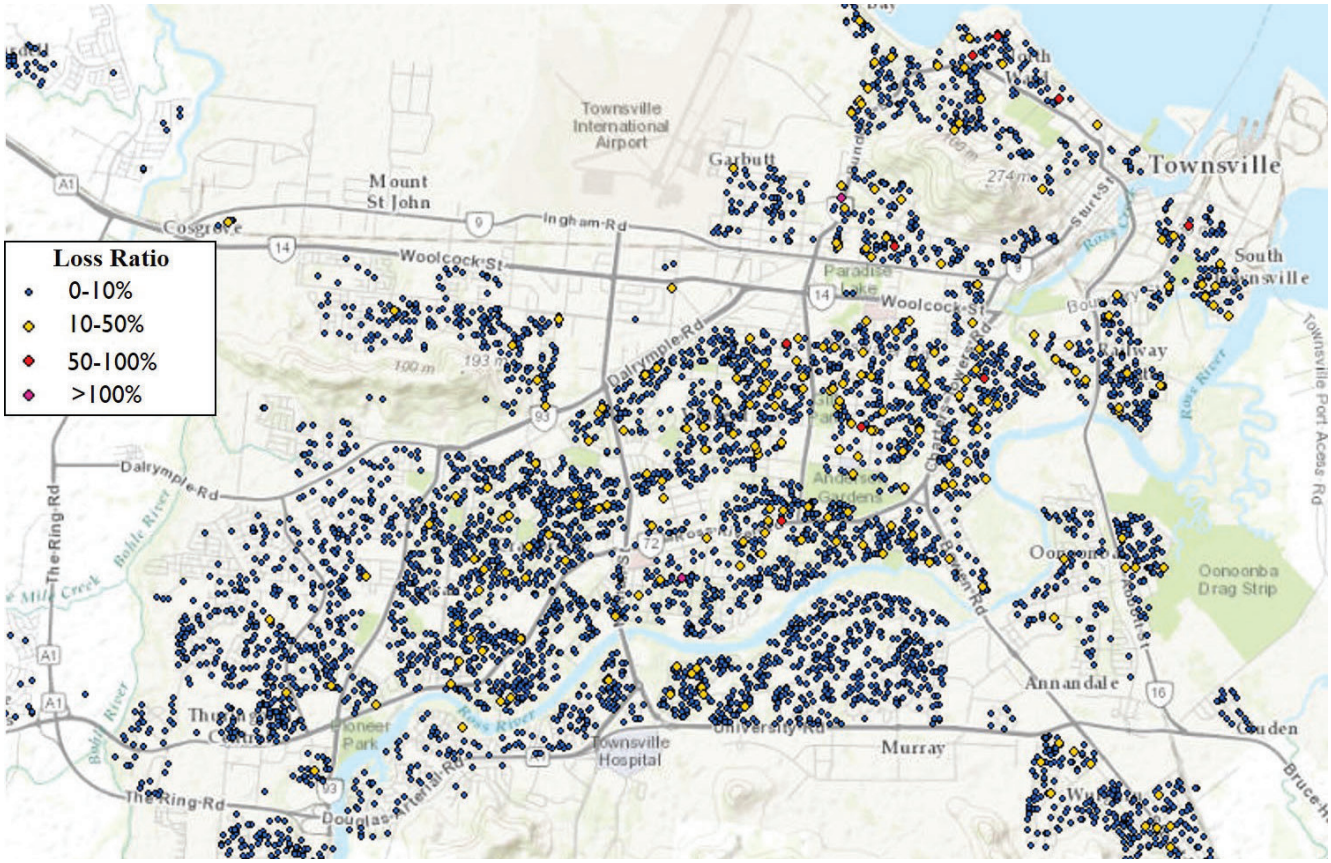

Figure 2: Distribution of loss ratio (i.e. claim value divided by sum insured value) for policies in Townsville, Australia from one insurer for *Cyclone Yasi* in 2011 (Smith & Henderson 2015a).

(Grayson & Pang 2014, Pinelli *et al.* 2009, Smith & Henderson 2015b, Smith, Henderson & Ginger 2015).

From an engineering perspective, appropriate methods of cyclone loss mitigation have been discussed extensively in the literature. These vary by construction type, age, location, etc. but generally include:

- increasing the wind uplift resistance of the house structure (Lavelle & Vickery 2013, Leatherman, Chowdhury & Robertson 2007)
- sealing the building envelope from water ingress (Lopez, Masters & Bolton 2011)
- securing items outside the house that are susceptible to wind uplift (e.g. outdoor furniture, yard equipment, etc.).

However, post-event damage assessments conducted over the last 15 years by the Cyclone Testing Station (www.cyclonetestingstation.com) show that engineering solutions to wind vulnerability, particularly for older homes, are not being widely implemented (Boughton & Falck 2007, Boughton *et al.* 2011, Henderson *et al.* 2006). This is due in large part to the absence of community engagement activities with respect to engineering solutions for risk mitigation. For example, the 'Get Ready Queensland' program is an important community outreach program that emphasises general disaster preparedness education (i.e. trimming trees, emergency kits, and evacuation plans) but does not identify engineering deficiencies and facilitate associated solutions, which typically drive severe losses during cyclones.

Engineering solutions to help buildings, particularly older buildings, cope during high winds are not widely implemented. *Image: Cyclone Testing Station, James Cook University.*

To provide experiential insight, examples of mitigation incentives implemented in the south-east USA since 2005 have been reviewed and are discussed. Despite measureable success in some of these approaches, wind vulnerability is still a major issue for the region. It is contested that higher levels of effectiveness can be achieved by developing engineering and community engagement solutions in parallel. Focusing here on the latter, typical drivers of mitigation behaviour (by homeowners) from the literature are presented. Finally, a smartphone application is discussed as a potential mitigation tool to stimulate mitigation actions in Australia and the USA.

Existing approaches

Existing mitigation approaches include the responses to average insured tropical cyclone losses from 2003 to 2012 ranging US$3-30 billion annually (Property Claim Services 2014). Florida is at the forefront, largely due to experience. Category 1-3 hurricane landfalls in Florida are biennial and Category 4-5 landfalls are quadrennial on average (Malmstadt, Scheitlin & Elsner 2009). Government and private funding schemes, premium reductions, and vulnerability rating systems are included.

Property Assessed Clean Energy (PACE) funding program

The PACE funding program in the USA is delivered by private companies and offers long-term loans to strengthen and retrofit homes (Florida PACE Funding Agency 2015). The program was originally developed in California for earthquake mitigation and now operates in conjunction with local governments in Florida to provide loans for eligible residents to undertake risk-reducing home improvements (e.g. window protection for debris impact). Works are done through state-approved contractors. The loans are available for commercial and residential buildings as long as they are covered by existing insurance. The government also provides financial security for mortgage lenders to reduce financial risks associated with defaults on mortgages. The length of the loan, which has repayment priority over a mortgage, is approximately 15-20 years and is attached to the building as opposed to the owner. These conditions have generated a degree of concern about the financial risk involved for an individual undertaking the loan (Federal Housing Finance Agency 2010).

Past evaluations in other states in the USA have reported success in acceptance of the program by residents as well as considerable economic benefits for the immediate community and broader population (Saha 2012). For example, in Boulder County, Colorado, a PACE program funded US$9.8 million in residential retrofit projects in the first phase of delivery (Goldberg, Clinburn & Coughlin 2011). The program also contributed an estimated US$14 million in economic activity for the county. Therefore, despite potential financial concerns, programs like PACE can be beneficial for regional

Cyclone Marcia caused significant damage to property in Yeppoon, Queensland due to its severe winds and the way properties were constructed. *Image: Cyclone Testing Station, James Cook University.*

communities by reducing structural vulnerability and enhancing the economic well-being of the region.

'My Safe Florida Home' program

The 'My Safe Florida Home' program is administered in Florida by the Department of Financial Services and was operated from 2007 to 2009 (the 2008 economic crisis pre-empted additional funding). This US$250 million program offered homeowners free assessment of their home for structural vulnerabilities and allowed them to apply for a US$5000 grant to retrofit their homes. Assessment findings were provided to the homeowner in a report that outlined appropriate structural improvements, the cost, and the associated insurance discount if improvements were completed. The program targeted lower-socio-economic owners of older single-family homes in high-wind risk regions. This provided an equitable approach to strengthening homes for those who would otherwise have been unable to afford it. The program delivered 401,372 home inspections and included over US$80 million in mitigation grant reimbursements (Chapman-Henderson & Rierson 2015). An estimated 55 per cent of inspected homes were eligible for an average US$217 premium discount, with potential state-wide insurance savings of US$24.5 million (Sink 2008), assuming retrofits were carried out.

A 2009 evaluation by Risk Management Solutions estimated that 'My Safe Florida Home' 'reduced the 100-year probable maximum loss (PML) by at least US$1.50 per dollar invested in grants' and that the reduction was equivalent to a reduction of approximately US$140 million in the 100-year PML of US$61.9 billion (Young 2009). A study by Chatterjee and Mozumder (2014) also found that residents who had home insurance, prior experience with damages, and a heightened sense of vulnerability were more likely to seek home inspection as part of the program. Other hurricane-prone USA states including Alabama, Louisiana, Mississippi, and South Carolina adopted and implemented similar initiatives.

FORTIFIED Program

The FORTIFIED program, developed by the Insurance Institute for Business and Home Safety (IBHS) in the USA, provides gold, silver and bronze resilience standards for homes with corresponding guidelines for both homeowners and insurance companies (IBHS 2013). The standards provide detailed construction requirements for each rating level, including guidelines for retrofitting. Laws and regulations are adopted at the state-level for providing insurance and other financial incentives based on the level of standard adopted. For example, in 2013 the Georgia Underwriting Association adopted a mitigation strategy that recognises the program by providing credits for the wind-risk component of insurance under the homeowners and dwelling programs. The credits include 5 per cent for Bronze, 7.5 per cent for Silver, and 10 per cent for Gold. A similar policy in Mississippi offers 17 per cent for Bronze, 25 per cent for Silver, and 30 per cent for Gold (IBHS 2013). The FORTIFIED program standards have been adopted in Alabama, Georgia, Mississippi and North Carolina.

These programs focus on perceived financial benefit (Poussin, Botzen & Aerts 2014); an obvious driver of preparedness action. Although financial incentives are an important motivator (Boon 2013), they do not ensure mitigation action. A public opinion survey during the 'My

Severe roofing failure due to weak roof framing connections in properties happened during *Cyclone Marcia* in 2015 in Yeppoon, Queensland. *Image: Cyclone Testing Station, James Cook University.*

Safe Florida Home' program found that only 40 per cent of respondents indicated that reduced insurance premiums were a key motivator in undertaking improvements to their home (Sink 2008). Financial incentives of this nature are more likely to be effective if used in concert with other behavioural drivers.

Behavioural drivers

Missing from the existing approaches is a holistic perspective on what drives individuals to take mitigation actions. Each of the programs reviewed hinge on financial incentive and fail to encompass other motivators. Identifying other incentives can be difficult as they can be situationally and contextually specific to the individual. Factors affecting the success of mitigation activities therefore differ by region, event type, and citizen-behaviour patterns. Four key factors were identified in the literature that show factors beyond financial incentive.

Prior event experience

The prior experience an individual has with weather events can have both positive and negative effects on their likelihood of engaging in preparedness action. Research demonstrates that those who have a negative prior experience with disaster or extreme weather events are more likely to prepare for future events (Boon *et al.* 2012, Paton, Smith & Violanti 2000). However, those experiencing minimal damage or loss during prior events may have biased perceptions of risk resulting in an underestimation of event consequences or overestimation of the effectiveness of preparatory actions. The findings of a 2013 Queensland homeowner survey supports this concept (Inspector-General Emergency Management 2014). A perception study exposed participants to varying wind fields and asked them to estimate the speed and corresponding risk they felt (i.e. higher perceived wind speed, greater perceived risk). Agdas and colleagues (2012) found that individuals with prior experience of cyclones were more accurate in their estimations and, therefore, more accurately understood the risk.

Mitigation capacity

Mitigation capacity refers to an individual's:

- knowledge of risks associated with the hazard
- knowledge of actions to reduce risk
- ability to execute those actions.

For example, Mishra and Suar (2012) show that individuals who have greater preparedness education and access to resources (e.g. income, education, social resources) are more likely to adequately prepare. Thus, it is important to identify barriers and enablers of education and resources for mitigation within the target community or region.

Social connectedness

Social connectedness includes the shared experience, reciprocity and trust individuals have toward one another within a community (Cocklin & Alston 2002, Malecki 2011). For example, homeowner cost-benefit evaluation of an action can be influenced by who is recommending the action (Pennings & Grossman 2008, Ramirez, Antrobus & Williamson 2013). In a survey of Florida homeowners, 40 per cent of respondents reported being more likely to undertake improvements to their home if others in the community were also strengthening their homes (Sink 2008). This is consistent with findings from Ramirez and colleagues (2013), that suggests people are more likely to respond in a manner similar to those with whom they have connections and trust (i.e. neighbours and friends) than unfamiliar entities (e.g. hypothetical exemplars in promotional materials). Therefore, understanding and leveraging the nature of relationships individuals have within communities can increase the effectiveness of strategy implementation.

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Freedom of choice

Freedom of choice is a critical and often understated component of a homeowner's decision-making process for undertaking mitigation actions. The ability to choose how, when, and why to participate, offers a sense of ownership in the action plan. This helps to promote positive feelings (e.g. sense of accomplishment) about

the experience, which increases the likelihood of taking additional actions and communicating the experience to peers. Control over choice is consistently associated with increased probability of performing an action (Brody, Glover & Vedlitz 2011, Sattler, Kaiser& Hittner 2000). This is further supported by Sink (2008), which indicates that survey respondents valued something they could choose to do rather than actions forced upon them.

Resilient Residence

ResilientResidence, or 'ResRe', is a prototype smartphone tool that is being developed in parallel in Florida and Queensland through a partnership between engineering and behavioural science researchers at the University of Florida (Prevatt & Florig 2015) and James Cook University (Smith *et al.* 2015). The application provides a specific wind-risk assessment of the user's home, including an estimate of anticipated losses that would occur in a scenario event (e.g. Category 2 cyclone). In addition, based on data supplied by the user, the tool suggests appropriate retrofit solutions. Without a complete mental picture of the key behavioural drivers, it is difficult to determine the right parcel of incentives. Therefore, development focus of ResRe is on understanding the mental models (e.g. decision trees) that homeowners have when it comes to mitigation actions for hazards.

Screen captures of current wire-frame U.S. version of ResilientResidence™ including building attribute selection (left) and attribute help screens (right).

Discussion

In developing new ways for Australians to identify and assess risk and take meaningful mitigation actions, the experience of previous efforts from the USA should be leveraged. Vulnerability rating systems (e.g. FORTIFIED) can be a valuable tool to facilitate the interaction between engineering-based risk assessment and risk-reflective pricing in the insurance industry, providing financial incentive for retrofitting. The required framework for the system is already in place. Some insurers in Queensland now offer premium reductions for household upgrades in cyclone-prone regions. Reductions should be used in tandem with loan assistance (e.g. PACE) or government-supported grant programs (e.g. 'My Safe Florida Home') to help realise the more costly upgrades that otherwise would not be financially viable. Such programs can stimulate growth in construction and manufacturing industries as new, more cost effective retrofit products are developed. In the longer term, risk-reflective pricing in real estate markets can also be used to support mitigation.

Ultimately, the onus to protect a home falls on those living in it. There are a range of mitigation support efforts that can and should be used to support that decision-making process. However, those efforts must incorporate a holistic understanding of an individual's decision process to turn increased understanding and knowledge about risk exposure into mitigation actions to increase household, and thus, community resilience.

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ABSTRACT

In the context of a natural disaster, gender stereotypes play an active role in determining the health and safety of everyone involved. Focusing on men, this paper demonstrates the harmful effects that social expectations of masculinity can have on coping mechanisms and decision-making. Expectations based on gender have broad implications for families and communities and for the ways in which emergency management personnel and procedures operate during crisis response. Research findings convey observations and feelings of 32 men about their experiences of the Black Saturday bushfires in 2009. The findings conclude that constructed ideals of masculinity, and the resulting pressures and expectations, contribute significantly to community suffering, and that acknowledgement of this by the emergency management sector is necessary for improvements in response and recovery.

Men and disaster: Men's experiences of the Black Saturday bushfires and the aftermath

Claire Zara, Debra Parkinson, Alyssa Duncan and Kiri Joyce, Gender and Disaster Pod[1], detail recent research into aspects of stereotypes for men surviving disasters.

Background

The context for this research on men and disaster is the Black Saturday bushfires on 7 February 2009 in which 173 people died, 414 were injured, and 7,000 lost their homes. Motivated by the need to increase the safety of women and children after disasters and reduce harmful behaviours, Women's Health Goulburn North East (WHGNE) and Monash Injury Research Institute established this research project and an advisory group with specialist academic, professional and community expertise. This collaboration followed research by WHGNE with 47 workers and 29 women that found increased violence against women after Black Saturday. At conferences and related speaking events throughout Victoria, researchers were constantly asked, 'But what about the men?'. The partnership with Monash Injury Research Institute was then funded by the National Disaster Resilience Grants Scheme to begin to answer this question. The men's research findings convey 32 men's observations and feelings about their experiences of Black Saturday. Speaking openly and generously, they suggested ways to improve the health and wellbeing of all by managing disasters and their aftermath.

Writing of the new gender and disaster subfield generally, American sociologist Elaine Enarson writes:

> *Sex and gender shape men's lives before, during and after disasters. While gender relations typically empower men as decision makers with more control than women over key resources, gender identities and gender norms can also increase their vulnerability.* (Enarson 2009, para 1)

Although men's health and wellbeing are known to be jeopardised by unhealthy coping strategies post-disaster, the nature and extent of these effects are poorly understood. Current disaster risk management practices do not incorporate a specific focus on men in resilience work, and there is little research on the effect of social construction of masculinity on preparation and response (Tyler & Fairbrother 2012). What has been suggested is that 'from Peru to Alaska, men cope through alcohol abuse and aggression' (Enarson & Phillips 2008, p. 51). Indeed, the legacy of disasters for men may be a feeling of inadequacy at having failed to meet the expectations of manhood (Austin 2008). Despite the significance of these findings and their implications for individual and family safety, and community recovery, there is a dearth of information in this area globally and, in particular, in Australia.

1 The Gender and Disaster POD is a Women's Health Goulburn North East, Women's Health in the North, and Monash University disaster resilience initiative.

Literature review

A detailed literature review preceded this research (Zara, Weiss & Parkinson 2012). The literature review found that Australian men face different health risks to women, with a shorter life expectancy, greater risk-taking behaviour, higher rates of mortality (avoidable and premature), and higher levels of suicide (Victorian Government 2015). The apparent reluctance by men to engage with health services and belief in traditional male values are identified as contributing factors (Victorian Government 2015).

Masculinity studies generally find no single dominant performance of manhood, instead identifying culturally and historically specific forms of idealised masculinity against which men are measured. This study is informed by social constructionist approaches to masculinity, such as those theorised by Raewyn Connell (2005). The work of Bob Pease (2010) and others is drawn on to understand the 'hierarchy of privilege' that empowers middle class, heterosexual, able-bodied white men; men who are able and willing to live up to the prevailing norms of heterosexuality, authority, rationality, emotional control, risk-taking, dominance, aggression, and violence (Austin 2008, Kahn 2011, Pease 2010). Masculinities theorists identify that patriarchy ultimately damages men who aspire to and closely conform to notions of the ideal man (Kahn 2011). Research shows that men have poorer health than women, weaker social support and higher rates of alcohol abuse (Connell 2005, Kahn 2011, Kimmel 2002). Men, as well as women, pay a price for male privilege (Dowd 2010) and constant efforts to live up to Western ideals of manhood can lead to stress, illness and early death (Greig, Kimmel & Lang 2000, Jalmert 2003, Medrado & Lyra 2003).

Australian rural masculinity appears to be a particularly damaging model for men, espousing as it does, the strong, silent and self-possessed man as the ideal (Eriksen, Gill & Head 2010). Tyler and Fairbrother (2012, 2013) note a number of characteristics that are pertinent in this country, being frontier mentality and the idea of man-against-nature, the importance of physical strength, and the valorisation of risk-taking. Another is the concept of mateship, with loyalty and practical support prioritised over emotional support (Butera 2008). This is not to say that notions of mateship, or indeed masculinity, are inherently bad things. The problem is specifically the way that dominant ideas of masculinity engender emotional withdrawal and isolation, as opposed to promoting communication, emotional support and mental wellbeing.

The limited scholarship on gender and disaster events, mostly since Enarson and Morrow's *The Gendered Terrain of Disaster* (1998), finds that disaster research and emergency management have traditionally been 'through the eyes of men' (p. 4) and that this male dominance has seen a focus on practicalities and has influenced the language of disasters as well as who we see as heroes. Firefighting, for example, is associated with heroism, heterosexuality and male hegemony, offering status (Ainsworth, Batty & Burchielli 2014, Tyler & Fairbrother 2013). A number of researchers in Australia write of the dominance of masculinity in narratives of disaster, particularly bushfires (Cox 1998, Eriksen, Gill & Head 2010, Tyler & Fairbrother 2013). In a survey of Australian attitudes to bushfire, the myth of the (male) firefighter volunteer remains strong, and is reinforced by women's exclusion (Eriksen & Gill 2010, Eriksen, Gill & Head 2010). Men's prominence in emergency management gives decision-making powers and control over resources, but, as Enarson notes (2009) gender stereotyped expectations also bring men's reduced perception of danger, valorisation of risk-taking, and the reality of front-line work.

> *Individuals … who do not conform to these stereotypes, may experience varying degrees of rejection and marginalisation, including verbal and physical harassment, victimization, isolation, and potentially traumatic wounding of their sense of self.* (Ballou, Hill & West 2008, cited in Kahn 2011, p. 66)

Such expectations of men test and sometimes expose men for perceived failure to live up to ideal male standards (Austin 2008). A UK study after floods found some men felt unable to protect families (Enarson & Fordham 2001). A rare study in Australia after the Ash Wednesday bushfires (Valent 1984) noted the shame and guilt experienced by men unable to fulfil expected male roles. In times of disaster, men with marginalised sexual identities can also be isolated, and power relationships between men generally can be heightened and increase vulnerability (Enarson 2009). 'Hyper-masculinity' may result during and after disasters as men try to claim their 'manhood' (Austin 2008). The period after disaster has its own tensions, and psychological problems that persist are related to events in the aftermath in addition to events during disaster itself (Borrell & Boulet 2009). Both internationally and in Australia, violence against women increases in the aftermath of disasters (Parkinson 2011, Parkinson 2015, Sety 2012, George & Harris 2014, Enarson 1999, Meyering *et al.* 2014, True 2013).

The extant international and Australian literature provided a rich foundation for research in this area after Black Saturday.

Methodology

The research methodology was qualitative, inviting the men interviewed to speak frankly in individual interviews about their experiences and feelings. Ethics approval was received from both Monash University Human Research Ethics Committee and North East Health. The two primary researchers jointly conducted the in-depth, semi-structured interviews. Interviews were digitally recorded with permission and transcribed verbatim. Four open-ended guiding research questions were pursued,

each asked in ways that allowed participants to lead the interview in new directions:

1. What were the effects on men's physical and mental health and wellbeing, if any, during and in the aftermath of the Black Saturday bushfires?
2. What were/are the implications of these effects for the safety and wellbeing of fire-affected men, and for those around them, including their intimate partners and families and work colleagues?
3. What personal, interpersonal, or institutional resources, if any, were available to them in the aftermath with respect to psychosocial effects?
4. What would have helped minimise or eliminate risk of harmful behaviours?

Sample recruitment and characteristics

Theoretical sampling was used to identify potential participants. This approach does not seek a statistically representative sample but a group that is selected in order to flesh out particular concepts or theoretical points, in this case the missing gender perspective of men caught up in bushfire.

This qualitative study involved 32 adult men affected by the fires and their aftermath in Kinglake, Flowerdale, Marysville, Seymour, Alexandra and Yea and surrounding areas within the shires of Mitchell and Murrindindi in Victoria. Participants were recruited through community, health, and emergency services networks and public outreach, resulting in a self-selected sample of men aged 36-69, with a median of 14 years in residence, and most living in stable relationships. Many (12) were firefighters or Country Fire Authority (CFA) or State Emergency Service (SES) volunteers at the time of the fires, and other men had taken these volunteer roles in past years.

Data collection and analysis

Individual interviews were conducted to collect data. Standard ethical research protocols were applied, providing participants the opportunity to amend their interview following verbatim transcription. Grounded theory following Spradley (1980) guided analysis. Grounded theory offers rules for data collection and analysis that minimise ethnocentrism in the attribution of meaning, combining theoretical sampling (described earlier) and the thematic analysis approach developed by Glaser and Strauss (1967). Thematic analysis is the identification of themes through a careful reading and rereading of the data. The methodology is inductive, building up concepts and theories from the data. Although Glaser and Strauss (1967) point to experience, deduction and induction all playing a role in grounded theory, its great strength is the technique it offers for inductive reasoning. The unit of analysis was the sentence, and coding was assisted by the software package Nvivo V.10. Coding validity was enhanced by the second researcher's careful reading following coding by the first researcher, and by participant checks of their own transcript as well as the draft report.

Ethics procedures

When men phoned the researchers to express interest in the research, an Explanatory Statement was used to explain the project and its risks and benefits. Upon commencement of the interview a hard copy was provided and participants were asked if they had read it carefully and if they had any questions before signing a Consent Form. Confidentiality concerns arise in the rural, post-disaster context and the limits of anonymity were identified in the ethics document. Anonymity was enhanced by the use of pseudonyms in reports and by altering minor details that might have otherwise exposed context and identity. Participants were advised during the consent procedure that they had the right to stop the interview at any time, and to refuse to answer any questions.

To further reduce risk, each man was advised of his right to request post-research debriefing through the Men's Counselling Service or the Bushfire Grief and Bereavement Team. While some men indicated they had current access to a counsellor, it was not part of the researcher role to follow up with the men as to whether they accessed any of the counselling options as a result of their interview. However, participants often benefit from participation in research with the potential to speak freely without advice or judgement. In these interviews it seemed a cathartic experience for men to speak about their experiences and feelings. One man requested a follow-up interview soon after his first, and subsequently all 32 men indicated they would be interested in another interview at a future time. Running counter to the common assertion that 'men don't talk' about such things (MensLine Australia), the interviews were approximately two hours in length. The men's own comments – that 'The right questions need to be asked' or that 'No-one had asked them' – may explain the misconception. Without exception, they articulated their appreciation of this opportunity to help others.

Results

Men's experiences on Black Saturday

There were many seasoned volunteer firefighters among those interviewed. One man had spent 32 summers on fire duty. These men, and others in the sample, were acutely aware of the dangerous weather conditions on 7 February 2009. Official warnings could not have been clearer. Yet the bushfires on Black Saturday were unlike other fires. 'Surreal' is the word that seems to capture the enormity and seeming unreality of the day. Men used this word to describe the atmospheric conditions that preceded the fire storm, and the hours and days that followed as its tragic impacts became apparent.

> *We were stuck in this noxious environment. The smoke was really bad and then as it got dark, I still remember the moon coming up and it was like something out of Lord of the Rings, like Mordor. Every ridge that you could see from anywhere to the*

> *north of Yarra Glen was on fire. It's a huge Melbourne wedding capital of the world so there's people in ball gowns – quite surreal. And chaos. No-one knew what was going on.* (James)

> *We drove into town and cars were all lined up. Then we just sat there while the town burned. We heard the bangs and booms. The [petrol] station was shooting jets of fuel into the air. It was just a real apocalypse experience. People – dirty, burned, smoke covered people – carrying babies and children, just walking or driving in, I reckon 1000 to 1200 people. The whole area between the shops and the CFA was absolutely packed with people. It was really surreal, emotional. For me it just all seems like it was out of an apocalyptic movie … just charred landscape full of dead bodies and burned out cars, fallen down buildings.* (Edward)

Edward described 'a series of increasingly hot 46, 45, 46, 47, 48 degree days' in the lead up to Black Saturday. Some participants spoke of monitoring every possible communication about the progress of the fire and tracking it from their own observations. Many travelled to vantage points and used their CFA training, or previous bushfire experience, or expertise from other fields to 'size up' the fire to assess its progress, future path and speed. Other men were not firefighters, but had decided to stay and defend either their homes or those of close friends or family. For some, it was a well-planned decision, backed up by rigorous preparation with equipment suitable for most bushfires. Yet the best preparation was rarely enough:

> *I thought we had protection and I was just kidding myself.* (Patrick)

Adam described his relatives' extensive preparations prior to the fire. Tragically, they died in their home. The firestorm tested the logic of decades of fire knowledge and experience.

> *They were trained CFA firefighters. They had everything in place … They had proper firefighting type clothes on. They had heavy boots on … Everything in the house was full of water … They had hoses and everything going. They were consumed by the worst thing we've ever seen.* (Adam)

There was a sharp distinction between before and after. Innocence pervaded the men's narratives of going in, feeling prepared, ready to do the job they had trained for. Too soon, their experiences of the firestorm destroyed any semblance of control.

> *With SES events we're always in control of the situation, but with what happened to me I wasn't in control. And that was probably the hardest thing I've had to deal with – that I had no control over what was happening to me.* (Aaron)

> *The driver poked his head out of the window and said, 'F..k this, we are going to die here'. [The local fire station had said], 'We're not coming up there to get you, it's not safe'. The … crew declared a mayday as the comms said 'No, no-one's coming up there to get you'. We just didn't think we were going to get out of there. The truck driver was crying.* (Lee)

Echoing this, men who had responsibility with the CFA or who had fought previous major fires reflected on their confidence going into Black Saturday as delusional:

> *I thought as long as we were careful and diligent we'd be fine.* (James)

> *I was reasonably confident that we would be ok. I was even confident that we'd be able to protect the house – and all of that was misplaced, of course … All around me I could see the fire moving towards our sheds – they caught fire. I had fire pumps and hoses everywhere but before we knew it, it was into the ceiling and so it was all over.* (Vincent)

Several men reported their wife's or partner's concern emerging before their own. As in other literature, it seemed that the adult with primary caring responsibilities was most keen to leave (Mulilis 1999).

Some of the participants were on CFA deployments and spoke of feeling frustrated by directives from authorities about roadblocks and command centres. Nobody had sound advice to give about local and surrounding conditions and predictions. Pre-Black Saturday procedures seemed unsuited to the extreme conditions. In life-and-death situations, following rules and suppressing individual judgements meant the men could not attempt to save others. The hope was that the rules were right. While the team environment and command-and-control regime offered a measure of security to some in this day of unknowns, others followed the directions of those in authority only to regret not following their own gut instincts. Todd said, 'You sort of try and do what the CFA tells you. That's the first and last time I'll ever do that'.

However, the risks to men's health that emerged from hyper-masculine and risk-taking behaviours held the potential for physical injury and death. On Black Saturday, men were sometimes overly casual in response to the impending threat and sometimes unnecessarily took themselves *into* dangerous situations. Despite the danger to men's health, these were tolerated and even rewarded behaviours, with labels of 'heroism' and awards of bravery medals. Media coverage of individuals who were 'heroes' were very much focused on notions of masculine heroism. For example, 'Australia's bare-chested national hero' was the headline above a newspaper picture of a man defying safety guidelines by standing on a hotel roof wearing only thongs and shorts hosing down the property (*The Telegraph* 12 February 2009). This celebration of male heroism overlooked the heroism of women in traditional female supportive roles, and was galling to those who had different perceptions of events.

> *If you're talking about men and fighting bushfires, never forget there's a fair bit of ego in it for them.* (Walter)

Pressures on men in the aftermath

After surviving the fire, the aftermath presented a further challenge. For some, the sights they saw kept them awake at night years later. Drug and alcohol use, reckless driving, and extreme sports temporarily relieved men's suffering in an acceptably masculine way. Over-work was common.

> *One [friend] in particular, he's done a magnificent job, rebuilt his home … and now … he just can't stop. His way of managing is to just keep working.* (Bob)

> *We were all driving around drunk, which we shouldn't have done but … I think the police … just thought, 'Let these guys do their thing'. Because how do you get it out of their system?* (Luke)

Homeless and displaced locals wishing to rebuild on their land faced costs that were inconceivable before the fires. In a free-market economy, builders exploited a situation where needs were high, supply was low, and funds were available from grants and insurance. Speculation builders bought cheap land in the immediate aftermath and built display homes. Locals, keen to get back to normal and with grant or insurance funds in the bank, paid what was asked. This real estate speculation caused an increase in house prices and meant some people were unable to move back. Competition to contract a builder was high too, so even before consideration of plans, prices were at a premium. Despite high prices, work standards were questionable. Participants expressed despair at the red tape and bureaucracy that delayed or prevented rebuilding even four years after the event.

> *They're still a bit rattled and they're not thinking clearly and there's so much competition to get a builder … the builders are picking and choosing because there's 300 houses to build or something in this little locality and they're all charging extra to come up the hill. They're loading it up for everything they can think of and it really did cause a little mini bubble.* (Scott)

> *We then went through this extraordinary period of (a) trying to find a builder, (b) trying to comply with the new regulations, which I didn't actually find difficult or offensive, until you actually started pricing things and getting builders to look at what that might cost them to do. Because they were unsure of what they were faced with they said, this might cost us more so they added a premium.* (James)

The initiative and drive of the locals in the early days were smothered by a recovery process described as overlooking local knowledge and expertise. The effect was one of disempowering local people and marginalising them from real decision-making processes. Their sense of being disenfranchised ran counter to the appearance of deep community consultation. Such issues have been documented elsewhere, but are touched on here as men described the *effect* of what they saw as lack of genuine consultation. The sense of being patronised and controlled engendered anger. Meetings were described as 'top-down'.

> *What we found in the aftermath of the fires was that people were assuming authority … it was 'power over' rather than 'power with'. We found the same with police, and emergency services staff, state government staff, local government staff, professionals … It's profoundly disempowering.* (Paul)

The disaster's aftermath saw a change in leadership in some communities as people who had this role before Black Saturday were unable to continue through personal grief and other demands. In the void, others (mostly men) took on leadership roles, for example, as heading community recovery committees. As people aligned with those of similar values, factions emerged, intensifying community anger and division, even to physical aggression and violence. Points of difference arose over the direction of community rebuilding, and local and state government decisions that directly impacted on people's daily lives as they tried to re-establish.

> *After the honeymoon period of cooperation and collaboration, about six months in, people shifted from turning to one-another to turning away from one-another and to turning on one-another.* (Paul)

> *It actually became very personal where people didn't speak to each other. Very nasty where people threatened other people, made obscene gestures at people, derogatory … remarks at people in the street because they didn't agree.* (James)

Layer upon layer of inequity and dishonesty fuelled the discord. The unfairness and seeming capriciousness of grants and insurance drove much community anger. It seemed to come down to good fortune in having an effective case manager, having an insurance company that did not 'rip you off', and being considered deserving of a grant. Apparent 'obsession' with funding domestic housing over business was of concern to several men interviewed.

> *Insured, uninsured, it didn't matter, just money turned up in their accounts … [There was] a real disparity here of needs being met … If I was sitting in Spring Street I'd be saying, 'Well people donated … this money to help people. Okay, this guy's lost his joinery shop, he's the only one on the hill, he's fairly useful when they're doing rebuild'. There was a mechanic … who had his shop burned down, his workshop. There was a sawmill, all these things were just left to dissipate into the ether. They're just gone now.* (Scott)

The enormous task of 'the clean-up' was controversial from the outset with the tender given to Grocon. Once the tender was granted, local men (and women) were sidelined from participating in the official clean-up for a number of reasons. Perceptions of 'fire-brain' affecting those fire-affected (suggesting they were not thinking clearly) sat alongside Grocon's inflexible work and employment practices for the clean-up. These practices demanded employees work 10-hour days for five or

six days a week. Local people, with the complex and unrelenting pressures of rebuilding a life in communities devastated by trauma and tragedy, were practically and emotionally ill-equipped for such a workload away from their own properties and families. Although the literature points to men more than women benefiting from recovery employment, the men who did the bulk of the paid clean-up after Black Saturday were predominantly from outside the area. Few locals benefitted.

> *Oh no, you stand back out of the way, we'll bring the other people in from outside... Grocon, they need the money, better help them out.* (Scott)

> *People who needed the work after the disaster, both for financial reasons and for emotional psychological recovery reasons, weren't getting the work. And yet they were sitting here in their town watching all these trucks track in from all over the place every day with outside contractors coming in to do all the work ... And given that most of the blokes around here are tradies that was a huge issue for them.* (Brad)

In the immediate aftermath, when donations and media coverage were at their height, employers were generally supportive. Some men were fortunate to have supportive workplaces. Where workplaces were calm and colleagues were aware of what Black Saturday survivors had been through, early return to work was helpful. Yet, in two accounts, men spoke of their employer's extraordinary insensitivity. Both were asked to undertake work that revived their traumatic bushfire experiences. It was confronting for the men and beyond what should reasonably be asked of workers returning after a disaster experience. One man was expected to undertake work that would implicate him in appearing before the Royal Commission, thereby reliving his disaster experiences in a courtroom even though he had stated his reluctance. A second man spoke of working long hours for more than a month, helping police and forensic teams locate and identify bodies of local people killed in the fires. Yet, when he returned to work, he was directed to work on evidence-gathering from the Triple Zero tapes for the Royal Commission. He said:

> *It's one thing to listen to audio tapes. It's one thing to see dead bodies. It's different to actually put the conversation that you're having to the image ... That was the straw that broke the camel's back.* (Chris)

Mental and emotional impacts were clearly present. One man spoke of being haunted by flashbacks, and described anxiety to the core of his body. Others described unexpected and abnormal depressive states in the aftermath:

> *When it got bad for me [for a couple of months] I didn't actually want to get out of bed... My wife would come home ... with our son and it was like, 'Are you still in bed?' The neighbours would come and knock on the door and you'd pull the blankets up.* (Bernard)

Sadly, four participants spoke of their own suicidal feelings. Many spoke of the suicides of others that they believed resulted from disaster experience or the additional pressure that the fires and the aftermath exerted on complex lives.

> *There's been a lot of suicides and they don't publicise it, of course ... They got killed in the fires and they just didn't know it ... About four months ago, in about four weeks there were five people committing suicide.* (Todd)

> *His issues were pre-fire of course but his capacity post-fire to live with everything that had happened was clearly challenged and ... he should have been added to the list of people who died because of the fires.* (Vincent)

Domestic violence

Violence against women after disasters was documented in Australia after Black Saturday (Parkinson 2012, Parkinson & Zara 2013) and internationally (e.g. Austin 2008, Enarson 2012, Sety 2012). Some men, brought up not to cry and not to seek help, reacted to their own failures or their trauma with anger and aggression, or turned to drugs and alcohol, with results that sometimes exacerbated abusive or harmful behaviours and increased risk to women and children.

> *Our street was replete with domestic violence ... We had local coppers and they have their own strong social relationships and I think that they were sometimes inappropriately protecting perpetrators and inappropriately protecting people who were drinking or using drugs, et cetera. So I don't think that they really realised the vulnerability of children and partners at home.* (Paul)

Gender stereotypes

In contrast to the acceptance of men's aggression, traditionally 'feminine' behaviours like expressing emotion and seeking help were perceived as unacceptable. For volunteer firefighters and those employed in firefighting roles, the implications were that their future roles within the CFA or the DSE could be limited by perceptions that they had 'not coped'. The parameters of expected and acceptable behaviours were defined for individuals by their gender first. Men who were perceived as not coping were stigmatised, judged as not measuring up to the hegemonic masculinity that characterises emergency services. This was an absurd expectation on a day like Black Saturday and in its aftermath marked by chaos and grief. There is a perception, or perhaps an understanding, that accessing such individual counselling may affect future prospects within emergency service organisations.

> *People would be worried about the confidentiality, whether there was any feedback that came around the back saying, 'Keep this guy away from big fires'.* (Matthew)

When the Works Coordinator was away [I used to be on higher duties]. When I took that month off, which I took off as stress leave, ever since then there's been nothing. (Stuart)

Rather than provide effective support, employing bodies often failed to offer accessible and personal debriefing or ongoing and confidential access to counselling. Alternative work roles were rarely an option. An institutional paradigmatic shift could achieve better support for men, rather than fail to support this generation of firefighters and emergency management professionals.

I don't care how many psychologists and psychiatrists everybody sees … the only way this stops with anybody … is when you die. (Eric)

Stigma associated with seeking counselling and men's reluctance to talk about their trauma or their treatment emerged as a strong theme. This has been described in the literature as double jeopardy; the masculine ideal is impossible to meet but help cannot be sought because real men do not admit any 'weakness' such as PTSD or depression or anxiety (Addis & Mahalik 2003, cited in Kahn 2011). One CFA leader tried to cut through this by sharing that he needed assistance to deal with the trauma, but was met with some disdain.

I've talked about how I got depressed, and how I took medication and all that, just to try and show, that hey, this guy that they seem to respect is okay with it, so why shouldn't you? A few of them sort of scoffed … I guess is that there is a stigma attached to seeking counselling. (Chris)

Discussion

Taken together, the current findings indicate the psychological costs of a hegemonic masculinity ideal and the way this manifests in a crisis. A tough, staunch, and risk-inclined construction of masculinity can jeopardise the mental and physical health and safety of men themselves, and their families and communities. Even though the risks to men's health associated with hyper-masculine and risk-taking behaviours place them in physical danger, these behaviours are not only tolerated but celebrated. The way in which gender is constructed in rural Australia meant that men were expected to measure up to the firestorm in their behaviour and to not break down in its aftermath. The research indicates that impossible gendered expectations resulted in suicide ideation and depression for some men, and contributed to increased drug and alcohol abuse, and the increased risk of domestic violence against women and children. Negative perceptions of those who had 'not coped' affected their employability and their work relationships. Without the disaster of Black Saturday, the men interviewed would not have been propelled into the situations of powerlessness they described. None had ever experienced a fire like that before. Most had never been viewed as a victim in any aspect of their life before the fires, nor relied on others for the basics of life. Their loss of control during the fire lived on in continuing loss of control in its aftermath. The cost of male privilege is most apparent in these circumstances. Emergency management is highly male-dominated, and is a sector in which hyper-masculinity is celebrated and rewarded, as it is in the broader Australian society (Parkinson, Duncan & Hedger 2015, Hogg 2013).

Contribution and limitations of the research

This research contributes to understanding the gendered terrain of disaster (Enarson 2012, Enarson & Morrow 1998) and begins to address the gap in sociological research into men's experience of disaster. It finds that disaster impacts can be severe and long-lasting, yet men may be penalised for seeking psychological help. In the aftermath, employment issues, housing and rebuilding, and drug and alcohol abuse can inhibit recovery. Interpersonal and domestic violence often increase, along with community anger and aggression.

The research is limited in that no young men were interviewed, and there was little ethnic diversity as the sample reflects the ethnic composition of the shires of Mitchell and Murrindindi (only 5.7 per cent of the population in Mitchell, and 3.3 per cent in Murrindindi speak a language other than English in the home (ABS 2016). Time constraints meant that data analysis was necessarily limited to domains that were relevant to the funding. This report reflects a first attempt to document men's perceptions of events on and after Black Saturday. More time to reflect and engage further with the men could be of value.

Future research could begin in the following focus areas:

- Research effective ways to address gender norms that may restrict men from seeking help. Research effective psychosocial support strategies for application in disasters.
- Research effective gender and disaster awareness packages and incorporate them broadly in emergency response trainings across the sector, prioritising men's self-care and safety.
- Research, trial and implement a sustained social marketing campaign to proactively educate the public on disasters 'through men's eyes' and 'through women's eyes', modelled on effective mental health awareness campaigns.
- Research independently and retrospectively the fairness of recovery grants to ensure equitable support, especially among those men most vulnerable to the economic impacts of disasters. Use the findings of this audit to develop improved grant guidelines for both men and women.

Conclusion

Catastrophic disasters test the ability of men to live up to the impossible hegemonic male role expected of them; to be brave, heroic, decisive, unemotional and stoic. The increasing risk of more frequent catastrophic disasters resulting from climate change dictates that planning, response and recovery move beyond the stereotypes and myths of strong, silent men protecting and providing. Men, no matter how closely they fitted the image of the ideal, hegemonic male, were helpless in the path of the firestorm on Black Saturday. For men, a huge risk in the aftermath of the fires was the risk of not managing emotions. The narratives used in this research illustrate the ways they were punished for apparently being out of control, crying in public, or struggling with grief and loss in the workplace. The stigma they felt led to perceptions that they were being sidelined, no longer thought of as reliable, and not promoted. Some had internalised this as their own failure to live up to the prescribed hegemonic male role, not realising that few men ever do.

With more women playing equal roles in emergency management and more men taking up caring responsibilities, many of the gendered risks described in this paper and in other disaster research may be reduced. The lived experience of gender equality in disaster and in the home is yet to be known, but the gendered risks as explored in this and other research suggest such a move will benefit both men and women. Clearly, breaking down expectations of 'ideal' and 'manly' behaviour can only increase the health and wellbeing of men as well as those around them.

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Child-centred disaster risk reduction: can disaster resilience programs reduce risk and increase the resilience of children and households?

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ABSTRACT

There has been an increasing research and policy focus internationally on the role of child-centred disaster risk reduction and resilience (CC-DRR), including disaster risk reduction and resilience education programs for children and youth. This paper summarises developments and emphasises current progress and challenges. While research has increased in the past 15 years, there are significant research gaps, including those regarding the effectiveness of programs and their relatively patchy implementation. How to solve these problems has been the focus of a world-first national program of research funded by the Bushfire and Natural Hazards CRC. Building on international and national research to date, this paper focuses on the question of 'how can we create, evaluate, implement and scale up CC-DRR programs that work over time, including during disasters and into adulthood, to reduce risk and increase resilience for children, youth, schools, households and communities?' This includes a guiding model for research and use, and a set of research-informed tools either developed or being developed to facilitate further progress.

Introduction

There has been increasing research and policy focus internationally on the role of child-centred disaster risk reduction and resilience, including disaster risk reduction and resilience education programs for children and youth. This paper summarises national and international, developments following the signing of the *Sendai Framework for Disaster Risk Reduction 2015-2030* (SFDRR).

To summarise pre-SFDRR developments (Ronan 2015a, b), including over the SFDRR predecessor, the *Hyogo Framework for Action 2005-2015* (HFA), much progress has been made in CC-DRR policy, practice and research. Moving from only one study published pre-2000, research has grown exponentially, including research on the effectiveness and implementation of CC-DRR education programs. Well over half of the 146 countries self-reporting during the HFA documented DRR being included in their national curriculum at one or more levels (primary, secondary, university and professional programs). Comprehensive, evidence-informed guidance on the development of programs was also provided through UNICEF and UNESCO (2013). This has been accompanied by a proliferation of CC-DRR-infused education programs, and other initiatives, in schools and community settings (UNESCO and UNICEF 2012), accompanied by a large number of related resources available through the UNISDR's Prevention Web website.

A background review completed for UNISDR, commissioned by UNICEF and UNESCO (Ronan 2015b), also confirmed DRR curriculum and training are featuring more prominently in national policy across an increasing number of reporting countries. In the Australian context, school-based disaster resilience education programs have been included within Australia's guiding disaster policy, the *National Strategy for Disaster Resilience* (COAG 2011). International progress includes attempts at national roll-out of disaster resilience education in a few countries (e.g. Turkey, Philippines and Indonesia), including in New Zealand 'What's the Plan, Stan?' (see Johnson *et al.* 2014b). The development of a policy and practice framework, Comprehensive School

Safety (CSS) is facilitating comprehensive CC-DRR infusion within schools. The CSS Framework is seeing increased prominence in New Zealand and Australia (a review of progress is covered in Ronan 2015b, see also Amri *et al.* 2016, Ronan 2015a).

Moving forward: intended outcomes and goals

Public policy initiatives tend to organise around a set of principles, intentions, values and beliefs that are held and advocated for by various bodies (e.g. advocacy groups and political entities). When there is sufficient support for a set of values, these can be enacted through various means at different political levels. The enactment of those values is codified through a set of actions, including measures and practices, designed to realise the set of principles (Page 2008). Thus, the SFDRR is first a set of values and principles agreed upon by 189 countries linked to disaster risk reduction and building the resilience of nations and communities to disasters. Based on these values, a set of outcomes and goals have been established that begin to operationalise these values. As articulated in the SFDRR, the major outcome to be realised by 2030 is the following:

> *The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries* (p. 6).

From this general outcome, the following specific seven global targets have been established (SFDRR 2015, pp. 7-8):

- Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015.
- Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015.
- Reduce direct disaster economic loss in relation to global gross domestic product by 2030.
- Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.
- Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
- Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030.

To achieve these outcomes the SFDRR's primary goal is to:

> *Prevent new and reduce existing disaster risk through the implementation of integrated and inclusive economic, structural, legal, social, health, cultural, educational, environmental, technological, political and institutional measures that prevent and reduce hazard exposure and vulnerability to disaster, increase preparedness for response and recovery, and thus strengthen resilience* (SFDRR 2015, p. 7).

Thus, the focus of the SFDRR is squarely on prevention, mitigation and preparedness, while also accounting for the entire disaster cycle. To achieve outcomes and this main goal, a set of actionable behaviours, or Priorities for Action (PFA), were established. These are:

1. Understanding disaster risk.
2. Strengthening disaster risk governance to manage disaster risk.
3. Investing in disaster risk reduction for resilience.
4. Enhancing disaster preparedness for effective response, and to 'Build Back Better' in recovery, rehabilitation and reconstruction.

Across the PFA's, numerous recommendations for participatory public education are made, including by providing formal, informal and civic education strategies that are nationally-based yet tailored to specific localities. As stated in the SFDRR, to contribute to 'a culture of prevention and education on disaster risk…and advocate for resilient communities', an 'inclusive and all-of-society disaster risk management which strengthen the synergies across groups' is necessary. Groups noted in particular include children and youth. Emphasising their role as 'agents of change', they 'should be given the space and modalities to contribute to disaster risk reduction' that are aligned with 'legislation, national practice and educational curricula' (SFDRR 2015, p. 20).

The National Strategy for Disaster Resilience (NSDR)

The NSDR (COAG 2011) revolves around the organising theme of disaster risk reduction being a 'shared responsibility' between government and the community; one that promotes a 'culture of disaster resilience.' An important exemplar reflecting shared responsibility is the following:

> *Providing information and warnings is important but educating people how to act on their knowledge is equally important* (p. 10).

Main NSDR principles that support these themes include:

- understanding risks (section 3.2)
- empowering individuals and communities to exercise choice and take responsibility (section 3.5)
- reducing risks in the built environment (section 3.6)
- supporting capabilities for disaster resilience (section 3.7).

Two additional principles facilitate these outcomes:

- Partnering with those who effect change (section 3.4).

- Communicating with and educating people about risks (section 3.3).

Shared responsibility through partnerships, including those that link emergency management agencies with community networks, can promote the outcomes and facilitators:

> *Knowledge, innovation and education can enhance a culture of resilience at all levels of the community and should contribute to a continual cycle of learning.... Knowledge is fundamental to enabling everyone in the community to determine their hazards and risks, and to inform preparation and mitigation measures'* (p. 9)

> *'Existing community structures and networks are used to promote and enhance disaster resilience* (p.10).

A primary community node is one that revolves around a local school system that links children and youth with households that are embedded within other community networks. The NSDR itself stresses both participatory and educational outcomes as key to developing shared responsibility and a culture of disaster resilience:

> *Risk reduction knowledge is included in relevant education and training programs, such as enterprise training programs, professional education packages, schools and institutions of higher education* (p. 8).

More recently, the Australian Institute for Disaster Resilience has started to implement a strategy to develop and deliver national initiatives to teach disaster resilience in Australian schools.

CC-DRR: policy-practice-research guiding model

At both international and national levels there is policy agreement on the role of partnering with those who effect change and the role of education in promoting a culture of prevention, mitigation, preparedness and resilience. Children and youth are most at-risk in disasters for both physical (WHO 2011) and psychological effects (Norris *et al.* 2002). They are also identified in the SFDRR as 'agents of change'. These two accord with main rights of children and youth according to the United Nations *Convention on the Rights of the Child*; the rights of protection and participation. Thus, there is a set of policy-based, value-driven rationales, supported by research findings that strongly support the important role for young people in community disaster risk reduction and resilience promotion.

Another convergence between the SFDRR and NSDR is the importance of linking policy with research and practice. As a result, the linkages between policy, practice and research are important to keep in mind when trying to solve any societal problem (deLeeuw, McNess & Stagnitti 2008), including those related to DRR (see Figure 1). This includes identifiable frameworks and means to transfer research-produced knowledge into policy and practice (Redman *et al.* 2015).

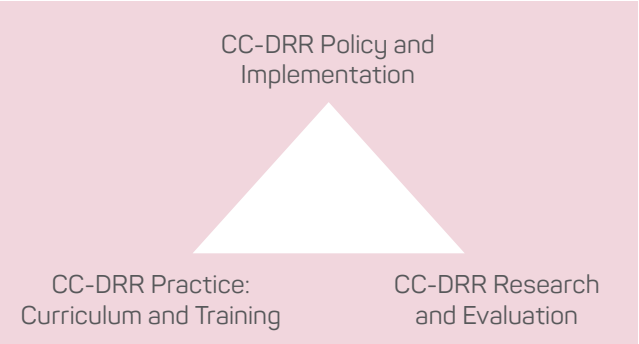

Figure 1: The Policy-Practice-Research nexus.

With this more generic policy-practice-research model in mind, a guiding model for CC-DRR research that incorporates this nexus has been developed. Figure 2 shows the two major issues of scoping and review. International scoping (Ronan 2015b, Ronan *et al.* 2015) and national scoping (via a Bushfire and Natural Hazards CRC-funded project) have identified the core themes of CC-DRR and disaster resilience education (DRE) research. The two main themes, or problems-to-be-solved, are ensuring the effectiveness of CC-DRR/DRE initiatives and facilitating CC-DRR/DRE policy and practice implementation.

CC-DRR effectiveness: promise and unintended consequences

With over 40 studies published, both correlational and experimental findings support CC-DRR initiatives. In particular, disaster resilience education programs that focus on DRR and resilience have been shown to produce beneficial outcomes for children, youth and households (Amri *et al.* 2016, Johnson *et al.* 2014a, Ronan *et al.* 2015). At the same time, many challenges remain. For example, evaluations tend to focus primarily on knowledge-based outcomes versus more skill- or action-based DRR and resilience outcomes. Evaluations are often carried out by academic evaluators and not as an intrinsic part of program monitoring and evaluation (Johnson *et al.* 2014a, Amri *et al.* 2016). Another issue is that programs tend to have a 'key safety messages' emphasis (IFRC 2013), often focusing on the key prevention, mitigation, preparedness, response-related behaviours that reduce risk.[1] These key messages can have an all-hazards focus (e.g. develop and practice a family emergency plan) or a more specific hazard focus (e.g. for bushfires, house fires, floods, cyclones and storms, drought and earthquakes). There is now no question, based on findings to date, that such a focus can produce beneficial outcomes, including increased knowledge, reduced hazard fears, more realistic risk perceptions, and increased family and household preparedness (Haynes & Tanner 2015, Mitchell *et al.* 2008, Ronan & Johnston 2003, Johnson *et al.* 2014a). Additional research has identified some active

1 These are also referred to as 'action-oriented key messages for DRR'.

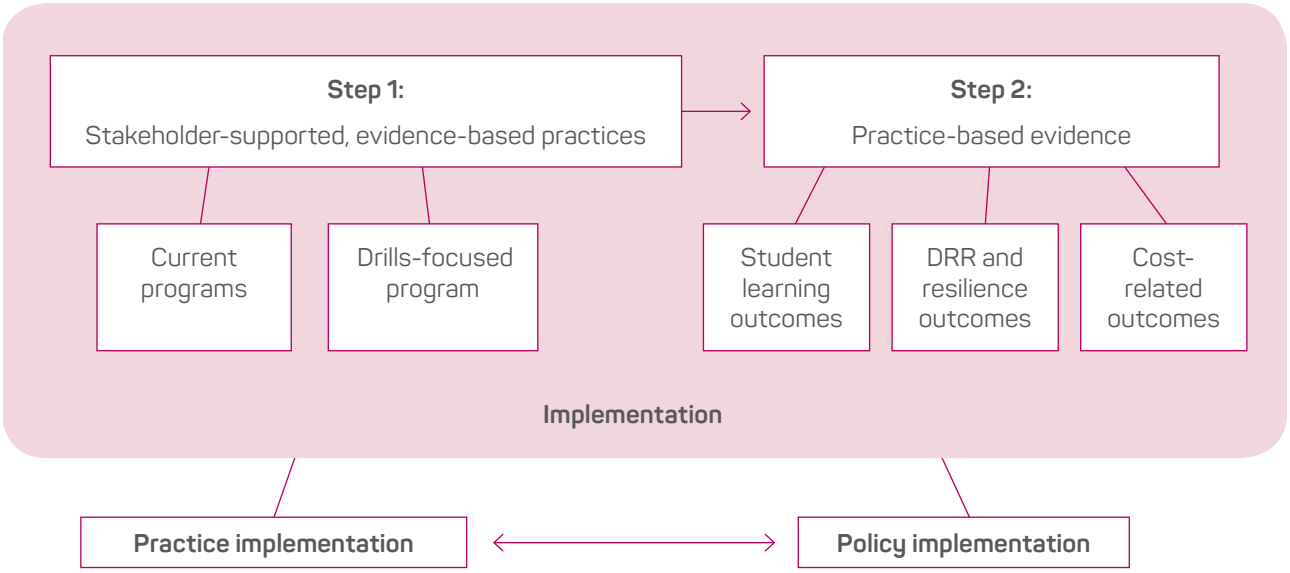

Figure 2: Guiding model for CC-DRR research.

aspects of DRE programs. Factors that predict increased household preparedness include:

- increased child and youth DRR- and emergency-management-focused knowledge
- involvement in an increased number of DRE programs
- recent DRE program involvement
- guiding children to talk with parents about what was learned, including child-parent interactive homework (Ronan & Johnston 2001, 2003, Ronan, Crellin & Johnston 2010).

Another factor is supporting children to research problems and talk to community leaders and local officials about root causes and risk reduction measures (Haynes & Tanner 2015). However, at the same time, in the face of these promising outcomes, there is little empirical evidence of how DRR and resilience benefits extend into response and recovery. The handful of experimental and time-series-designed studies done to date have used pre-post approaches, thus limiting findings to immediate benefits (Johnson *et al.* 2014a, Haynes & Tanner 2015). Research that follows cohorts over time is essential to understand the long-term effectiveness of these programs during and following a hazardous event.

While findings to date support that learning key safety messages can confer benefits, this focus may have unintended consequences. In different studies, it has been shown that education programs can improve knowledge of what to do in the event of a hazardous event (Johnson *et al.* 2014a). However, while children may know a correct set of responses, two studies (Ronan *et al.* 2001, Johnson *et al.* 2014) have shown that these same children can also endorse a range of incorrect DRR responses. In some instances, a majority of children may at the same time endorse incorrect responses (Johnson 2014). Such findings demonstrate that while children may know a correct key safety message, they also believe that other behaviours that raise risk are also correct. Thus, research has demonstrated that children may lack of clarity about which behaviours are the ones that will keep them safe. Additional research shows that children who participate in DRE programs tend to have reduced fears of hazards and increased DRR-related confidence. However, one study has demonstrated that confidence increases do not correspond to knowledge increases (Amri *et al.* 2016). In that study, 71 per cent of the child participants indicated confidence in what to do to be safe in disasters. However, only 4 per cent of the overall sample had DRR knowledge in the high range category, whereas 96 per cent had knowledge in the low to medium range categories. Another example of unintended consequences are field observations in Nepal during the 2015 earthquakes by Paci-Green and colleagues (2015), who concluded:

> *Notably, school staff in all three Rasuwa schools indicated that some school children that had been taught drop, cover and hold ran back into collapsing stone houses to crawl under tables and beds. The students did not understand how to protect themselves while outside. They stayed inside stone houses, when perhaps they could have exited, as there had been no instruction about how to protect themselves in the most prominent housing type – stone construction* (Paci-Green, Pandey & Friedman 2015, p. 17).

Consistent with these field observations, larger group-based research on earthquake key safety messages has been carried out. In the context of school drills-related education programs,[2] Johnson and co-authors found that almost 100 per cent of children knew the correct key message for earthquakes (drop, cover, hold) at both pre- and post-testing. At the same time, a majority (three-quarters) of the sample of over 500 children and youth endorsed running to a doorway as another option.

2 This research focused on school drills related to the International initiative, 'ShakeOut'. At: www.shakeout.org/home.html.

With research showing that 'movement during shaking' is a key risk factor, perhaps even the strongest, for injury and death (Johnston *et al.* 2014), this action should no longer be recommended. Another finding in that study was that only about 20 per cent of children were aware that drop, cover and hold prevented falling. Similarly, as demonstrated in Towers (2015) in a bushfire context, children may be able to correctly recite key messages about safe response behaviours, but their understanding of the purpose and function of those behaviours is often misconceived.

One of the implications of this line of research is that education programs, and school drills, that focus only on standard messages, including routine 'rote' drilling actions, may not be reducing risks for children and youth to the extent necessary (Ronan *et al.* 2015).

The way forward

The items included here, when endorsed, were verified through a series of questions (who, what, where, when, who was responsible) to ensure a planning or practice factor was undertaken. This verification procedure was completed based on research that has demonstrated that participants, adults, children and youth, may endorse having undertaken certain DRR planning and practice actions or knowledge acquisition (e.g. a home emergency plan, knowing correct DRR safety steps) but that, when queried in more depth, actually have not done or incorporated them (Ballantyne *et al.* 2000, FEMA 2010). Those studies indicate that only around 15 per cent who endorse some planning and practice factor actually enacted or incorporated the factor. In the FEMA research, about 15 per cent of children who endorsed having a home safety plan appeared actually to have completed such an activity with parents (FEMA 2010).

Based on findings, moving beyond a focus on key messages and routine drilling procedures is warranted. Education research demonstrates that a focus on knowledge and skills development through participatory, interactive, experiential learning formats can confer enhanced benefits, including related to DRR and resilience (Haynes & Tanner 2015, Ronan & Towers 2014). A study carried out in Canberra (Webb & Ronan 2014) used an approach incorporating elements based on theory and research that produced highly significant changes in knowledge, skills, home preparedness and a reduction in fears of hazards. For example, in the brief four-session program, parents of the children and youth involved reported an average increase of just under six additional preparedness and risk mitigation activities undertaken at home between pre- and post-testing. Children were found to demonstrate about 40 per cent pre-post gain in both recognition (multiple choice) and recall knowledge (listing important DRR steps). These are possibly the biggest gains reported to date in the published literature. In addition, related to skill development, children and youth had significant gains in verified 'planning and practice' factors (e.g. 'have you and your family planned and practiced what to do in an emergency?').

Another example that used a problem-solving approach was that of Haynes and Tanner (2015). This study investigated the use of child-centred participatory video as a tool for engaging and empowering young people in disaster risk reduction and climate change adaptation. The action research involved a multi-stage process of training, film-making and participatory screening workshops with communities and government officials in the Philippines. The film-making process was iterative, enabling children to investigate, learn and discuss issues with members of their family, community and decision-makers. Similarly the screening workshops were designed to gather community input and generate collaboration between young people and adults around measures to reduce risks. The project generated a number of positive outcomes from increased knowledge of the children and their communities to various tangible mitigation measures, including the installation of shelving to ensure that school materials are stored above maximum flood heights, and policy to address and enforce a reduction in illegal mining and deforestation, which was increasing the flood risk. Importantly, this study highlighted that while many education initiatives can increase the awareness and knowledge of children and their communities, it is also important to examine how such programs can target policy and practice to address the root causes and drivers of risk and vulnerability.

These findings also show that major stakeholders in CC-DRR, including children and youth, parents and teachers, endorse the value of these programs (e.g. Amri *et al.* 2016, Kelly & Ronan 2016, Johnson & Ronan 2014, Johnson *et al.* 2014). Findings indicate that parents and teachers have a preference for programs based on an interactive problem-solving approach versus a key safety message only or didactic approach (Kelly & Ronan 2016). Thus, programs developed with input from theory and research (Ronan & Towers 2014), and with input from those who participate in and deliver these programs, appear worthwhile.

With this combination of a bottom-up and top-down approach to program development, a large majority of children indicated they are motivated to learn about disasters. Additionally, they and their parents and teachers want them to be involved in DRR efforts at home and school (e.g. Amri *et al.* 2016, Webb & Ronan 2014, Johnson *et al.* 2014a). On the top-down side, international policy developments have moved the focus from DRE-based programs to a more comprehensive school safety (CSS) focus. The CSS Framework is a United Nations-driven development of an alliance of school safety advocates and practitioners led by UNICEF and UNESCO and includes UNISDR and some NGOs,

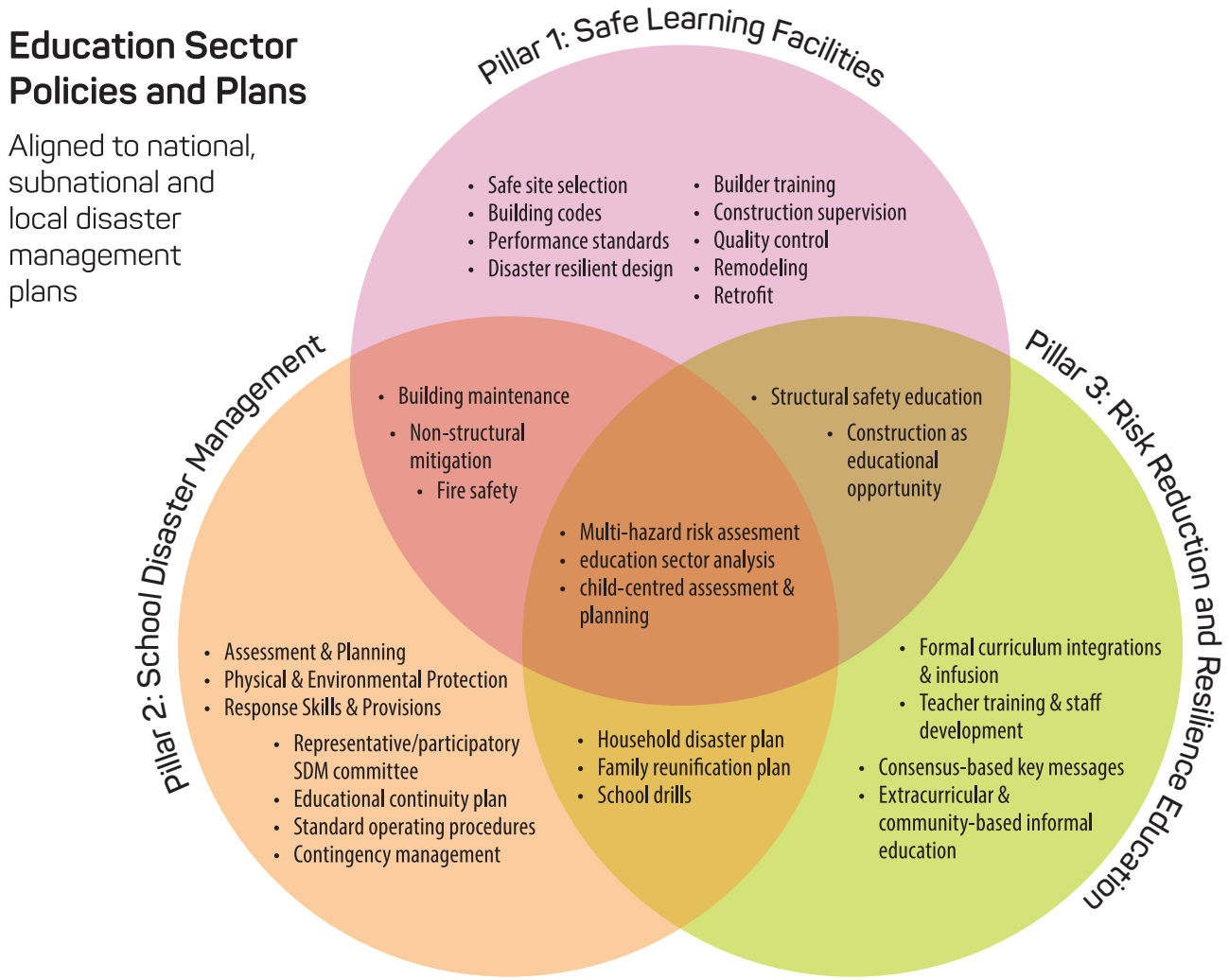

Figure 3: Comprehensive School Safety Framework: the Three Pillars.

including Save the Children. Figure 3 shows the CSS approach of three inter-connected pillars:

- safe learning facilities (Pillar 1)
- school disaster management (Pillar 2)
- DRR and resilience education (Pillar 3).

The idea is that these inter-connected pillars will lead to the protection of children and staff in school facilities, improve education continuity in times of emergency and crisis, safeguard education-sector investments, and build a long-term culture of participatory risk reduction, resilience and safety.

The potential benefits of this comprehensive approach for children and youth would be increased child participation in whole-of-school and whole-of-risk approaches. These start with understanding and assessing risk through to participating in the development of school emergency plans, linking DRE program knowledge with enactment and skills-based learning (linking schools with household planning, safe reunification procedures, flexible, versus routine-only, drilling skills and procedures[3]). Research is underway to test such possibilities.

3 Note that all of these link Pillar 2 with Pillar 3.

Teacher training also raises some issues. Research indicates that teachers express interest in delivering these programs (Amri *et al.* 2016, Johnson *et al.* 2014b). However, they express concerns about not being trained and potentially exacerbating problems for children and youth (Amri *et al.* 2016, Johnson & Ronan 2014, Johnson *et al.* 2014b). This appears to be one of the deterrents to uptake and implementation of such programs in classroom and school settings.

Implementation

Reviews have shown that most CC-DRR initiatives, including disaster resilience education, tend to have a short 'shelf-life.' That is, scaled, sustainable implementation is a major problem both internationally and in Australia. Research has begun to identify ways to support scaling up effective programs (Johnson *et al.* 2014a, Domschrader *et al.* 2009).

Johnson and colleagues (2014b) summarise previous research linked to a New Zealand DRE initiative, 'What's the Plan, Stan?' (WTPS). This includes findings from national focus group research with teachers (Johnson 2011, Johnson & Ronan 2014) and national survey

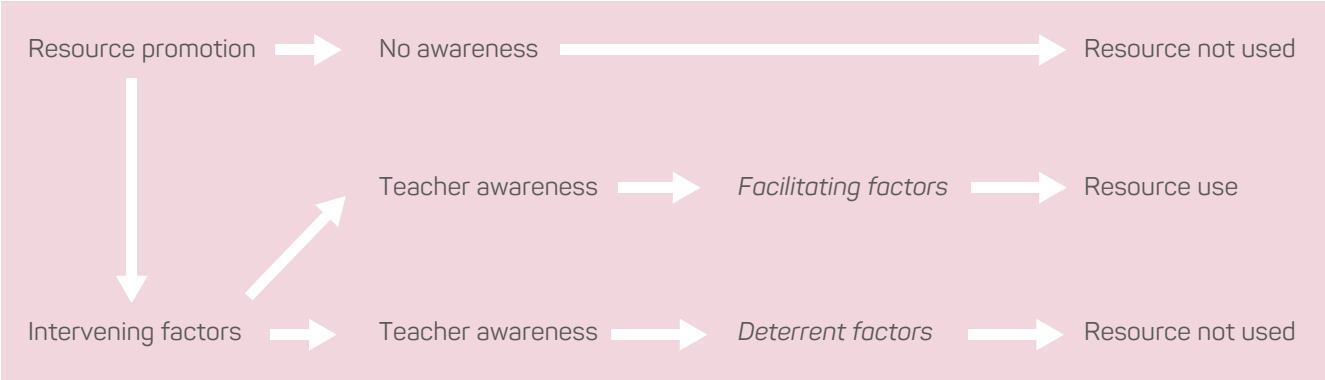

Figure 4: An implementation model for 'What's the Plan, Stan?'
Source: Johnson *et al.* 2014b. Copyright permission from Emerald Group Publishing.

research with primary school leadership, including principals (Renwick 2012). The overall purpose of review was to test a simple implementation theoretical model as illustrated in Figure 4.[4]

A WTPS program was sent to all primary schools in New Zealand in 2006 for use in classrooms. To assess attitudes and uptake, survey and focus group research was carried out. A survey was sent to all primary schools in New Zealand, with 1020 being returned (47 per cent return rate). The survey assessed awareness, use of WTPS and implementation deterrents and facilitators (Renwick 2012). For additional research on WTPS, Johnson and colleagues (2011, Johnson & Ronan 2014, Johnston *et al.* 2014b) employed a mixed methods approach.[5] The survey was carried out across the country in seven of 16 regions to get a representative mix of locales and schools (small, medium, large). This included a mix of rural and urban areas. In the schools (N = 31) that participated, 49 teachers and principals agreed to participate in focus groups. Twelve of these teachers also filled out a survey. Additional research (interviews and focus groups) was carried out with civil defence staff in the regions.

In testing the model, the Renwick study found relatively low to moderate awareness (24 per cent of principals surveyed indicated an awareness of the resource but had not read it, 24 per cent had no awareness). Across survey and focus group findings, teachers appeared receptive to the program (Johnson 2011, Johnson & Ronan 2014). However, they identified significant obstacles to using the program and factors that facilitated use. These are (Johnson *et al.* 2014b):

Facilitating factors

- school-wide use of the resource*
- teacher training (if available)
- direct engagement with local emergency management staff
- good-quality design
- promotion of the resource by teachers
- student interest in the subject
- personal interest in the subject
- recent disaster

*strongest facilitator

Deterrent factors to classroom/school use

- lack of awareness of the resource*
- perception that teacher training is needed*
- lack of time/competing interests*
- voluntary nature*
- lack of direct engagement with local emergency management staff
- incompatibility with teaching methods
- lack of school-wide use
- lack of relevancy when no disaster has occurred

*strongest deterrents

Research in Indonesia replicated and extended these findings (Amri *et al.* 2016), including identifying similar facilitators and deterrents and generating recommendations for the Indonesian context.

Thus, from this set of studies, promoting programs at school through school-wide or Ministry-level support and providing teacher training appear to be critical factors required for scaled implementation and use of a resource. On the other hand, simply creating a resource and disseminating it for voluntary use at local school level, by teachers not aware or confident to deliver it, is likely to lead to low uptake and use (Johnson *et al.* 2014b, Amri *et al.* 2016, Ronan 2015b). Implementation efforts that are based on education department and ministry policy infusion that are supported through research findings of the sort reported here would have a better chance of success.

A CSS Framework might have added benefits for children, schools, families and communities, and can be used to help policy-makers and practitioners solve some implementation problems. For example, schools

4 Another implementation framework worth mentioning given it is currently being used in some emergency management research settings to guide implementation efforts is the consolidated implementation framework for research (Damschroder *et al.* 2009).

5 Mixed methods approaches combine both qualitative data-gathering (focus groups) with quantitative methods (surveys).

have a duty of care for children's safety. Given the research on schools drilling, a re-think on drills may be necessary. At the same time, drills are conducted in virtually all schools in Australia and New Zealand. Linking CSS Pillar 2 activities (school disaster management that includes drilling) with Pillar 3 (disaster risk reduction and resilience education) may help solve this duty of care problem. Thus, creating a brief education program and companion brief teacher training that uses drills (and drill simulations) as the leveraging point might enhance effective implementation potential. Linking school drilling with a broader CSS-driven risk reduction and resilience educational school planning agenda would be thought to produce benefits for children, households and schools. If such an implementation effort is coupled with local emergency management agency partnerships, identified in the research as an implementation facilitator, this would enhance the chances of CC-DRR DRE implementation.

A lack of teacher training is a significant implementation deterrent as reported by teachers. There are examples of national teacher training approaches, including those that use internet technology for large scale and relatively low cost dissemination. Perhaps the best example of widespread dissemination and uptake is in Turkey (Petal & Sanduvac 2012). However, implementation of pre- or in-service teacher training approaches requires accompanying evaluations of effectiveness. To date, with Turkey as an exception, no data are available on DRE teacher training effectiveness. Teacher training is a problem that clearly needs more attention.

Promoting theory-based monitoring and evaluation

Part of a co-development process with the Bushfire and Natural Hazards CRC CC-DRR project end users, is a new research-informed, CC-DRR Practice Framework tool that evaluates the internal workings of DRE programs, including program design, monitoring, evaluation and implementation.

Systematic testing of CC-DRR outcomes and implementation can be carried out through theoretically-driven evaluation models (i.e. to test CC-DRR models systematically and consistently). Based on a comprehensive review of the literature (Johnson *et al.* 2016), models available for testing program outcomes and implementation and the accompanying questions they answer, respectively, are:

1. Program theory matrix: Is the program producing desired immediate, intermediate, and ultimate outcomes and what are the mechanisms responsible for producing those outcomes?
2. Stage step model: Is the program being implemented in the manner planned, what are the barriers and facilitators to effective implementation, and what is the program's reach and ability to produce sustainable, long-term, cost-effective impacts?

Johnson and co-authors (2016) provide more details on each of the models in a CC-DRR context, alongside examples from recent research. Advantages of these models are that they are reasonably pragmatic; a necessary consideration for implementation in settings that develop and carry out CC-DRR DRE programming (Johnson *et al.* 2014b).

Does DRE save money?

Within a theory-driven evaluation model, benefit-cost analysis and cost effectiveness research is important. Cost-relevant analyses link first to program theory matrix-driven evaluations and provide data on larger scale implementation and evaluation. Costing analyses are deemed an important consideration of politicians and policy-makers. Regarding space considerations, the discussion here is limited to summary words. In a review of cost-effective measures for disasters, particularly earthquakes, Kenny (2012) makes the following data-based conclusion:

> *...regardless of context, emergency communication systems that can be utilised in a range of disaster conditions and require little in the way of complex (re-) construction are likely to be both comparatively cost-effective and institutionally simple to implement. This suggests priorities for....agencies seeking to reduce the risk posed by future disasters, and indicates that measures are not, in reality, always prioritised in a reasonable manner. In countries rich and poor, the simple logic of prioritising cheap, institutionally simple responses does not always prevail.*
> (Kenny 2012, p. 576)

Theoretically, in costing terms, increasing community awareness, knowledge and skills may be cost-effective (Gibbs *et al.* 2015). According to Kelman (2014), 'the more structural a measure, the less cost-effective it usually is...' (p. 2). Positive benefit-cost ratios for a range of social solutions have been reported (Kelman 2014, see also Rose *et al.* 2007). For example, a major cause of flood-related deaths, both in Australia and overseas, is drowning due to risk-taking, which may well be largely preventable through non-costly means. This would be true whether in relation to driving or in the case of children and youth walking, swimming or playing in flooded waters (Gissing *et al.* 2016, Haynes *et al.* 2016). In bushfires, a major cause of deaths and property losses is a lack of household mitigation and preparedness leading to late evacuation and poorly-prepared properties (Whittaker *et al.* 2013, Haynes *et al.* 2010). Thus, in both floods and bushfires, compared to the costs of response (rescue and recovery operations), both economic and social investment in prevention and mitigation efforts through community-based education programs would save lives and, in some cases, a considerable amount of money (e.g. in Australian bushfires, Gibbs *et al.* 2015). However, in terms of community-level education programs, research has not yet been conducted, and is necessary, to evaluate the cost-savings potential in relation to CC-DRR/DRE programs.

Summary

One of the ways forward in CC-DRR research is for researchers to partner with end users in emergency management agencies, schools (including children and personnel), policy contexts (state, territory and federal departments and emergency management agencies), and others to create and implement effective and cost-effective CC-DRR initiatives, including disaster resilience education programs. One way is to build research-informed capacities in the sector. Another is to co-develop a set of research-driven tools with end users that include:

- developing stakeholder and theory- and research-supported CC-DRR/DRE programs
- building CC-DRR/DRE programs that include routine monitoring and evaluation of outcomes to ensure effectiveness; from student learning outcomes to DRR and resilience outcomes
- promoting scaled, sustainable implementation of cost-effective CC-DRR/DRE programs.

As part of this toolbox, evaluating outcome effectiveness and implementation with theory-driven evaluation models would assist. Importantly, these tools have to take account of agency and school resource issues and ensure that they are pragmatic and actually can, and will, be used. Given the progress in theory development and research to date, these developments can translate into a research-informed toolbox that helps CC-DRR programs be effective and be implemented in consistent, scaled ways that take account of factors that in the past have led to their more sporadic use.

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Towards tsunami-safer schools in the Wellington region of New Zealand: evaluating drills and awareness programs

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ABSTRACT

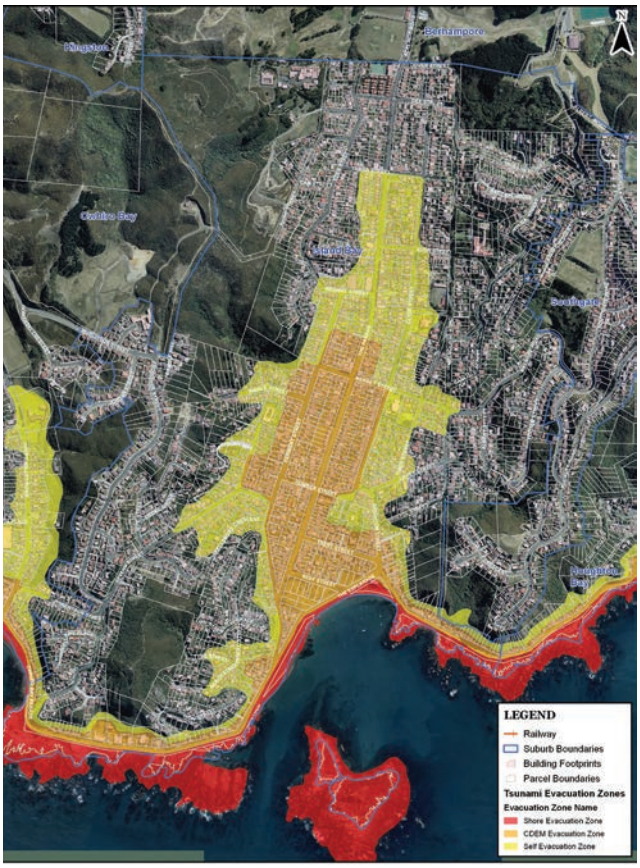
The Wellington region of New Zealand is exposed to a wide range of potentially damaging impacts from various hazard events (e.g. earthquakes, tsunami, storms and floods). Wellington is situated in one of the most active seismic regions in New Zealand, creating a significant earthquake and tsunami risk. Given the variety of hazards Wellington faces, consideration needs to be given to how the risks are managed within schools. The purpose of the present study was to investigate tsunami preparedness activities undertaken in schools in the region in association with the New Zealand 'ShakeOut' exercise. In November 2015, a survey was carried out in 17 schools from several Wellington tsunami evacuation zones. Results revealed that the sample schools had undertaken at least some tsunami preparedness activities, and some schools reported formal planning, and practice-drills. Importantly however, not all at-risk schools are fully prepared for a tsunami; one of the greatest life-safety risks for students attending school within the Wellington tsunami inundation zones. It is expected that results of the present study will help inform school-based tsunami preparedness guidelines for New Zealand schools.

Introduction

The Wellington region of New Zealand (NZ) is susceptible to both earthquakes and tsunami, with tsunami being one of the greatest threats to life. For example, the Hikurangi subduction margin north-east of the North Island of NZ is capable of generating earthquakes in excess of Mw 9.0 (Power *et al.* 2016, Wallace *et al.* 2009). If a major rupture were to occur at the southern end of the margin it could generate tsunami similar to those observed in Japan in the Mw 9.0 Tohoku event in March 2011 (Power 2013), reaching Wellington within tens of minutes (Fraser *et al.* 2014). In addition, the many fault lines that cross Cook Strait, adjacent to Wellington, also pose a potential tsunami threat. Tsunami evacuation maps produced by the Crown Research Institute GNS Science and Wellington Region Emergency Management Office (WREMO) (Figure 1) have enabled the identification of 46 schools within the Wellington region that are located in potential tsunami inundation zones.

Under NZ health and safety legislation (New Zealand Government 2015) schools are required to develop plans and procedures for all foreseeable emergencies including earthquakes and other natural events. In addition, it is necessary for schools to provide staff and students with the education and training necessary to implement the emergency plans and have the knowledge and skills to assist in their own safety. Plans and skills such as moving students to an evacuation zone, and the efficacy of 'drop, cover, hold' drills have been evaluated in two single school studies (Johnston *et al.* 2011, Tipler *et al.* 2016), but there are no known systematic studies that have evaluated plans and skills in NZ schools. Existing research in NZ schools (e.g. Coomer *et al.* 2008, Tipler *et al.* 2015) has found differences across schools in the types of emergency preparedness activities undertaken (e.g. planning for students and staff with disabilities, engaging with emergency management professionals, developing reunification plans). Such differences in preparedness are also common throughout the international literature (e.g. Graham *et al.* 2006, Kano *et al.* 2007).

For example, research conducted after the 2011 Japanese earthquake and tsunami found that regional differences in school preparedness levels directly influenced child mortality rates (Nakahara & Ichikawa 2013). Only half of schools impacted by the tsunami had developed evacuation plans, with plan-



Source: Wellington Region Emergency Management Office, www.getprepared.org.nz/tsunami-zone-maps.

Figure 1: Tsunami evacuation zones for Island Bay.

Wellington region tsunami evacuation zones are defined using the methodology developed by GNS Science (Leonard *et al*. 2008).

content varying across schools. Nakahara and Ichikawa surmised from anecdotal evidence that although it was standard practice for schools to return students to their parents immediately after the disaster, schools that evacuated to safe sites saved students. This highlights the importance of planning, preparedness, exercising, and reviewing best practice for tsunami in the school context, and for the wider community.

Given the importance of whole school tsunami planning, and participating in hazard education activities, the present study aimed to run a pilot to explore tsunami preparedness in schools within the Wellington tsunami inundation zone.

Background to the present study

On 15 October 2015, NZ conducted its second nationwide 'ShakeOut' earthquake drill, with participants practising 'drop, cover, hold'. The ShakeOut drill originated in California (Jones *et al*. 2008) and promotied appropriate response actions during an earthquake (e.g. 'drop, cover, hold'), as well as promoting preparedness and planning for earthquakes prior to an event. More than 1.36 million people throughout NZ participated in the 2015 ShakeOut exercise (Becker *et al*. 2016). In the Wellington region, 214 schools, representing 85,105 participants (students, staff and visitors), registered their participation in the drill on the ShakeOut website. For schools in tsunami inundation zones, the ShakeOut exercise presented an opportunity not only for the earthquake 'drop, cover, hold' drill, but also for undertaking tsunami planning and preparedness, and for practising tsunami response actions.

Method

The Wellington tsunami inundation zone comprises coastal areas around Kapiti, Porirua, Wellington City, and the Hutt Valley regions, where there is a total of 46 primary and secondary schools within the inundation zone. Researchers were interested to know whether the ShakeOut earthquake exercise had acted as a prompt to undertake tsunami planning and preparedness activities. How prepared were these schools for tsunami events in terms of, for example, knowledge of and practice for evacuating to higher ground, and procedures for family reunification?

A questionnaire surveying earthquake and tsunami preparedness was developed by the Joint Centre for Disaster Research, Massey University and GNS Science, and peer-reviewed by the WREMO. The questionnaire was divided into two main parts. Part 1 focused on school engagement in tsunami activities in the 2015 ShakeOut campaign, including questions concerning recognition of the tsunami zone, evacuation practice, classroom teaching, resources for teachers, and planning at home. Part 2 focused on general tsunami preparedness activities, including response plans, stakeholder involvement, drill practices, family reunification plans, classroom teaching and resources, and challenges to preparation. The nine tsunami-related preparedness activities were developed through a review of school preparedness literature and in consultation with emergency management practitioners working with schools. Ethics approval was granted by the Massey University Human Ethics Committee in November 2015.

Six weeks after the ShakeOut exercise, the authors visited 42 of the 46 schools in the Wellington tsunami inundation zone to hand out questionnaires. A reply-paid envelope was provided for ease of return. Distributing the surveys in person provided an opportunity to increase hazard awareness dialogue, to thank the school in advance for their participation at a busy time of the year, and to discuss any concerns in completing the survey the school may have raised. Schools were asked to return their questionnaire by the end of the school year, which was three weeks after distribution of the questionnaires. Seventeen schools consented to participate in the study (see Table 1), and questionnaires were completed by either the principal or a senior staff member. The study was conducted at the end of the school year, a time when schools are typically engaged in many end-of-year activities. It is likely that time and effort considerations at such a busy time of year impacted on the number of participating schools.

Tsunami steps at Seatoun School, Wellington (seen in the background) were funded by a community fund-raising event (shown in the photo) on 13 March 2016 and from local council. *Image: David Johnston*

Although comprising a sample of only 17 schools, the present exploratory study serves as a starting point for understanding some aspects of school preparedness for tsunami, and informs some future research requirements.

Table 1: Participating schools by type.

School Type	n
Full primary (Y 1-8)	10
Contributing primary (Y 1-6)	5
Composite (Y 1-13)	1
Secondary (Y 9-13)	1

Results

Results of the survey include general tsunami preparedness actions undertaken by schools and also tsunami activities associated with the 2015 ShakeOut drill. Fifteen of the seventeen schools were primary schools (and one school was a composite of Years 1-13), so results are almost exclusively relevant to primary school students (i.e. Years 1-8).

Knowledge of own environment

Sixteen schools (94 per cent) reported being aware their school was located in the tsunami inundation zone.

Tsunami-related preparedness activities

All schools reported undertaking some of the nine tsunami preparedness activities (see Table 2), with 11 schools reporting they had undertaken all nine preparedness activities. Sixteen of the 17 schools had developed a tsunami response plan. The school without a tsunami response plan did not know the school was in a tsunami inundation zone. Sixteen schools had also developed communication plans from the evacuation site, had get-away kits, had developed family reunification procedures from the evacuation site, and had informed families of the reunification procedures. Less common was the development of a map showing the school's evacuation route, and least common was evaluation of the school's tsunami preparedness activities.

Tsunami evacuation drills

Five schools (29 per cent) conducted a tsunami evacuation as part of their ShakeOut drill. The main obstacles identified enroute to higher ground were congestion during evacuation due to multiple schools using the same routes, and potential obstacles on the evacuation route (e.g. power lines down and students having to cross roads). Four schools (24 per cent) reported having never conducted a tsunami drill.

Evaluation of tsunami evacuation drills

All 17 schools evaluated their performance in the ShakeOut drill. While 15 schools (88 per cent) included students in the evaluation of ShakeOut, only four of the schools (24 per cent) regularly involved students in the evaluation of their tsunami drills. Parents and caregivers were involved in evaluating tsunami preparedness activities in less than 20 per cent of schools. More than half (59 per cent) of school Boards of Trustees (BoTs) (i.e. individual school governance bodies) were involved in the ongoing evaluation of tsunami preparedness activities in their school. The WREMO and emergency services were involved in evaluations in only two schools. Although the questionnaire asked who had been involved in evaluations, the questionnaire did not gather data on the nature of the evaluations.

Classroom teaching about tsunami

During the ShakeOut exercise, 16 schools (94 per cent) reported teaching and learning about earthquakes. Although it could be expected that tsunami would be discussed in relation to earthquakes, less than half of the schools (41 per cent) reported doing this.

Of all aspects of tsunami teaching, the most widely taught was the importance of getting to higher ground, reported by ten schools (59 per cent). About one quarter of schools (24 per cent) provided staff with information for preparing for a tsunami at home. However, just under half of schools (47 per cent) taught students how to prepare at home for a tsunami.

Table 2: Tsunami-related preparedness activities undertaken by schools.

Tsunami-related preparedness activities	per cent	n
Created an earthquake response plan	100	17
Developed procedures for how staff and students with special needs or disabilities will get to tsunami evacuation point	100	17
Created a tsunami response plan	94	16
Developed procedures for communicating from the tsunami evacuation point (e.g., with families, emergency services, WREMO)	94	16
Prepared 'get-away' kit to take during an evacuation (e.g., first aid kit, contact lists for students, important documents, portable radio, student's medicines)	94	16
Developed procedures for family reunification at the tsunami evacuation point	94	16
Informed parents/caregivers about the family reunification procedures	94	16
Developed a map showing school evacuation routes to tsunami evacuation point	82	14
Evaluated tsunami preparedness activities	71	12

Classroom resources for tsunami education

Regardless of whether schools were teaching about earthquakes or tsunami, the ShakeOut website was the most widely used resource for preparedness education (12 schools, 71 per cent). 'What's the Plan, Stan?' (WTPS), the educational resource provided to all primary and intermediate schools by the Ministry of Civil Defence and Emergency Management, was next, being used by about half of schools (53 per cent), though it is not known how extensively the resource was used. Another resource compiled by emergency management practitioners, the 'It's Easy' Planning Guide from the WREMO, was used by about a quarter of schools (24 per cent).

Stakeholder involvement in tsunami-related planning and drills

Schools reported involving a range of stakeholders in their tsunami preparedness. Stakeholders most commonly involved in developing tsunami response plans were school staff (15 schools: 88 per cent), BoTs (12: 71 per cent), and emergency management personnel (seven: 41 per cent). Only six schools (35 per cent) included parents/caregivers and students. Three schools (18 per cent) involved emergency services, and only one school consulted local *iwi* (i.e. indigenous Māori residents descended from a common ancestor and associated with a distinct territory) when developing response plans.

Drills were predominantly conducted with staff and students (75 per cent), and to a lesser degree with parents and caregivers present (35 per cent). External stakeholders (e.g. emergency management personnel and emergency services) were generally not involved as regular observers, helpers or participants.

Family reunification drills

Only seven schools (41 per cent) conducted annual family reunification drills from the tsunami evacuation point, with one additional school reporting having practised reunification drills with families 'every few years'. Neither the secondary school nor the composite school in the study, both located in the Wellington CBD (Thorndon), reported having ever having conducted a family reunification drill from their tsunami evacuation point.

Barriers or challenges to tsunami preparedness activities

The greatest barrier to schools' tsunami-related preparedness activities (see Table 3) was limited time in the curriculum to provide students with education about tsunami (59 per cent). In addition, relatively common challenges faced by schools in their tsunami preparedness efforts were the availability of teacher-time for preparing tsunami education programs (29 per cent) and a lack of resources to help students and staff prepare at home (29 per cent).

Table 3: Barriers or challenges to tsunami preparedness activities in schools.

Barriers and Challengers	per cent	n
Limited **curriculum time** available to teach students about tsunami	59	10
Limited **time** available to prepare the school for a tsunami	29	5
Limited **resources** about how to prepare for tsunami at home	29	5
Limited **resources for teaching** students about tsunami	29	5
Limited **knowledge** on how to prepare the school for a tsunami	12	2
Limited **resources** on how to prepare the school for a tsunami	12	2
Limited **staff knowledge** to teach students about tsunami	12	2

Discussion

Knowledge of own environment

The majority of schools were able to recognise that their location placed them at risk from tsunami and had undertaken preparedness activities in response to that risk. However, the present study suggests the likelihood that many New Zealanders, including staff and students of at-risk schools, are unaware of how to recognise potential tsunami inundation zones, and are not prepared to respond appropriately in a tsunami event. While the present study comprised only 17 schools in the Wellington region, these findings are supported by Johnson and colleagues (2014a) and Tipler and colleagues (2016) who also found that education programs had not succeeded in fully preparing schools for a tsunami event. Findings of the present study have implications for wider NZ. Tsunami impacts pose a greater life-safety threat to the schools located in the Wellington tsunami inundation zone represented in the present study than the widely acknowledged earthquake risk, and yet some schools are less prepared for a tsunami than for a significant earthquake.

Tsunami-related preparedness activities

All schools in the present study undertook a range of tsunami preparedness activities. However it is unclear how extensive schools' preparation and planning efforts were. Previous research conducted in schools in NZ (Johnson *et al.* 2014b, Tipler *et al.* 2015) and internationally (e.g. Graham *et al.* 2006, Johnson *et al.* 2014b, Kano *et al.* 2007) has found that while most schools undertake basic emergency preparedness activities (plans and drills), the learning outcomes for the students and staff, and the depth of emergency preparedness activities remains unclear. For example, an impact evaluation would be needed to understand if students and staff understood the causes of tsunami and knew how to protect themselves whether at school or other less familiar locations.

New Zealand students need this type of education regardless of where they live and go to school. In the present study, there was little emergency planning that involved parents and caregivers. These findings suggest a potential weakness in the national requirement to have a school plan for which there are no guidelines on stakeholder involvement and on how the plan should be formulated or evaluated.

Tsunami evacuation drills

Three-quarters of schools in the tsunami zone practised a tsunami drill at least once a year. One school found that high numbers of students (700+) and the distance to an evacuation zone posed a barrier to their tsunami evacuation efforts. For such large schools, comprehensive plans are required that are tailored to the needs of the particular school and its environs to ensure plans and drills are well developed, workable, and practised.

Practising a tsunami drill is also an important educational opportunity for students and staff to understand why they would be asked to move to high ground in an emergency event. There may be little time in an emergency event for explanation and execution. An evaluation of a similar ShakeOut tsunami drill in two coastal schools in Washington State, USA found that about a quarter of middle and high school students in both schools were unaware they were practising a response for a tsunami (Johnson *et al.* 2014a). Schools should be concerned that without practice and education, their students and staff may be ignorant of the life-saving measures necessary for both individual and group safety.

Evaluation of tsunami evacuation drills

Evaluation of emergency drills provides opportunities to assess participant performance and also a chance to review the schools existing emergency plans and procedures. The Tipler and co-authors (2016) examination of school participation in the 2012 ShakeOut exercise identified 18 lessons learned by schools including the importance of establishing building evacuation criteria; considering potential hazards along evacuation routes. And using drills as opportunities for promoting and improving school preparedness. Behavioural activities often reveal practical aspects of learning that classroom teaching and learning can sometimes miss. For example, the value of drills was demonstrated for some schools that identified the safety route they needed to make special preparations for in future (e.g. teaching students how to behave around live power lines that may have collapsed onto a road they had to cross to higher ground). While the majority of schools (88 per cent) involved students in the evaluation of the ShakeOut earthquake drill, numbers were much lower (23 per cent) for the school's tsunami drills conducted at other times. Planning and evaluating drills can be valuable learning exercises for students if opportunities are provided for them to take part in these activities. Frequent moderate earthquakes in the region and, to date, no tsunami in the living memories of students and staff, could account for the difference between attention given to the evaluation of earthquake drills, compared with tsunami drills.

Evaluation is critical to ongoing improvement in preparedness. Evaluation of emergency drills provides opportunities to assess participant's performance and also a chance to review the schools' existing emergency plans and procedures.

Classroom teaching about tsunami

Less than half of schools (41 per cent) reported teaching students about tsunami as part of the ShakeOut exercise, which is in line with findings from the Coomer and co-authors (2008) survey of 84 Wellington schools (43 per cent). Such teaching is critical to NZ students,

and it is important that all students have access to tsunami education and response actions (e.g. rapid evacuation to higher ground) wherever they live, and in particular where schools are situated in tsunami zones. In NZ, annual fire drills are the only safety drills required by law. Otherwise schools design their own curriculum based on the National School Curriculum (Ministry of Education 2016). The principal function of the National School Curriculum is to 'set the direction for student learning and to provide guidance for schools as they design and review their curriculum' (Ministry of Education 2016). That is, students are engaged in self-care programs at school and learn how to keep themselves safe. But the nature of these programs is determined by the school and there is no specific curriculum requirement for learning and practising tsunami safety. Through public education and research dissemination, emergency management practitioners and researchers can recommend that schools include hazards education programs, Schools can be invited to take part in hazards drills and education programs provided from outside the school. Effective pedagogy would support the integration of hazards education with other areas of the curriculum to motivate and consolidate learning. However, schools have the ultimate decision and control of their curricula.

Encouraging students to prepare at home for earthquakes and tsunami was reported by just under half of schools (47 per cent). A previous survey of preparedness in 355 NZ schools (Tipler *et al.* 2015) found much higher rates of students and staff being encouraged to prepare for emergencies at home (72 per cent). It is possible that schools in the present study expected students would transfer their learning from school to other environments. However, studies reveal that:

1. students do not always understand the rationale for being taught particular safety behaviours
2. student learning is not necessarily applied in new situations or environments (e.g. Johnson *et al.* 2014a, Tipler *et al.* 2016).

It is important that students understand the rationale for tsunami safety and other safety behaviours they are taught so they can make sense of their learning and develop safety initiatives in other areas of their lives. It is likely that if follow-up tsunami activities from school were taken home to share with others, these activities could reinforce learning and be motivating for the whole family, potentially increasing protection for the wider community from a tsunami at any time.

Classroom resources for tsunami education

Linking classroom resources to the national ShakeOut exercise provided relevant and easily-accessible material for schools. This is an important point, as time for teachers to prepare, and curriculum space for earthquake and tsunami education are both important factors in how much time and effort teachers can give to tsunami education at school. The wide media coverage of ShakeOut assisted schools to focus their efforts in being part of a national exercise, and promoted the use of up-to-date and readily-available resources to support the exercise itself and associated teaching. Teachers understand that students generally enjoy activities where they are finding out something for themselves, and there is a vast electronic source of material, including some instructional games, that students could now be encouraged to use.

Research on NZ schools' use of WTPS found that a school-wide curriculum topic on disasters, driven by school leadership, was one of the strongest facilitating factors of disaster education in schools (Johnson *et al.* 2014b).

Stakeholder involvement in tsunami-related planning and drills

School staff were the highest group involved in planning tsunami preparedness activities, followed by BoTs, and emergency management personnel. Parents and students were not widely consulted, and only one school consulted local *iwi* when developing response plans. Planning could be more inclusive, and give greater attention to detail if perspectives of all stakeholders were considered. The Canterbury, NZ, earthquakes of 2010-2012 have taught us lessons about the value of local *iwi* playing a significant role. For example, Phibbs and colleauges (2016) assert that disaster risk management should be inclusive of ethnic differences so that policy and planning at all levels integrates the cultural strengths of minority groups. It could be expected that the response in the tsunami zone of the present study could be strengthened if local *iwi* were included in participation.

Involving parents in planning, participating, and evaluation would be likely to encourage greater interest and support for students, as well as increasing resilience in the wider community. Likewise, it is important that BoTs are involved in evaluating tsunami preparedness activities, as BoTs have an invested interest and legal responsibility in keeping students safe at their schools. It is also important that school staff consult emergency management experts as well, to maximise hazards-understanding and safety protocols in schools.

Family reunification drills

In the present study, a minority of schools had ever conducted annual family reunification drills from their tsunami evacuation point. In a real-life emergency, the first priority for parents and caregivers would be to get to the school and be with their children. When parents and caregivers are not aware of the schools tsunami evacuation plans there is an increased likelihood they may put themselves at risk by going to the school rather than to the evacuation site (Johnson *et al.* 2014a). Another study conducted in the USA (American Academy of Pediatrics 2008) stated that when parents are unclear about the school's family reunification procedures they can aggravate the crisis and negatively influence the school's ability to respond. Family reunification drills and protocols are imperative, and it is critical that all schools in all parts of the country have

well-established procedures for children to be reunited with their parents and caregivers.

Barriers or challenges to tsunami preparedness activities

Schools have tight curricula, and teachers have demanding schedules. However, the schools involved in the present study were all located within a tsunami zone, and it is important that BoTs and teachers prioritise tsunami preparedness within their curriculum and teaching-preparation time. Teaching resources are available, and there is vast material available through reputable internet sources, as well as through materials such as WTPS provided by the Ministry of Civil Defence and Emergency Management and the WREMO.

Conclusion

Results from the present study reveal that participating schools in the Wellington tsunami inundation zone have undertaken at least some tsunami preparedness activities, and some schools reported planning and practising drills. However, not all at-risk schools are fully prepared for a tsunami in terms of evacuating to higher ground and family reunification. Preparation is critical, given that tsunami is one of the greatest life-safety risks for students attending school within the Wellington tsunami inundation zones.

While the ShakeOut drill provided a pivotal point around which some schools undertook tsunami-related activities, the safety of students could be increased in future if the ShakeOut drill were linked to tsunami planning and preparedness activities, taking additional account of companion research in earthquake and tsunami safety (Johnson *et al.* 2014a).

Limitations and future research

The present study was a pilot study, and although the aims did not include an evaluation of preparedness drills, it is recognised as a limitation of the study. To date, little work has been done to evaluate the effectiveness of drills, and this lack of evaluation is supported by Johnson and colleagues (2014a) in their Washington study of student learning earthquake response capacities. Johnson and colleagues' 2014 quantitative data revealed learning improvements overall for the sample of 495 students who completed questionnaires before and after practising earthquake drills. However, at an individual level, the study revealed that many students did not understand what to do to keep safe in unfamiliar environments, and did not understand the rationale for some of the safety behaviours they had been taught. Future research is necessary to develop and trial comprehensive evaluation tools for a pilot study investigating tsunami preparedness in schools. As a first step, future research could explore tsunami drill behaviour and learning in a small sample of schools, and work with these schools to develop a practical and valid tsunami preparedness evaluation tool.

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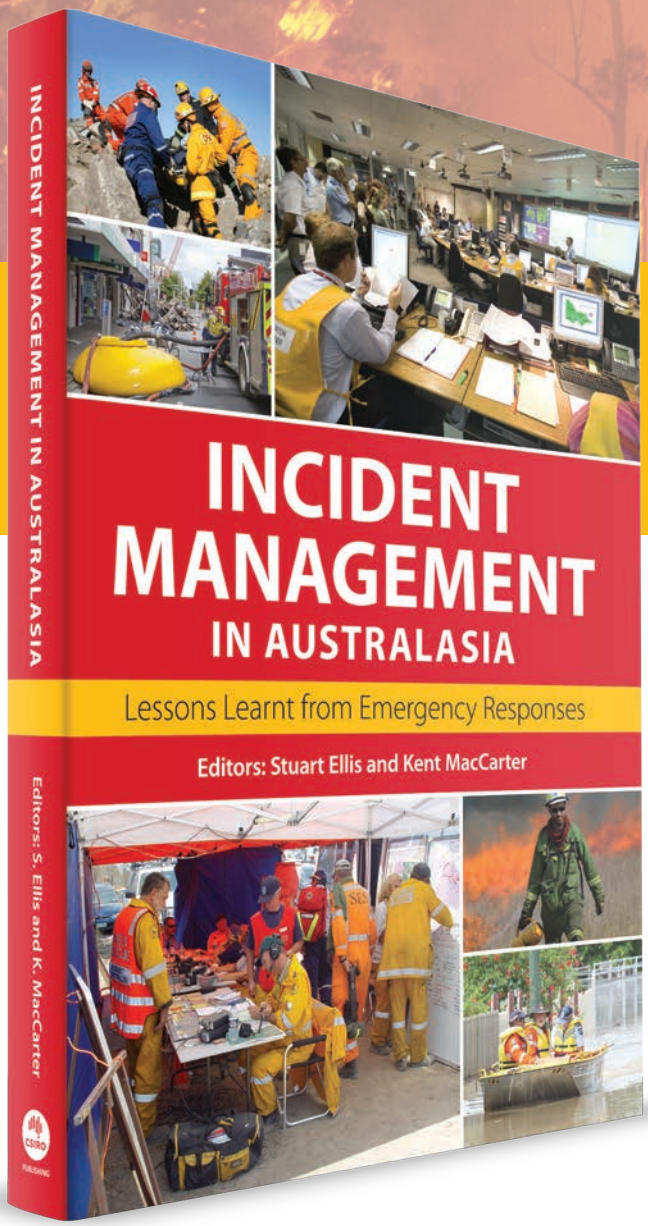

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