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Living at the interface:
hazard readiness in an urban-bush landscape Page 21

Cover image: Winner 2019 Resilient Australia National Photography Award.

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About the journal

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

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

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Image: James Spencer

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Contents

News and views

Research

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

Foreword

Amanda Leck, Australian Institute for Disaster Resilience

It is communities supporting each other who are the unsung heroes of the bushfire disaster that is unfolding across Australia this summer.

While much media attention has rightly focused on the role that fire and emergency services workers, both volunteers and employees, are tasked with to protect communities from the bushfires ripping across the nation, it is community members themselves who are stepping up all across the country to help each other.

These actions are as diverse as neighbours helping neighbours to defend property, to communities establishing relief and recovery centres to provide a focal point for local residents who have, in some cases, lost everything to the destructive bushfires, to working side by side with residents to restore order out of the chaos.

The generosity of Australians, whether it be through fundraising efforts or giving of time, exemplifies the Australian spirit during disasters such as that which we are experiencing.

Having recently returned from the northern area of NSW that was devastated by bushfire in mid-November, I have seen first-hand the resilience that local communities display in the face of this unfolding bushfire disaster.

I met with residents in an isolated community who had set up a recovery centre in a local hall. And while food and essential supplies were an important part of what they were providing, more importantly the hall provided a place where locals could come together and share stories of what they had been through and what they had lost. It was a welcoming place where people could laugh and cry and figure out what comes next for them.

I also spent time with publicans whose hotel served as the community hub before the bushfires hit, and who then swung into action and provided practical assistance - meals, showers and beds - for those who had lost their home. They restored power to the community through the provision of generators and re-established communications. And they reached out to local government to get assistance for residents who needed it most.

It is actions such as this that often go unnoticed except by the few whose lives are made better because someone reached out and cared enough to do something during the worst of times. And it is these selfless actions of individuals and communities that are playing out right across Australia during this bushfire crisis.

This edition of the *Australian Journal of Emergency Management* includes relevant research and commentary that is timely. For the emergency management and disaster resilience sectors, our work continues to understand the needs of communities and to assist them to recognise risk and take action to improve their situation.

This edition of the journal also celebrates the winners from the 2019 Resilient Australia Awards. This year marks the 20th anniversary milestone of the Awards that showcase the practical action communities, businesses, governments and schools are taking to build a more resilient Australia.

Australians are being tested once again and are proving themselves to be resilient in the face of adversity – and it is this community spirit that makes us resilient as a nation.

Amanda Leck

Executive Director,
Australian Institute for Disaster Resilience

Children, councils and creative approaches to resilience at national awards

Costa Haritos, Australian Institute for Disaster Resilience

A range of high quality initiatives were celebrated at the 20th Resilient Australia Awards, with a focus on child-centred disaster education and empowerment to action. The line-up of national winners featured community engagement, local government partnerships and other initiatives that captured strength in the face of disaster.

Executive Director at the Australian Institute for Disaster Resilience, Amanda Leck said the award winners illustrate exciting and creative approaches to resilience, with a high level of impact.

'The quality of entries has been impressive. I wish to send my heartfelt thanks to all who submitted projects and photos this year, your efforts are inspiring,' Ms Leck said.

The high quality of children's projects suggests the crucial role they have in disaster resilience education and community strength and recovery.

Dr Robert Glasser, former Head of the UN Office for Disaster Risk Reduction, featured as the opening keynote at the Australian Disaster Resilience Conference in 2019.

'Children have a huge role to play in reducing risk in their communities, in managing once a disaster strikes, and in helping support the recovery afterwards,' Dr Glasser said.

New Scout badge teaches valuable, real-world skills

Sarah Hamilton was completing a training course with Scouts Western Australia when she saw clear similarities between scouting and the emergency services.

The State Emergency Service (SES) volunteer found many younger scouts were 'intimidated' by the amount of equipment and tools involved in an emergency or rescue operation.

To overcome this fear and develop a bridge between the two organisations, Ms Hamilton developed The SES Awareness Badge for Scouts. The badge is an introduction to the SES and communicates a Scout's understanding of emergency operations while celebrating the shared value of public service between the two organisations.

'I think secretly all SES members did Scouts in their youth, it's a huge common connection, so why don't we just establish that appropriately and have a badge and that pathway available for them?' she asks.

Ms Hamilton built up confidence in the Scouts by linking their activities to the important work of the emergency services through their local SES unit. She also asked the Scouts what they wanted to learn from SES volunteers to help guide the development of the badge.

'When we were trialling it, they just loved all the activities, like doing hand tools and sandbagging, lots of scouts really want to come out with us at 2 o'clock in the morning,' Ms Hamilton said.

The SES Awareness Badge took out the 2019 Resilient Australia National Award at a ceremony in Adelaide. The awards celebrated 20 years of recognising resilience across communities, governments, businesses, schools and through photography.

Ms Hamilton was recognised for her passion for building disaster awareness and resilience at a grassroots level. She says the 'youth-leading, adults-supporting' approach has helped with the success of the program.

'It's every SES members' dream to wear this badge,' Ms Hamilton said.

The introduction of the SES Awareness Badge has already seen a major shift in how young Scouts are approaching their work, with over 500 recipients since its inception in April 2018.

The badge can be earned at all five youth sections – Joeys, Cubs, Scouts, Venturers and Rovers.

L-R: Jane Hamilton, Sarah Hamilton and Barb de la Hunty.
Image: Australian Institute for Disaster Resilience

Flood and bushfire programs receive awards

The Northern Territory Emergency Service was highly commended for their flood safe short films designed to educate the Aboriginal and Torres Strait Islander population about the importance of flood safety.

Between 1960 and 2017, at least 27 fatal floods in the Northern Territory have claimed the lives of 38 people.

To overcome the barrier of language in public safety information and flood warnings, the films are available in English as well as six local languages – Kriol, Arrernte, Kunwinku, Murrinh Patha, Warlpiri and Yolngu Matha.

The films create awareness about the dangers of entering floodwater. Remote television stations broadcast both the full and cut down versions.

NSW Rural Fire Service (RFS) also received a highly commended award for their Prepare.Act.Survive initiative, which is celebrating 10 years of risk recognition and community preparedness before a bushfire.

After the Black Saturday bushfires in Victoria, research showed only 30 per cent of Australians had a bushfire survival plan in place.

The long-serving NSW RFS public safety campaign has seen positive improvements to community responses expectations when there is a bushfire threat, with 69 per cent of communities now prepared with a bushfire survival plan in place.

Children leading in the classroom

The Sunshine Coast Regional Council took out the Local Government National Award for the 'Get Ready Schools Program'.

In Australia's most disaster-prone state, the Get Ready Schools Program builds on the natural hazard knowledge of young Queenslanders through an interactive learning platform. The program provides students with the skills to prepare for, respond to and recover from the impacts of disaster.

Sunshine Coast Regional Council staff deliver the program to schools across the locality and engage with upper-primary students in grades four, five and six.

In 2001, Eudlo resident, Christine Davis, bought a house on a flat block of land in a rural environment and was 'quite surprised when it flooded'.

Through the Get Ready Schools Program, Ms Davis's granddaughter Annaleisa has learnt about the severity of a flood in a rural environment like Eudlo.

'Last year I wasn't very prepared because I didn't know much. All I knew was that rain could come down at any minute and lightning could hurt you.

'I think I would be pretty prepared and know what to grab if I had to evacuate,' Annaleisa said.

The program also benefits teachers who can link the program's interactive learning activities to their humanities and social science curriculum.

'As well as learning about natural disasters and being receivers of this knowledge, they are also able to be sharers and teachers,' Rachel Kalle, a grade five teacher said.

Palmwoods State School has delivered the program to more than 1000 students, with a potential reach of over 4000 family, friends and community members.

Students developed a deeper understanding of natural hazards through personal recounts from local community members, creative writing activities, school camps focusing on flood mitigation and the council's online Disaster Hub to identify at-risk areas and stay informed.

'They're getting it first-hand when their young and hopefully that will stay with them and they can build on that,' Ms Davis said.

Innovative councils showcase resilience in action

The Hume City Council in Victoria and the Redland City Council in Queensland received highly commended awards at the national ceremony.

The Hume City Council welcomed over 4400 new residents from overseas in 2016. The English and Emergencies - Learn and Prepare initiative builds English literacy to help local students respond to an emergency.

The Redland City Council was recognised for its Community Champions program that encourages a community-led response to disasters, such as the North Stradbroke Island fires that threatened Russell Island in 2019. The program provided clear communication and messaging to the community, leading to positive preparedness and community responses.

The program is a joint initiative between the Redlands Coast Southern Bay Islands community and the council in partnership with Australian Red Cross, Queensland Fire and Emergency Service and Volunteering Queensland.

L-R: Martha Martin (Hume City Council), Steve Cameron (Emergency Management Victoria) and Tina Georgiev (Hume City Council).

Image: Australian Institute for Disaster Resilience

L-R: Lisal O'Brien (Country Fire Authority) and Scarlett Harrison (Strathewen Primary School, Student).

Image: Australian Institute for Disaster Resilience

Youth-led education continues to shine

The power of building disaster resilience through children was again on show as students from Strathewen Primary School in Victoria took out the Resilient Australia National Schools Award.

For many years, bushfire information evenings run by the Country Fire Authority (CFA) were poorly attended, with many brochures ending in the recycling bin upon departure.

But local students have since taken the lead, sharing their past experiences of losing their school during the devastating Black Saturday bushfires.

Eleven years since the fires, the school has embraced its history and is working in partnership with the CFA to deliver an interactive and engaging outdoor bushfire education program.

'Adults generally don't listen to kids, so if we can tell them what we can learn at a young age, we can continue that through our life,' said Scarlett Harrison, a student at Strathewen Primary School who was just a toddler when the fires killed 22 residents and destroyed 80 per cent of the towns buildings.

Students at the school understand fire danger ratings, fire behaviour, environmental influences and risk factors.

Dr Briony Towers, who researches child-centred disaster education at RMIT University and the Bushfire and Natural Hazards CRC, says the program has long-term effects, rather than being a 'one off'.

'The benefit of this program is that it has really become part of the school culture,' Dr Towers said.

Schoolyard resilience on display

The school mural at Swayneville State School received a highly commended award at the Resilient Australia Award ceremony. When Cyclone Debbie destroyed the main access road into the small, rural community of Sarina Range in 2017, a temporary school campus was established at the top of the town.

Students designed and created a mural to illustrate their strength after the cyclone and connect the two school campuses. The mural serves as a positive reminder of the student's resilience, providing a fitting backdrop for school photos and a positive talking point for visitors.

Tathra Public School students showcased their resilience through words and imagery after a devastating bushfire in March 2018 destroyed almost 70 homes in their town. The school produced a picture book, When the fire met the sea, written and illustrated by students at the school.

The school was in the direct line of the fire front. Burnt trees, ash-smothered classrooms and a destroyed playground stood as the physical remnants of the event.

The book features poems, stories and vivid artwork about the students' experiences during the fire and is a historical reminder of their resilience. A copy of the book is in the National Library of Australia in Canberra with other copies available for sale to raise further funds for the school.

Emotional resilience in photography category

James Spencer received the Resilient Australia National Photography Award for his image of Tasmanian resident

L-R: Leah Mullane (Swayneville School Principal), Jordannah Moren (Student), Wendy Robinson (Teacher), Maddelyn Eames (Student), and Jodie Connolly (Artist).

Image: Australian Institute for Disaster Resilience

This aerial photograph shows the environmental damage from the Pierces Creek fire, which burned through Canberra's west.

Image: Marta Yebra

Dale 'Hairyman' Fullard, who is pictured sitting along the Huon River.

Mr Fullard lost his property during the Tasmanian bushfires in early 2018.

'I remember shutting my house door and then I actually said goodbye to it, not knowing if I'd see it again.

'It was a strange feeling to walk away and not know what you might come back to,' Mr Fullard said.

He says the most horrible part was coming back and seeing the bare ground.

'It's amazing how disasters bring communities together,' Mr Fullard said.

Photographer James Spencer says he did not think twice about taking Dale's photo and sharing his story.

'Nothing says resilience more than someone who's carrying on with their life after such a massive loss like that.

'It's a good attitude to have,' Mr Spencer says.

The award winning photograph is the cover of January 2020 edition of the *Australian Journal of Emergency Management*.

Dr Marta Yebra was honoured with a highly commended award for her aerial photography after the Pierces Creek fire in the Australian Capital Territory.

Dr Yebra's photograph illustrates the effect of climate change, with the fire taking place before the traditional start to the bushfire season.

Lurline Byles also received a highly commended award for her image of Clydesdale Jemima and her owner and volunteer, Claire Curr.

Jemima was rescued as a foal during Black Saturday but is now part of the Department of Fire and Emergency Services mounted section, where she is involved in multiple searches to assist police in locating and reuniting missing loved ones with their families.

Rescued as a foal during Black Saturday, Clydesdale Jemima is helping local police with search and rescue operations with her owner and volunteer Claire Curr.

Image: Lurline Byles

Domestic violence and child-centred trauma initiatives

Disasters can increase the prevalence of domestic violence and mental health complications for children. Two nationally significant programs that addressed these concerns were highlighted at the 20th Resilient Australia National Awards.

Natural hazards and emergencies can provoke a range of traumatic experiences and responses for individuals, couples and families.

Climate change brings with it an increase in the frequency and severity of natural hazards. As a

consequence, communities at increased risk of these hazards are likely to be at an increased risk of mental health complications and problematic behaviour in the aftermath.

Two initiatives help bridge the gap between natural hazards and their consequences by providing research-informed training and resources to emergency services and communities.

Emerging Minds has worked alongside the Australian National University to develop the Community Trauma Toolkit; a collection of trauma-centred mental health resources tailored to the needs of children.

Likewise, the Gender and Disaster (GAD) Pod has developed interactive training packages designed to break down gender and communication barriers to reduce the risk of domestic violence following disasters.

Both initiatives received a special honour at the national awards for their significant contributions to recovery and resilience.

The awards were celebrated at a national ceremony held at the Adelaide Convention and Exhibition Centre, where projects from across Australia were acknowledged.

Australian Institute for Disaster Resilience (AIDR) Executive Director Amanda Leck was impressed by the submissions entered in the awards.

'We were so overwhelmed by the quality of the work, the judges decided to recognise two special projects for their national significance in addition to the National Award.

'We continue to be in awe of the creativity and community spirit we see in the applications,' Ms Leck said.

The awards received a record-breaking number of submissions across business, local government, school, community, government and photography categories.

Children's mental health in the spotlight

Up to 43 per cent of children who have been exposed to some degree of trauma will develop post-traumatic stress disorder, with some experiencing anxiety, depression and other health disturbances.

Natural hazards and exposure to other traumatic events can increase the risk of serious and long-term consequences for a child's wellbeing.

The Community Trauma Toolkit is a comprehensive trauma-informed approach to educate employees and families about infant and child mental health in the context of disasters.

The toolkit provides a range of resources divided by audience. It equips parents, educators, operational personnel and health and social service providers with the skills and knowledge to support children before, during and after disaster. To best support their implementation, the resources are designed for flexible delivery options.

Nicola Palfrey leads the project through the Australian Child and Adolescent Trauma, Loss and Grief Network at the Australian National University. The program provides free access to vital experience and expertise.

'It pulls together the wisdom and knowledge of individuals who have lived through disaster, expert clinicians and research to provide clear, accessible information for families and professionals.

'It addresses a gap in drawing together this information in one place and focusing on children under 12 years of age who are particularly vulnerable to the impacts of community trauma events,' Ms Palfrey says.

Nicola Palfrey from the Emerging Minds team.

Image: Australian Institute for Disaster Resilience

The toolkit allows users to choose between five timelines: preparedness, immediate, short term, long term and ongoing. Each module provides advice and information about how children may experience mental health impacts during each time period.

- **Preparedness:** this entails educating children about the risks in their immediate area and including children in preparedness plans and family meetings.
- **Immediate:** this focuses on the immediate four weeks following a disaster. It encourages comfort for children, limited media coverage and providing a safe space for children to talk about their feelings.
- **Short term:** in the immediate months following a traumatic event, parents are encouraged to be patient, maintain stability and allow children to recover.
- **Long term:** in the four or more months following a disaster, adults are encouraged to support children to find their 'new normal' but should be aware of event anniversaries or reminders.

- **Ongoing:** these resources focus on disasters like droughts, which can trigger a child's mental health for months or years following exposure to a traumatic event.

In addition to over 100 written resources, videos and podcasts, the toolkit includes a series of training modules tailored to different audiences and their engagement with children during disaster.

The first responders training program focuses on simple and practical strategies for emergency service personnel to support children experiencing stress and trauma during an emergency.

The community training sessions focus on disaster preparedness and understanding trauma. These sessions aim to build community connectedness and resilience at a grassroots level. The customisable nature of the toolkit allows communities around Australia to receive the information in a clear and relevant way.

The organisation community training is delivered in workplaces, such as Save the Children in South Australia, Australian Red Cross and Uniting Church. The training leverages off the resources already employed throughout the communities they serve.

Ms Palfrey described the award as a 'wonderful recognition'.

'It is an acknowledgment of the importance of children and their wellbeing, and the willingness of workforces and communities to want to learn more about supporting children,' Ms Palfrey says.

L-R: Laura Gooyers, Hon. Corey Wingard MP, Nicola Palfrey.
Image: Australian Institute for Disaster Resilience

Addressing domestic violence after a disaster

One in six Australians are likely to be exposed to a disaster in their lifetime, but men and women will experience these disasters differently.

A Victorian initiative is helping emergency services organisations to understand and address domestic violence concerns following disaster with practical strategies for gendered considerations in emergency management policy, planning, decision making and service delivery.

The GAD Pod is an initiative of two Victorian women's health organisations; Women's Health in Goulburn North East and Women's Health in the North, and the Monash University Disaster Resilience Initiative.

The face-to-face education and training resources, which include two comprehensive training packages and a train-the-trainer package, was acknowledged with the 2019 Resilient Australia National Significance Award.

The program was recognised for its innovative and interactive approach to breaking down the barriers, behaviours and attitudes between men and women after a disaster.

Over 400 emergency management personnel have taken part in the training across 25 sessions, including representatives from the Metropolitan Fire and Emergency Services Board; Country Fire Authority; the Victorian Department of Environment, Land, Water and Planning; Victorian State Emergency Service personnel and volunteers as well as police, local government staff and community members.

Dr Debra Parkinson leads the project and said receiving a Resilient Australia National Award represents a pivotal occasion for her team.

'This award recognises the national significance of the increased domestic violence after disasters, and the relevance of it to disaster resilience and the emergency management sector.

'This prestigious award will further enhance understanding and action on family violence in disasters, and nationwide awareness of the *Gender and Emergency Management Guidelines*,' Dr Parkinson said.

The training has also taken place in Tasmania, where 11 middle and senior emergency managers took part. The Inspector-General of Emergency Management Queensland and Australian Red Cross also partnered to deliver the program in relation to domestic and family violence.

The program focuses on the gaps in research and community behaviour. The initial research phase involved men and women who survived the 2009 Black Saturday bushfires in Victoria, which claimed 173 lives. Many Victorian communities continue to experience trauma and mental health complications associated with the event.

The research uncovered that men suffered from mental health issues and women experienced domestic violence following Australia's most devastating bushfire disaster.

'This award is shared by the women and men who told us about the worst times in their lives during and after Black Saturday.

'It was a big risk for women and men to step away from society's expectations and speak of the pressure they

felt from gendered expectations, and the damage that resulted,' Dr Parkinson said.

The training materials also incorporate findings from the All on Board project, which sought to reduce the compounding effects of gender on disaster impact by filling the gaps in knowledge, policy and practice.

The study examined gendered expectations in the aftermath of disaster. While men are expected to protect and provide, women are expected to nurture and care for others.

'Society wants to believe in the myths of strong, silent and stoic men, and women who support their men,' Dr Parkinson said.

The research consulted over 350 emergency management personnel from around Australia to create a literature review and a companion checklist. The checklist focuses on inclusive attitudes towards women and the LGBTIQ+ community.

The interactive GAD Pod sessions bring the research to life by sharing local and international resources about family violence after a disaster. Each session focuses on the challenges faced by men and considers the planning, response and recovery phases of a disaster.

Part of the GAD Pod training modules educate emergency management personnel about the importance of referring women to the services and support they need in emergencies and after disasters.

It also supports men to break down traditional ideas of masculinity and access help in the community or workplace.

Parts of the program are targeted towards boys and girls to eliminate an upbringing with gendered expectations. Through the removal of these expectations, harmful behaviours after disasters and in emergency situations can be monitored and removed over time.

The project leader said 'so much has changed' since the team began the research and the message is catching on across the state. The GAD Pod's 'Disaster is no excuse for violence' postcard has also been influential, with over 30,000 postcards circulated to organisations throughout Victoria in 2019 alone.

Domestic violence and emergency management is on the policy agenda following the development of the *National Gender and Emergency Management Guidelines* by the Attorney-General's Department. The guidelines serve as a starting point for conversations, reform and understanding.

L-R: Deb Parkinson, Helen Riseborough, Caroline Spencer from GAD Pod.

Image: Australian Institute for Disaster Resilience

Helping men, women and children

Debra Parkinson, Gender and Disaster Pod

Disasters, like the current bushfires in Australia, place pressure on men to be silent and stoic protectors, which makes them reluctant to seek help. What does this mean for families in such terrible times?

Evidence shows that men may fear career penalties if they seek psychological help after disasters. For women, there's an expectation that they will put their own needs last to support their husbands, partners and families who may be traumatised from fighting fires and protecting homes. Some women face increased or new domestic violence and, in a post-disaster context, there is even greater pressure for them to remain silent about it.

For the massive fires across the country over Christmas and New Year, anecdotal reports were coming through early that relationship pressure and domestic violence were occurring. Increased family violence during disasters can be prevented or reduced if community members and health professionals are aware of this likelihood and know how to respond constructively. With widespread disruption to face-to-face services, it is important to remind men, women and children of the helplines available. The 'Disaster is no excuse for family violence' postcard provides a simple four-step process related to family violence and provides information about support services.

It is equally important for community members to wind back expectations and judgements of men and women based on outdated notions of masculinity and femininity. Stop asking men what they did on the day and if they've re-established the home. Stop asking women to be supportive of suffering partners no matter what's happening at home. Stop asking if they're 'over it'. Disaster effects are severe and long-lasting. As one research informant said, 'I don't think you can ever put a pin in and say it's all over'.[1]

Saving lives through fire planning with a gendered lens

Gendered expectations (of men to protect and provide and women to sacrifice and nurture) complicate fire planning. Men are frequently expected to defend properties and women often delay leaving properties in order to persuade husbands or partners to leave. The GAD Pod's research into long-term disaster resilience found children may remain traumatised into their adulthood if they witness this conflict.

Following advice from emergency services organisations and officials to 'Leave (early) and Live' will save lives and will prevent lifelong physical and mental health effects for survivors. Yet, conflict within couples frequently prevents fire planning discussions.

The GAD Pod 'Fire planning with a gendered lens' postcards encourage women and men to discuss their roles in a potential fire. The aim is to create understanding of gendered expectations in emergency situations.

For more information see www.genderanddisaster.com.au.

Men's Helpline: 1300 766 491

Kid's Helpline: 1800 55 1800

Questions postcard: www.genderanddisaster.com.au/wp-content/uploads/2019/05/Postcard-LTR-1-of-2-revised.pdf.

Facts postcard: www.genderanddisaster.com.au/wp-content/uploads/2019/05/Postcard-LTDR-2-of-2.pdf.

1 Gender and Disaster Pod 2018, *Long-term Disaster Resilience. At: www.genderanddisaster.com.au/wp-content/uploads/2018/10/Vol-1-Executive-Summary-29-Oct-with-references.pdf.*

Bringing future resilience to life with national forums

Monica Osuchowski, Emergency Management Australia

Forums on Understanding Disaster Risk were held across Australia in October 2019 as part of a national discussion on climate and disaster risk.

The Department of Home Affairs, in partnership with the Australian Institute for Disaster Resilience (AIDR) and CSIRO, ran the forums during October 2019. The focal point of the Understanding Disaster Risk forums was a new agenda for disaster risk reduction. This brings to life the key outcomes from the National Resilience Taskforce.

Over 700 people from a broad range of sectors gained insights into contemporary thinking about climate and disaster risk reduction, vulnerability and decision-making to support the implementation of the *National Disaster Risk Reduction Framework*. The interactive forums allowed attendees to share their thoughts on the current disaster-risk landscape and hear from a panel of representatives about climate and disaster risk initiatives in their state.

Attendees represented a broad range of sectors including banking and superannuation, insurance, community services, not-for-profit, consulting, health care, state and local governments, critical infrastructure providers, research and emergency management. The private sector made up 17 per cent of attendees; a growing area of engagement for disaster resilience.

Attendees provided positive feedback to the event series, with many looking forward to applying the new knowledge and guidance to implement disaster risk reduction initiatives in their sphere.

The forums were shaped around sharing insights, information and guidance about climate and disaster risk developed by the Australian Government through the former National Resilience Taskforce to support the implementation of the *National Disaster Risk Reduction Framework* and the *Sendai Framework for Disaster Risk Reduction*. Resources include *Profiling Australia's Vulnerability: The interconnected causes and cascading effects of systemic disaster risk* and *Guidance for Strategic Decisions on Climate and Disaster Risk*.

National Disaster Risk Reduction Framework

The *National Disaster Risk Reduction Framework*, released in April 2019, sets foundational work needed to reduce existing risk, prevent new risk from being created and ensuring information exists to meet these demands.

It identifies seven guiding principles and four priority areas. Each priority area details a range of five-year outcomes. The Framework's central premise is that by changing how communities think about disasters and through greater collaboration working together, action can be taken to better prepare and enhance resilience.

The least understood dimension of disaster risk – vulnerability – is explained in *Profiling Australia's Vulnerability*, which provides the language and vocabulary surrounding the term.

The report encourages thinking about 'why' and 'how' naturally occurring events can lead to devastating suffering and loss. Better understanding of the underlying drivers of disaster, now and into the future, along with better understanding the dimension of what people value, provides new perspectives in thinking about disaster risk.

Stories about vulnerability are shared from systems perspective and a values perspective. It encourages new conversations to contemplate what matters the most, to make us more aware of how choices, decisions and the things we prioritise or trade-off have a related and cascading effect on the nation's social, economic and environmental resilience.

The *Guidance for Strategic Decisions on Climate and Disaster Risk* helps decision makers to incorporate future climate and disaster risk into current decision-making processes and encourages decision makers to act in ways that contribute to achieving the outcomes within the *National Disaster Risk Reduction Framework*. In particular, the guidance provides direction on how to call upon new knowledge, capabilities and processes to consider climate and disaster risk into strategic long-term planning and investment decisions.

The forum proceedings, including presentations and videos, are now available on the AIDR Knowledge Hub: knowledge.aidr.org.au/collections/disaster-risk-reduction/

This article contains images of Aboriginal and/or Torres Strait Islander peoples.

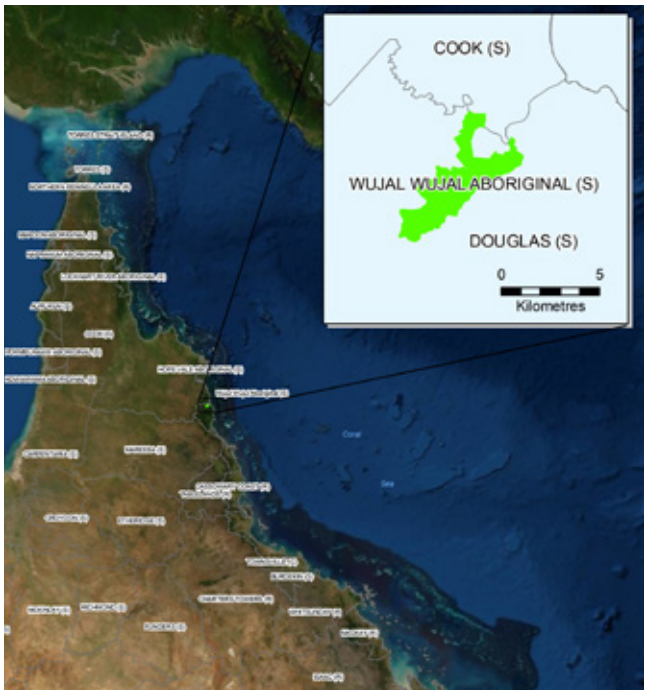
Local recovery planning process for Wujal Wujal

Alexandra Marsh, Queensland Reconstruction Authority

Following the North and Far North Queensland Monsoon in January 2019, the Wujal Wujal Aboriginal Shire Council has undertaken recovery activities. This case study looks at the recovery planning techniques used by the Queensland Reconstruction Authority and the local community.

The Wujal Wujal Aboriginal Shire is a local government area in the Cape York region of Far North Queensland. The name 'Wujal Wujal' means 'many falls' in one of the local Indigenous languages.

The Wujal Wujal community is home to three traditional clans and several Indigenous languages. It covers an area of 20 kms and is located approximately 30 kms north of Cape Tribulation and 60 kms south of Cooktown. Access to the community is via a sealed road from Cooktown or by the Bloomfield Track; an unsealed road from Cape Tribulation. During flooding the road from Cape Tribulation is impassable.



Far North Queensland showing location of the Wujal community.

Source: Queensland Reconstruction Authority

Wujal Wujal is an active, safe, progressive and healthy community with high levels of participation in sports and economic opportunities. The community is culturally rich with a strong appreciation of the traditional Eastern Kuku-Yalanji knowledge, language, skills and connection to the natural landscape and resources.

The scenic landscape, rainforest and the Bloomfield River are the traditional grounds of Eastern Kuku-Yalanji people. The lands and rivers are protected, valued and managed sustainably. Land is limited and community development is determined by a collaborative partnership between all stakeholders representing the community and providing a transparent decision-making process.

During January of 2019, Wujal Wujal was hit by substantial flooding. One Elder said, 'Everyone was worried for everybody who lives in the valley. Everybody who lives here lost something'.

The Queensland Reconstruction Authority's recovery team worked with the Wujal Wujal Aboriginal Shire Council so that the local recovery plan reflected the shire's distinctive qualities and strong links to community, culture and environment.

While scoping the development of the recovery plan a number of meetings were held with the Mayor, elected members, the council Chief Executive Officer and Elders of the Wujal Wujal community. These meetings developed trust and greater understanding of community perspectives that enabled an inclusive process to develop the plan. The plan is focused on Ngulkurrmanka (healing), Binalmalmal (learning) and Kabanka (rising), reflecting one's own individual journey and not necessarily a chronological approach. The colours used in the plan demonstrate strength and positivity.

Wujal Wujal community elders worked with Queensland Reconstruction Authority staff to develop the recovery plan.

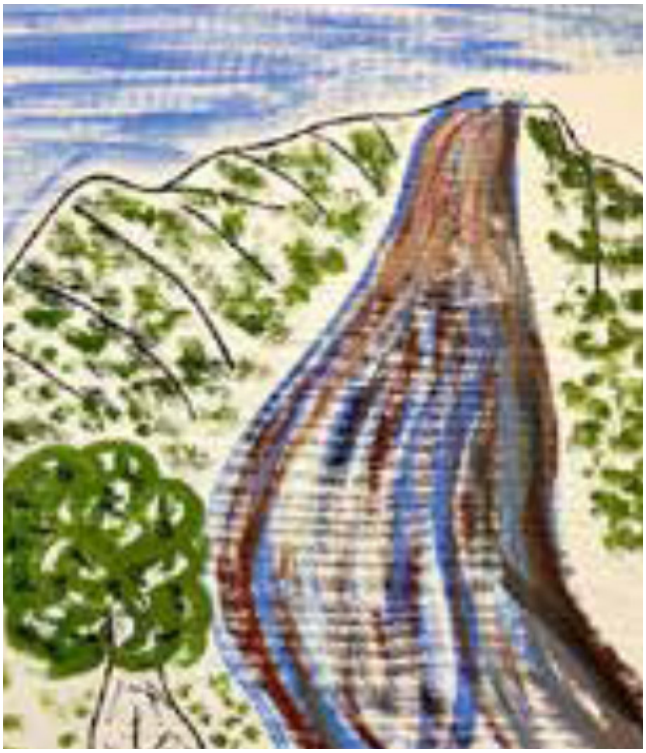
Image: Queensland Reconstruction Authority

The approach included the engagement of Queensland Reconstruction Authority staff with Elders from the Yalanji, Jalunji and Ngungkul people to learn the story of the community, the effects of the flooding and their vision for the future. The connection with the Elders and local council was the first time this approach had been used. This allowed the community's leadership to be involved and participate in the recovery process, recognising the role of both elected and traditional leadership.

To obtain these perspectives, 'yarning' was encouraged through picture cards, which focused on aspects of the community, cultural linkages and the damage caused by the event. The yarns improved the understanding of the story that was documented using the local language where possible.

As a way of facilitating the healing process linked to the plan, local artists created artwork to capture the event's story and the perceived future state of Wujal Wujal after the community recovers.

The plan is owned by the community, is accessible, highlights resilience, reflects the connections to the community and is completely distinctive. The community wants to share their journey with others as a story of strength. The final plan has been described as 'the embodiment of community; more than words on a page'.



Artists captured stories of floods.

Image: Wujal Wujal Art Group

Lessons from USA summit can help protect animals and people

Steve Glassey, University of Otago and Bushfire and Natural Hazards Cooperative Research Centre

Emergency management has come a long way over the past decade in recognising the intrinsic link that humans have with animals. Including consideration for animals throughout the phases of risk reduction, readiness, response and recovery has significant benefits for animal welfare and also for the safety and wellbeing of humans.

In December 2019, 'like minds' came together at the biennial National Alliance of State Agricultural and Animal Emergency Programs (NASAAEP) Summit in Bellevue, Washington. The summit attracted career and volunteer practitioners involved in animal management during emergency events from animal welfare organisations, state agricultural departments, the veterinary, military and academic sectors as well as training organisations. The NASAAEP is the only conference of its type and is an ideal forum at which to share ideas to improve animal management. The inclusive and open nature of the summit encourages participation and networking to build critical relationships. The all-stakeholder operating model of NASAAEP would be beneficial to replicate in Australasia.

Dealing with animals during times of disaster is not unique to the United States of America (USA). Other countries, including Australia and New Zealand, lack personnel appropriately trained in response capability for animals and ambiguity exists about animal decontamination responsibilities. There is also a deficiency of response-information sharing (incident management and animal registration platforms) and an absence of lessons management for animal response.

The USA has made major advances in these areas including the federal *Pet Emergency Transportation and Standards Act* of 2006 that has caused a positive cultural shift in companion animal emergency planning and funding. The USA has led the way in championing pet-friendly shelters, in particular, carrying out trials proving the effectiveness of co-habitated evacuation shelters where animals and people share living space. In New Zealand, the concept of co-located shelters (animals and people are in separate but close living facilities) have been established in Wellington but are largely overlooked elsewhere. The USA is moving away from animal-only shelters during evacuations in order to facilitate animals being cared for by their owners.

NASAAEP speakers shared their experiences of California's deadliest and most destructive wildfire in history, the Camp Fire of 2018. In particular, they examined the effectiveness of different emergency animal sheltering options. They found animal-only shelters to be unsustainable and these could not be scaled up for large numbers of animals; in the Camp Fire this involved an evacuation of 52,000 people and 4000 animals. A further 6000 animals were left in-situ with feed-in-place provisions.

The speakers found that animal-only shelters generally offered less individual animal care, attention and exercise that resulted in poor animal welfare outcomes. Conversely, shelters offering co-location and co-habitation provided higher levels of enrichment and care for animals. It also offered a sense of purpose for owners to control animal diets to avoid sudden changes in food that might result in diarrhoea. The paper-based animal registration systems used failed when managing large numbers of animals. Other complications occurred due to unclear handwriting as well as volunteers being unfamiliar with the forms.

Speakers such as Dr Dick Green and Tim Perciful from the American Society for the Prevention of Cruelty to Animal (ASPCA) detailed the significant cost and staffing requirements of animal-only shelters when compared to co-located and co-habitated shelters. In one county, during Hurricane Harvey in 2017, the county judge ordered that a co-located shelter be established for animals and people, possibly reflecting a cultural shift in thought that pets are very important to people and that saving animals can save human lives.

Other advances in the USA include rural communities at risk of wildfire having responsibility to prepare for such events. They have rallied together to create fire-safe evacuation zones, which are areas that have been cleared of vegetation and they have areas prepared

Left to right: Steve Glassey, University of Otago and BNHCRC Associate Student, Steve De Grey, Massey University and Professor Chris Riley, Massey University.

Image: supplied by Steve De Grey

where large animals can be safely evacuated to. This is similar to the concept of 'lily pads'; areas of elevated ground that are constructed to protect large animals during flooding.

Summit participants from the University of Otago and Massey University gave presentations on lessons management and stress injuries, respectively, with the former selected as an encore presentation. Other New Zealand technological accomplishments were presented, including a GIS-based companion animal population calculator and the successful application of the D4H incident management platform for animal response coordination and animal registration by Animal Evac New Zealand.

The ASPCA provides an innovative and collaborative response partnership model that encourages animal welfare groups to come under its auspices during disaster response. This is achieved via a memorandum of understanding that makes funding, equipment and training available for high levels of integration, coordination and improved resilience. This collaborative style of leadership undoubtedly has improved the effectiveness of animal disaster response experienced in the USA and adopting this approach within Australasia could yield similar benefits.

Acknowledgment

The author acknowledges the support of the University of Otago, the Bushfire and Natural Hazards Cooperative Research Centre, the American Society for the Prevention of Cruelty to Animals, International Fund for Animal Welfare and Animal Evac New Zealand for their support in making attendance of the summit possible.

For information, visit www.thenasaaep.com. For a video recording of the presentation given on lessons management, visit www.animaldisastermanagement.blog.

Is emergency planning for infants and young children adequate?

Associate Professor Karleen Gribble, Western Sydney University

Emergency plans should account for the special needs of vulnerable groups to mitigate the risks they face and to provide appropriate assistance. Australian research has examined the vulnerability of children, particularly infants.

Infant vulnerability relates primarily to feeding needs. Infants have specific food and fluid requirements, immature immune systems, are susceptible to dehydration and are dependent on others for their needs. While breastfed and formula-fed infants are vulnerable, formula-fed infants are more so because their wellbeing relies on access to resources that may be compromised, like clean water, electricity or gas for heating water, hygienic food preparation and washing environments as well as infant formula.

In past emergency situations, Australia has experienced high rates of infant sickness requiring medical treatment. Difficulties with feeding infants have included mothers avoiding or delaying evacuation because of feeding concerns, extended delays in supply of infant formula to evacuation centres, infants being wet-nursed in evacuation centres because of a lack of infant formula, parents using toilet facilities or pooled rainwater to wash baby milk bottles and confusion about what to pack in emergency kits for babies.

World Health Assembly Resolutions and the Australian National Breastfeeding Strategy[1] require that feeding infants and young children in emergencies (known as IYCF-E) planning be implemented by Australian governments. However, a Western Sydney University and the World Breastfeeding Trends Initiative found planning for infants during emergencies is inadequate.

The study considered emergency plans and guidance from all levels of Australian government. The content of these plans was examined for references dealing with the needs of infants and young children. As a comparison, the collected plans and guidance were searched for content dealing with the needs of animals. Documents were analysed for content and meaning.

Findings summary

The collected plans and guidance contained numerous pointers to the desirability of having plans that address IYCF-E. However, the research revealed a dearth of planning for the needs of infants and young children and for IYCF-E specifically. Where plans contained content related to infant feeding, they lacked detail, lacked important elements or evidence showed that they were not followed. The study found that guidance related to heat waves contained information that could prove dangerous, even fatal, to infants, such as 'Give children plenty of water before they become thirsty'. The study also found that no government or emergency services agency had designated responsibility for IYCF-E or children in general. In addition, only Queensland plans had detailed information on what to include in an emergency kit for babies.

In comparison, content related to animals was evident and comprehensive at all levels of government with clear lines of responsibility and detailed emergency preparedness guidance for the public.

This is not a new problem. An audit conducted in 2013 by Save the Children Australia concluded that children suffer from 'benign neglect' in emergency planning and their needs are not routinely nor systematically considered.

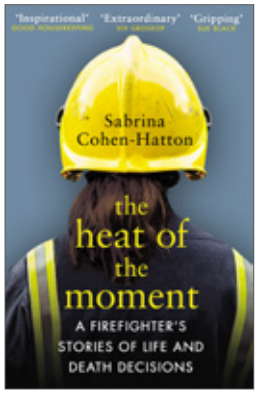
The study recommends that the Australian Department of Health convene and appropriately fund a national advisory committee for IYCF-E to incorporate the needs of mothers, caregivers, infants and young children into emergency planning at all levels of government. Also recommended was that health departments at state and territory levels should be responsible for IYCF-E, that guidance on IYCF-E be developed and that existing training on IYCF-E be made available to relevant health and emergency workers.

This research is available at https://bmcpublichealth.biomedcentral.com/track/pdf/10.1186/s12889-019-7528-0.
Further information: Karleen Gribble: k.gribble@westernsydney.edu.au.

1 *Australian National Breastfeeding Strategy*, at: https://apo.org.au/sites/default/files/resource-files/2019/08/apo-nid253556-1379891.pdf.

the heat of the moment

Reviewed by Associate Professor Valerie Ingham, Charles Sturt University



Published by Penguin Random House

Author: Dr Sabrina Cohen-Hatton

ISBN: 9780857525765

Racy and engaging from the get-go, Sabrina Cohen-Hatton compels her readers to speed through these pages at the rate of a responding fire truck. With expert deftness she builds the intensity from surviving as a homeless Welsh teenager to the newly appointed Chief Officer of West Sussex Fire and Rescue. *The heat of the moment* continues to increase in momentum as Cohen-Hatton draws us closer into the centre of incident command to stand with her as she faces the most difficult and traumatic life-and-death incident decision-making. From here, she expertly manoeuvres readers into a position that creates a sense of imperative and immediacy; fulfilling her stated purpose to show the 'human side of firefighting'.

Despite this focus she manages to inject the odd divergence to her PhD research on behavioural neuroscience. Her findings changed UK national policy, where the concept of 'decision control' is now embedded.

Put simply, this is a rapid mental check between making a decision and enacting it. Cohen-Hatton's research found this is where most human error occurs. Her goal is to support effective incident command and safety management. Combining the science (which she is well qualified to mention) and the emotional aspects of being a firefighter may not work for some, but it adds the solidifying dimension of expert voice to the strings of incident memoirs. On this note, a range of incident categories is incorporated without neglecting the emotional effects of being a firefighter; the adrenaline, stress and PTSD, all of which are tackled head-on in a raw and honest appraisal of her own experience. This has a normalising effect for the gamut of emotions experienced by emergency responders, not the least being survivor guilt and relief that were formative in her development as a firefighter and scholar.

This is an easy and gripping read, in part due to Cohen-Hatton writing in the first person with carefully simplified language. Footnotes are provided for the uninitiated, making this an accessible read for friends, family and other interested people who may have wondered what the working life of a firefighter is like. It is also a managerial textbook in palatable disguise because it combines autobiography with subtle teaching on managing difficult people, situations and experiences.

Cohen-Hatton has the luxury of interpreting people and saying it like it is because this is her book, not a journal article nor a training manual. As such, the medium works well, enabling her to write a thinly disguised memoir while providing accessible training in an attractive format to the firefighter mentality, which calls for fast-paced action and a rhythm that goes beyond the mundane.

There are many subtle messages in this book that, if preached at point blank range, would have fallen on hardened hearts. However, provided in the guise of memoir and delivered in the tone of confidentiality, they are palatable and consumable. This is a very clever strategy that possibly Cohen-Hatton herself does not realise she has employed.

Cohen-Hatton says sharing her early years was the most difficult thing she's ever done, but when reading her book I had to question this. Some of the incidents in the book are big and bloody and Cohen-Hatton doesn't shield her readers from the agony of the victims nor the angst of being in command.

This book is a poignant reminder that life is unpredictable and you can make a difference. It will make an excellent gift for partners, family and friends of emergency service personnel who've always wanted to know more about the job and what pressures their people face. Reflecting on her own past and the journey she has taken, she is keen to say her one big message is not to prejudge people. I think the one big message is not to judge Cohen-Hatton.

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Living with bushfires on the urban-bush interface

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ABSTRACT

Due to the attractiveness of living in a natural environment, more people are likely to reside in urban-bush interface areas that expose them to dangers from bushfires. Surveys conducted after fires over 2009–2015, indicated that many residents in urban-bush interface areas under-estimate their bushfire risk and do not prepare adequately for these events. For this study, householders living in urban-bush interface areas of Melbourne completed an online survey that showed that the attractiveness of the natural environment setting was the major reason for living in the location. The majority of respondents indicated bushfires as a negative feature of living in the urban-bush- interface. Compared with findings from post-bushfire surveys during 2009–2015, a greater number of respondents had a bushfire survival plan to evacuate as well as being prepared to evacuate if threatened. However, one in eight householders planned to 'wait and see' how a fire developed before taking action. Also, levels of activities to reduce house vulnerability to bushfire were low. For some householders, this was because they believed such preparations would be ineffective and, thus, pointless. This unpreparedness presents challenges to emergency management organisations and, in particular, fire agencies.

Introduction

In Australia, many people reside on the edges of cities in areas with high levels of vegetation sufficient to fuel major bushfires. These areas typically have large numbers of houses that abut or intermingle with flammable bushland vegetation (Radeloff *et al*. 2005). These areas are known variously as wildland-urban interfaces (Radeloff *et al*. 2005), rural-urban interfaces (Pearce 2019), peri-urban areas (Llausàs *et al*. 2016) or the urban-bush interface (Solangaarachchi, Griffin & Doherty 2012). Over the last 20 years, several Australian cities have experienced disastrous bushfires in the urban-bush interface, including the Canberra 'firestorm' in 2004, the Perth Hills fires of 2011 and 2015, the south-east Tasmania fire in 2013, the Blue Mountains fires of 2013 and the Adelaide Hills fire of 2015. Fires in the urban-bush interface are often more difficult to control than fires burning in areas with fewer houses (Radeloff *et al*. 2018) and have the potential to lead to very large losses of assets.

Growth in population, demand for housing and desire to live in a natural environment are leading to more people moving into the urban-bush interface, causing an increase in the threat from bushfires (Lohm & Davis 2015, Pearce 2018, Radeloff *et al*. 2018). While people who live in the urban-bush interface are increasingly exposed to bushfire, they may not adequately perceive the risk to which they are exposed (Every *et al*. 2015, Langer & Wegner 2018). There is limited research that has directly examined the experiences, beliefs and actions of residents in urban-bush interfaces in relation to bushfire risk. A study by Beringer (2000) reported low levels of bushfire preparations by urban-bush interface residents. Following the 2009 Victorian Black Saturday bushfires, surveys were commissioned and included urban-bush interface residents. Between 2009 and 2015, the Bushfire CRC and Bushfire and Natural Hazards CRC conducted nine post-bushfire surveys of householders threatened by serious bushfire events (see Table 1). Respondents included 1362 urban-bush interface residents. Survey findings indicated that prior to the bushfires, significant percentages of residents did not believe they were at risk and had no plan for what to do in the event of a bushfire. In addition, the surveys found that household bushfire safety planning and preparation levels for evacuation, house protection and property defence were lower than what fire agencies regarded as desirable (McLennan, Paton & Wright 2015). This finding is consistent with a longitudinal study of a sample of Victorian households in areas deemed to be at notably high risk of bushfire, most in urban-bush interface locations (Muir *et al*. 2017).

Lohm and Davis (2015) reported fewer negative findings from interviews (n = 11) with householders in at-risk locations on Melbourne's urban fringe. Using a qualitative methodology, they concluded that residents had a strong

Table 1: Threatened householders in urban-bush interface locations reporting no pre-fire concern and pre-fire plans.

Location, date; (number of interviews/online survey responses)[a], type of location	No pre-fire concern	No pre-fire plan	Planned to leave	Planned to stay and defend	Planned to wait and see
1. Eight fire complexes, Victoria; February 2009; (126)[b], IM, IF	25	33	25	33	3
2. Clifton Hill, WA; January 2011 (40)[c], IM	7	20	65	10	5
3. Perth Hills, WA; February 2011 (456)[c], IM, IF	nr	24	28	20	28
4. South-eastern Tasmania; January 2013 (245) [c], IM, IF	8	12	47	26	15
5. Shoalhaven, NSW; January 2013 (80)[d], IM, IF	16	28	nr	nr	nr
6. Blue Mountains, NSW; October 2013 (79)[e], IF	27	17	23	42	18
7. Port Stevens, NSW; October 2013 (52)[e], IM	44	52	8	25	15
8. Parkerville, WA; January 2014 (91)[c], IM, IF	9	19	49	25	7
9. Sampson Flat, South Australia; January 2015 (193)[f], IM	15	17	18	37	18
Unweighted average	22	25	33	28	14

Note: IM = housing bushland intermix, IF = housing bushland interface, nr = not reported.

[a] No.1–No.8 were interviews, No.9 was an online survey, [b] McLennan, Elliot and Omodei (2011), [c] McLennan, Paton and Wright (2015), [d] Mackie and colleagues (2013), [e] McLennan, Wright and Birch (2013), [f] Every and colleagues (2015).

emotional attachment to their property but were aware of the danger posed by bushfires and the likely limited effectiveness of preparations to protect their property. Lohm and Davis (2015) proposed the centrality of an ongoing existential dualism for the residents: a precarious balance of living in an environment that was both healthy and dangerous. The study suggested that bushland-dwelling residents engaged in a form of emotionally based risk management in which possible future danger from bushfire was counterpoised by love of the surrounding natural environment.

Anton and Lawrence (2016) found that while emotional place-attachment to home was related to bushfire mitigation and preparation in rural communities, this was not so in urban-bush interface communities. A study by Strahan, Whittaker and Handmer (2018) surveyed 457 mostly urban-bush interface residents in two areas that had experienced recent bushfire threats. On the basis of a cluster analysis of the information provided by the residents, seven groups or archetypes, of residents were identified. The seven archetypes were related to their stance on evacuating or remaining at their property under imminent bushfire threat:

- responsibility-denying evacuator
- dependent evacuator
- considered evacuator
- community-guided evacuator
- worried waverer
- threat-denying remainer
- experienced and independent defender.

That study concluded that the differences among the archetypes meant that fire agencies needed to adopt a range of approaches to promote bushfire safety. This would accommodate the different motivations and expectations of the different archetypal groups.

Community research after the 2009 Black Saturday fires showed that the lack of bushfire preparedness of people living in the urban-bush interface presents a challenge for fire agencies.

Image: Jim McLennan

In summary, appreciable percentages of people in the urban-bush interface sampled in the 2009–2015 post-bushfire surveys commissioned by fire agencies seriously misjudged their level of risk, had not planned what to do in the event of a bushfire threat and were not well-prepared to survive. The study by Strahan, Whittaker and Handmer (2018) suggested important differences among urban-bush interface householders in their beliefs about bushfire danger circumstances and appropriate survival options. However, what seems lacking is a broader understanding of the reasons householders reside in urban-bush interface locations, their associated everyday life issues, their perceptions of the threat posed by future bushfires and how these perceptions relate to bushfire safety preparations. Lohm and Davis (2015) go some way towards addressing these issues. However, the study involved a very small number of urban-bush interface residents and the method of recruitment (posters in public places and social networking inviting residents to contact the researchers to discuss bushfire risk and preparations) may have resulted in an unrepresentative group of interviewees who were especially concerned about bushfires.

The present study used an online survey to examine the experiences of a sample of urban-bush interface householders on the fringes of Melbourne. The study included reasons for choosing to live in the location, positive and negative aspects of living in an urban-bush interface area, perceptions of bushfire threat and plans and preparations for such an event. The aim was to understand how residents in the urban-bush interface view bushfire threat to their properties in the context of their living choices and experiences as well as how they plan and prepare for the possible threat.

The research was conducted as part of a larger study investigating how bushfire safety preparations relate to people's bushfire risk perceptions and everyday life activities. The major finding was that levels of householder bushfire safety preparation actions were linked more to their bushfire-related household priorities than to their perceptions of bushfire risk (Koksal *et al*. 2019).

Method

Participants

A total of 127 householders completed a survey using the Qualtrics[1] online survey software platform. Respondents comprised slightly more women (n = 69, 54 per cent) than men (n = 58, 46 per cent). The median age was 58 years (*M* = 56.1, *SD* = 13.19, range = 21–84). Most (n = 121, 95 per cent) were property owners, not renters, and the median period of residency on the property was 10 years (*M* = 15, *SD* = 12.63, range = 1–50).

1 Qualtrics. At www.qualtrics.com/au/.

Survey questionnaire

The online survey was developed using information gained from interviews with 32 urban-bush interface householders about their experiences of near-bushland living (Koksal *et al*. 2019). The survey gathered information about eight aspects of living in the location.

Procedure

The research was approved by the La Trobe University Human Ethics Committee (Reference S17–17). In 2017, 4000 invitations were mailed to residences in six postal areas selected because of their extensive areas of bushland. The postal areas were in three local government areas on the northern fringes of Greater Melbourne being Macedon, Yarra Ranges and Nillumbik. Householders who resided in or within 100 metres of bushland were invited to participate in a study of their experiences of living in their location. The survey introduction defined bushland to include forest, grassland, scrub, parkland, farmland and state or national parks. Eligible householders accessed and completed the survey online. Householders provided the address of their property with the assurance that the information would be deleted once the distance of their home from bushland had been checked using Google Maps satellite imagery.

Results

Close to half (52 per cent) of the 127 respondents were employed and one-third (34 per cent) were retired. The majority (62 per cent) resided on properties larger in size (>0.1 hectares) than a typical urban residential block (Table 2). Most participants (89 per cent) reported they had adequate house and contents insurance against loss due to bushfire.

Table 3 summarises householder reasons for living in the bushland location, and the positive and negative aspects of living in that location. Preference for a natural environment location and the associated lifestyle were the most frequently reported reasons for choosing to live in the location. These were also the most frequently reported positive aspects of bushland living, followed by the sense of community. Concern about bushfire, as a negative aspect of the location, was reported by almost three-quarters (n = 94, 74 per cent) of respondents. While this was the most frequently reported single negative aspect of living in the location (28 per cent), other negative aspects related to daily living such as high property maintenance, lack of services and transport, power outages and poor telecommunications were also mentioned, accounting in total for 67 per cent of the negative aspects of bushland living.

In response to the question about how concerned they were about bushfires when considering whether to live in the location, 24 per cent were not at all concerned, 39 per cent were a little concerned, 31 per cent were moderately concerned and 6 per cent were very or

Table 2: Householder occupations and property types (N = 127).

Occupation		Per cent
Employed full-time		28
Employed part-time		24
Retired		34
Home duties		6
Full-time student		6
Unemployed, seeking work		2
Property type	Normal-sized residential (~0.1 hectares)	27
	Larger-sized residential (>0.1 hectares)	31
	Large 'lifestyle' property[a]	31
	Agribusiness (farm, winery, nursery, orchard, horse stable)	11

[a] Usually 1–10 hectares in size, in a peri-urban location, used primarily as a residence because of its natural environment amenity rather than as an agribusiness.

extremely concerned. Almost half the householders (n = 60, 47 per cent) reported awareness of a bushfire threat warning sometime during the previous 10 years. Of these 60 householders, 46 (77 per cent) also reported bushfires as a negative aspect of living in the location. There had been significant bushfire threats to all three local government areas over the past 30 years. Homes had been destroyed and lives had been lost in parts of the Macedon area in the 'Ash Wednesday' fires of January 1983. Homes had been destroyed and lives had been lost in more northerly suburbs of Yarra Ranges and Nillumbik local government areas during the February 2009 'Black Saturday' bushfires (these suburbs were not sampled for the study). However, there was no relationship between a householder's awareness of a previous bushfire threat and nominating bushfire as a negative aspect of living in the location: $\chi^2(1, N = 127) = 0.13$, $p>0.70$.

Responses to the question about how likely respondents believed that their property would be threatened by a bushfire in the next five years were:

- extremely unlikely, 1 per cent
- highly unlikely, 4 per cent
- somewhat unlikely, 14 per cent
- somewhat likely, 32 per cent
- highly likely, 25 per cent
- extremely likely, 11 per cent
- almost certain, 13 per cent.

Survey questions:

- Demographic information.
- Please indicate: (a) the main reasons you chose to live in the location, (b) the most important things you enjoy about living in the location and (c) any negatives associated with living in your location.
- When you were deciding whether to live here, how concerned were you about dangers from bushfires? (1) not at all concerned, (2), a little concerned, (3) moderately concerned, (4) very concerned or (5) extremely concerned.
- How vulnerable do you think your house is to loss or damage due to a bushfire if one threatened your property? (1) not at all vulnerable, (2) very low, (3) low, (4) moderately vulnerable (5) quite vulnerable, (6) highly vulnerable or (7) extremely vulnerable.
- How likely do you think it is that your house will be seriously threatened by a bushfire in the future - say in the next five years? (1) not at all likely, (2) extremely unlikely, (3) highly unlikely, (4) somewhat unlikely, (5) somewhat likely, (6) highly likely or (7) extremely likely.
- Has there been a bushfire in the area since 2007? Yes or No.
- Would you say that you have a household plan for what you will do if the property is threatened by a bushfire? Select from (i) All members stay to defend the property, (ii) all members leave as soon as possible for a safer destination, (iii) some members leave as soon as possible, others stay to defend the property, (iv) wait and see how serious the threat is then decide to either leave or stay to defend the property or (v) no definite plan.
- Completion of a 15-item version of the Bushfire Safety Preparation Checklist (BSPC-15). This was a shortened version of the 23-item measure developed by McLennan and Elliott (2011). The 23-item measure was used in a pilot interview study. However, many of the householders interviewed were unclear about what constituted adequate bushfire safety preparations for their circumstances and inappropriately chose a 'Not Applicable' option for several of the items. It was decided to use a shortened version of the measure. Only items that were about evacuation or house protection preparations that had been answered appropriately during the pilot study were used. These 15 items are listed in Table 3. The internal consistency reliability was adequate for a checklist measure: $\alpha = 0.65$. The BSPC-15 comprised two sub-scales of Evacuation Preparations (five items, $\alpha = 0.55$) and House Protection (ten items, $\alpha = 0.60$).

Table 3: Living in the bushland location: initial reasons, positive aspects, negative aspects (N = 127)

Reasons for initially choosing to live at the location (total number of reasons, n = 454)	Percentage of number of reasons[a,b]
1. The natural environment	18
2. The lifestyle opportunities	18
3. Quiet, little traffic	16
4. Healthy, no pollution	13
5. Familiar with the area, liked it	13
6. Affordability of the property	12
7. The nature of the community	4
8. Near to work	3
9. Close to transport	3
Positive aspects of living in the location (total number of reasons, n = 267)	
1. The natural environment	42
2. The large size of the property, lifestyle	27
3. The sense of community	25
4. Public transport and accessibility	7
Negative aspects of living in the location (total number of reasons, n = 335)	
1. Threat of bushfire	28
2. High maintenance needs of the property	21
3. Distance from shops and facilities	12
4. Poor telecommunications service	12
5. Lack of utilities and services, power outages	11
6. Lack of public transport	11
7. Unsatisfactory road access	3
8. Poverty, crime	2

[a] Participants gave multiple responses, [b] Percentages may not sum to 100 due to rounding.

Responses to the question about how vulnerable their house was to loss due to bushfire were:

- low, 7 per cent
- moderately, 23 per cent
- quite, 31 per cent
- highly, 23 per cent
- extremely, 16 per cent.

Reported frequencies of household plans in the event of a bushfire threat were:

- all members leave (n = 76, 60 per cent)
- all members stay and defend the property (n = 15, 12 per cent)
- some members leave while others stay and defend the property (n = 18, 14 per cent)
- all members wait and see how serious the threat is before making a final decision to leave or stay and defend the property (n = 17, 13 per cent)
- no household plan (n = 1, 1 per cent).

The median BSPC-15 total score was 7. That is, half the householders had undertaken half or fewer of the 15 bushfire checklist safety actions (Table 4). The mean BSPC-15 total score was 7.4 (*SD* = 3.26). BSPC-15 total score was related significantly to householder age ($r = 0.22$, $p = 0.013$) and to residing on a larger-than-standard-sized residential property ($r = 0.21$, $p = 0.020$). It was not related significantly to retired occupational status, years of residence at the location nor to awareness of previous bushfire threat warnings.

BSPC-15 total scores were not correlated significantly with perceived bushfire probability ratings ($r = 0.10$, $p = 0.126$) but were related negatively, though not strongly, to perceived house vulnerability ratings ($r = -0.18$, $p = 0.046$). The finding of a negative relationship was unexpected. However, it seemed plausible that some householders who judged their house was notably vulnerable to bushfire attack might be reluctant to spend time, effort or money on potentially fruitless attempts to improve the survivability of the house during a bushfire.

In order to test this, separate analyses were conducted using the five-item evacuation preparations sub-scale and the ten-item house protection sub-scale of the BSPC-15 (Table 5). Scores on the house protection sub-scale were significantly negatively correlated with the perceived house vulnerability rating ($r = -0.26$, $p = 0.003$) but were not significantly correlated with perceived bushfire probability ratings. Scores on the evacuation preparations sub-scale were not significantly correlated with perceived house vulnerability ratings, nor with perceived bushfire probability ratings. All relationships in Table 5 were tested for curvilinearity, but no evidence was found.

Comparison of responses to the two BSPC sub-scales indicated that some respondents viewed the relative importance of the two aspects of bushfire safety preparation differently. The median score for the five-item evacuation preparations sub-scale was 4: that is half the householders had undertaken 80 per cent or fewer of the five listed preparation actions. The median score for the ten-item house protection sub-scale was 3: that is, half the respondents had completed only 30 per cent or fewer of the ten-listed preparation actions. Reporting adequate house insurance was not related meaningfully to evacuation preparation sub-scale score ($r = 0.09$), nor to house protection sub-scale score ($r = 0.01$).

Google satellite imagery was used to categorise homes as being at high-to-medium danger (<80 metres from

Table 4: Percentage of respondents who had implemented bushfire safety preparation actions.

Preparation action[a]	Household bushfire safety plan			
	Evacuation[b] (N = 76)	Defence[c] (N = 33)	Wait and see (N = 17)	All (N = 127)[d]
	%	%	%	%
House protection preparations				
Removed combustibles	57	48	65	55
Cleared grass and leaf litter	51	52	71	53
Installed water supply (tank, pond)	46	79	53	56
Removed tree branches and bushes	39	55	47	44
Covered gaps in roof and walls	34	45	29	36
Installed seals to external doors	30	39	35	34
Installed self-powered water pump	29	70	24	39
Landscaped to reduce bushfire fuels	26	39	35	31
Installed house protection sprinkler	14	45	18	23
Installed screens or shutters to windows	1	3	6	2
Evacuation preparations				
Chosen a safe evacuation destination	87	82	65	82
Planned safe evacuation route	75	67	76	72
Decided on a trigger to leave	75	45	53	64
Obtained a battery-powered radio	59	58	59	58
Prepared important documents and valuables ready to go	51	44	29	46

[a] In descending order for those planning to evacuate, [b] All members evacuate, [c] One or more members stay and defend, [d] One household did not have a bushfire plan.

Table 5: Correlations, means and standard deviations.

Measure	2	3	4	5	*M*	*SD*
1. House protection preparations[a]	0.24**	-0.26**	0.04	0.12	3.8	2.29
2. Evacuation preparations[b]		-0.02	0.09	0.09	3.3	1.39
3. Perceived house vulnerability[c]			0.52***	0.22*	5.2	1.17
4. Perceived bushfire likelihood[d]				0.17	5.6	1.36
5. Distance-based house danger[e]					0.46	0.50

*p<0.05, **p<0.01, ***p<0.001

[a] Score range 0–10, [b] Score range 0–5, [c] Score range 1 (not at all)– (extremely), [d] Score range 1 (not at all)–7 (extremely), [e] 0 (>80 metres from vegetation) and 1 (<80 metres from vegetation).

bushland) or at lower danger (>80 metres from bushland). This was based on findings by Blanchi and colleagues (2012) from historical Australian bushfire house loss data where the probability of house loss decreased markedly when the distance of the house from bushland was greater than 80 metres. House danger category was related significantly to perceived house vulnerability ratings (r = 0.22, p = 0.015) but not to scores on any of the other measures (Table 5).

Discussion

This study examined urban-bush interface householder experiences of living in or near to bushland. Despite the negatives associated with living in an urban-bush interface location it seems these were more than outweighed by the amenity value of the natural environment location. Compared with the overall findings from nine previous studies of urban-bush interface residents (Table 1) the responses from this study were similar with respect to the percentages reporting low levels of concern about a future bushfire, planning to defend property and planning to 'wait and see' when aware of a bushfire threat. However, in this study, all but one of the 127 urban-bush interface respondents reported having a plan and, for almost two-thirds, the plan was to evacuate—a pattern very different from that in Table 1. This suggests an increased level of awareness among residents in the urban-bush interface of the bushfire safety messages issued by the Country Fire Authority: bushfires are extremely dangerous, it is essential to have a bushfire survival plan and the safest plan is to evacuate.[2]

Perhaps the most interesting aspect of the findings was the negative relationship between perceived vulnerability of homes to bushfire attack and preparations to reduce what Cohen (2000) characterised as 'home ignitability'. This is consistent with findings by Lohm and Davis (2015) that many urban-bush interface residents accept the possible sacrifice of their home in return for the perceived benefits of living in the natural environment; some concluding there is nothing they can do to mitigate the threat to their homes. In some cases, the conclusion may be well-founded. However, for others, their pessimism may not be warranted. Judicious vegetation management and modifications to the house might reduce the probability of destruction, while also preserving the natural environment. How to encourage residents in the urban-bush interface to reduce the 'ignitability' of their homes through vegetation management and 'hardening' houses against ember attack is a challenge for fire agencies. Changes to regulations governing construction of homes following the 2009 Victorian bushfires help mitigate the problem to some degree for new houses. However, the problem remains for houses built prior to 2009. Development of new and less expensive ways to retro-harden older houses is an option worth encouraging.

Limitations of this research are acknowledged. The recruitment methodology required residents to actively 'opt-in' to the online survey by typing a link into an internet search engine. This needed a level of motivation that may have resulted in the sample having higher levels of interest in issues associated with near-bushland living, including bushfire threat, compared with neighbouring residents who did not take part. Caution should be exercised in generalising the findings to urban-bush interface residents in other areas. Time constraints and limited funding did not permit use of other approaches such as a randomly generated telephone survey and visiting properties to conduct interviews that may have produced a more representative sample.

The median age of respondents (58 years) was older than the median age of adult Victorian residents, based on 2016 Census data of 52 years (Australian Bureau of Statistics 2016). This could be due to younger residents in the selected postal areas being more likely to live in rental accommodation and not close to bushland; only five per cent of respondents were renters.

Conclusion

The attractiveness of the natural environment and associated lifestyle means that people live in urban-bush interface locations, despite their awareness of the threat of bushfire. As more people move to the urban-bush interface, there will be increasing numbers of people exposed to bushfires. This study showed that many residents in the Melbourne urban-bush interface are aware of the risk, know that evacuation is the safest option and understand the basic preparations they need to undertake to evacuate. This is consistent with previous study findings but presents a more positive picture than previous post-bushfire studies. However, work still remains to help people in Melbourne's urban-bush interface understand the dangers posed by bushfire during last-minute evacuation that result from a 'wait and see' plan and how to better prepare their homes to resist bushfire threat. It is important for researchers to examine the issues affecting levels of bushfire preparation for residents in other Australian urban-bush interface areas.

At the time this paper was published, serious and significant bushfires were affecting many communities in NSW, South Australia, Tasmania and Victoria. Initial reports indicate that numerous homes, business and properties had been destroyed, many at the edges of rural townships.

2 Country Fire Authority website: www.cfa.vic.gov.au/plan-prepare/before-and-during-a-fire.

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Based on a presentation at AFAC19 - the annual conference of AFAC and the Bushfire and Natural Hazards CRC.

Unpacking the meaning of resilience: the Tarnagulla community definition comparing to the literature

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ABSTRACT

In 2018, the Tarnagulla Alternative Energy Group in regional Victoria took steps to plan futures for their town and its local community that strengthened resilience to the many challenges in the area including those from climate change. Believing that 'anticipation strategies work against known problems, while resilient strategies are better against unknown problems' (IFRC 2012, p.5) the group turned to the RMIT Climate Change Transformations group to unpack the meaning of resilience as it related to the town and community. The purpose was to produce a locally-focused Resilience Action Plan. Despite an international consensus and media propagation of resilience as a silver bullet to address future uncertainties, the concept remains contentious and challenging to implement. This paper considers how the various framings of resilience—the 'conceptual' (in literature) and the 'operational' (in policy)—relate to the Tarnagulla community's lived experience and the implications. The comparison allows to unpack a mixture of the complexities in understanding the nature of values, preferences, expectations, capacities, contested knowledge, as well as, the uncertainties. Study findings show that communities are best placed to frame their resilience, collectively and from a 'systems' perspective, and that implementing actions, which may require radical change, hinge on a political voice and sustained support from policy makers.

Introduction

Tarnagulla is a small rural town in central Victoria, which is nestled within Box-Ironbark forests. Tarnagulla, similar to other rural communities, faces many risks. These include ongoing 'general' challenges related to the town's development or 'climate-related' challenges. According to the Intergovernmental Panel on Climate Change (IPCC), climate change is expected to increase the frequency and intensity of extreme weather events (IPCC 2014) and exacerbate present challenges. The Tarnagulla alternative energy group (TAEG) community group wanted to proactively plan a future they wish to have and become resilient. However, they did not have a clear understanding of what constitutes 'resilience' and the process of strengthening it.

This paper asked the question: 'how does the Tarnagulla community's definition of resilience based on lived experiences relate to those within the relevant literature?'

This paper reports on the Tarnagulla community's understanding and definition of resilience. This constitutes preliminary findings of an action-research project titled 'Resilience Action Plan for and by the Tarnagulla Community'. The framing and defining of resilience used by three different groups (academia, government and communities) are discussed and compared to identify the resilience of what, of whom, by whom, when and how. The comparison allowed an unpacking of the inherent complexities in the definition; the values, preferences, expectations, capacities and contested knowledge. The findings have implications for those working in the disaster risk reduction sector. Of importance is the need to frame resilience collectively and to have a shared goal (communities, practitioners, policy makers and researchers), which has potential for communities to adapt to uncertain futures.

Method

A predominantly qualitative methodology was used to investigate the research question. There was limited use of quantitative methodologies.

The action-research approach means the research is intertwined with actions taken through co-production approach. This methodology is appropriate considering resilience cannot be imposed on a community by externally stakeholders in a top-down manner; communities must be empowered to take collective action. A co-production method assists to frame resilience collaboratively and the project is process-driven and outcome-oriented.

Seven local people from the TAEG became the Project Leadership Group. The idea of a leadership group comes from insights from the community development (e.g. asset-based community development approach by Krezmann & McKnight 1993) that indicates the benefits of a core group to serve as a backbone for any project. The Project Leadership Group worked as a conduit between the RMIT and the community, making sure the project ran smoothly and acted as a community champion. The blue box in Figure 1 shows the topics covered in the study.

To define resilience, this research adopted a theoretical framework for 'community resilience' developed by the International Federation of Red Cross and Red Crescent Society (IFRC) (2012), whereby community resilience relies on:

- basic needs
- consideration for six capital forms (i.e. human, social, economic, natural, physical and political)
- qualities of these capital forms (i.e. robustness, diversity, equity, redundancy and are well-located)
- capacities to learn, be adaptive and be resourceful (Figure 2).

These capital forms, their qualities and capacities were used to unpack resilience concepts (strengths identification, highlighted in blue in Figure 1).

Both qualitative and quantitative data for stage one (strengths identification) were collected through one, three-hour co-production workshop, one community event and two surveys (blue outlined phase in Figure 1). Focus group discussions with the Project Leadership Group accompanied these activities. With permission from participants, discussions were audio recorded, activities completed on butcher's paper were scanned and people's photographs were taken. Quantitative data to demonstrate participation was gathered through sign-in sheets during each event and through two survey questionnaires; one at the start of the project to define resilience and a second midway into the project. The first survey was delivered in a play-based way. The second survey was conducted via printed forms available at the local Post Office as well as online. The purpose of the surveys was to assess the participation, commitment and change in perceptions and values of the respondents during the project. Over 120 members, including the Tarnagulla community and stakeholders, either living, working or related to the Tarnagulla township, participated in the project. Thematic content analysis was used for the qualitative data and clustered into capital forms based on the IFRC (2012) community resilience framework.

The project received RMIT College Human Ethics Advisory Network approval, CHEAN B 21763-10/18.

Significance of framing for resilience concept

The concept of resilience has etymological roots in the Latin verb *resilire* meaning 'to rebound or recoil'. Broadly, it refers to a capacity to 'bounce back'. In the 1970s, the concept was introduced to disaster and risk management. Since that time, the concept has been widely adopted as evidenced in the *Sendai Framework for Disaster Risk Reduction 2015–30* (UNISDR 2015). A key contribution of the resilience concept is the introduction of a systems-based approach and a long-term view and promotion of multi-sectorial, multi-disciplinary and multi-scalar interactions. While the systems-based resilience concept has led to the convergence of previously divergent disciplines, sectors and scales (encapsulated in hazards, disasters, risk management, sustainable development, climate change and climate adaptation studies), the concept remains contentious.

The resilience concept is also used in the disciplines of human psychology, engineering, ecology, finance and business. Such proliferation in diverse disciplines has meant it is understood differently. This makes its implementation in practice very challenging. Some scholars (e.g. Bahadur & Tanner 2014, p.202) suggest that resilience lacks a 'normative dimension'. Consequently, others (e.g. Cascio 2009, Folke 2006, Smit & Wandel 2006, Walker & Salt 2006) agree that clarification of resilience to what, of whom, by whom, when and how is required if the concept is to have real significance.

The concept of framing is useful to unpack the complexity of resilience as it is intimately linked to sense-making processes. McEvoy, Fünfgeld & Bosomworth (2013) claim that 'framing occurs when people with different knowledge, experiences and personal backgrounds consider a common challenge and attempt to make sense of it from their individual or organizational perspective' (p.28–82). The process of framing allows people with different mindsets and backgrounds to reach consensus on a problem.

Typically, framings occur at three levels:

- meta-level
- conceptual
- operational.

At the meta-level, framing concerns 'normative' understandings as broadcast by media. Conceptual framing is provided by scholars while operational framing by practitioners or policy makers. Meta-level framing is beyond the scope of this paper. Here, the focus is on conceptual and operational framing as well as the Tarnagulla community's framing of resilience based on lived experiences.

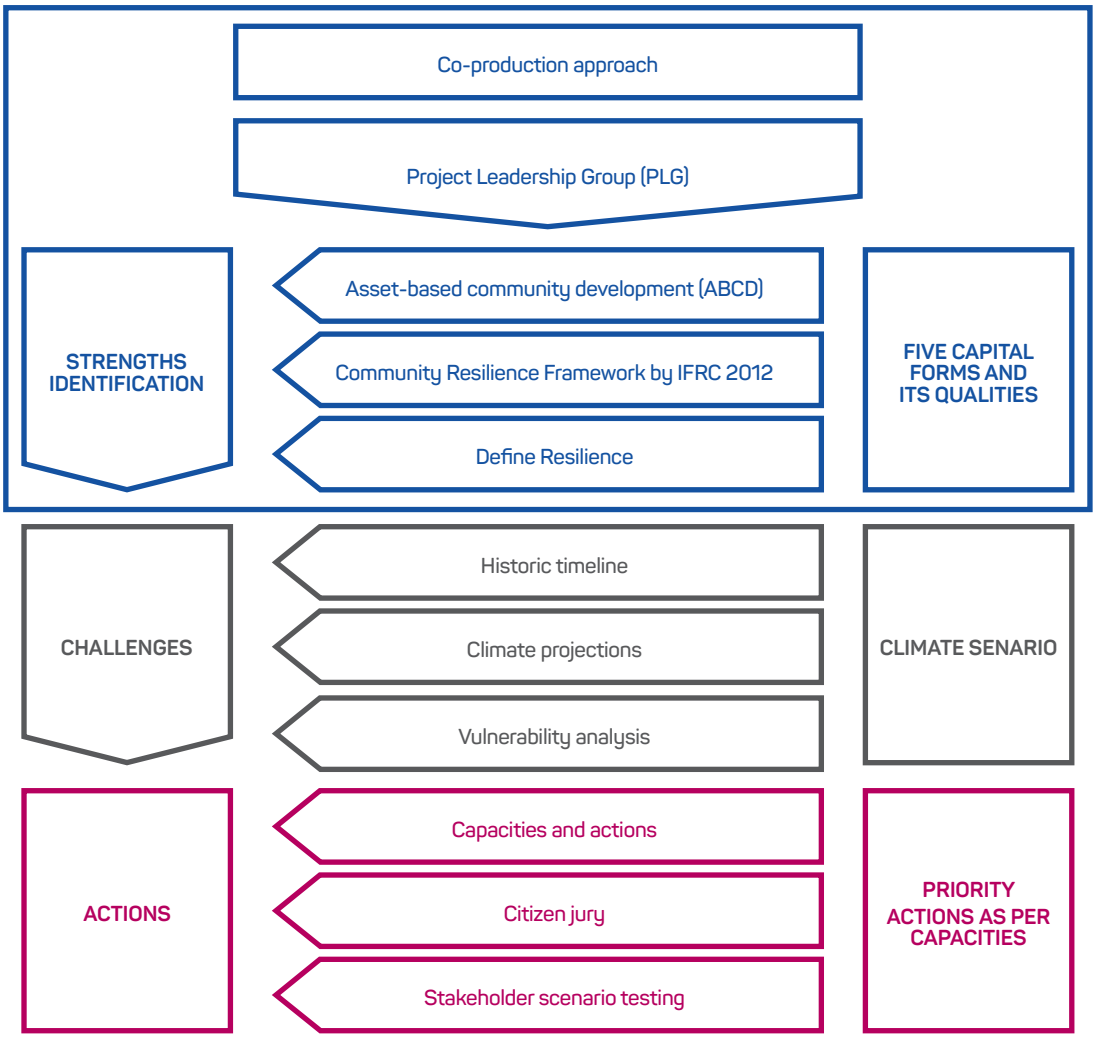

Figure 1: Methodology for the Resilience Action Plan for and by the Tarnagulla community (blue box shows the topics that are discussed in this article).

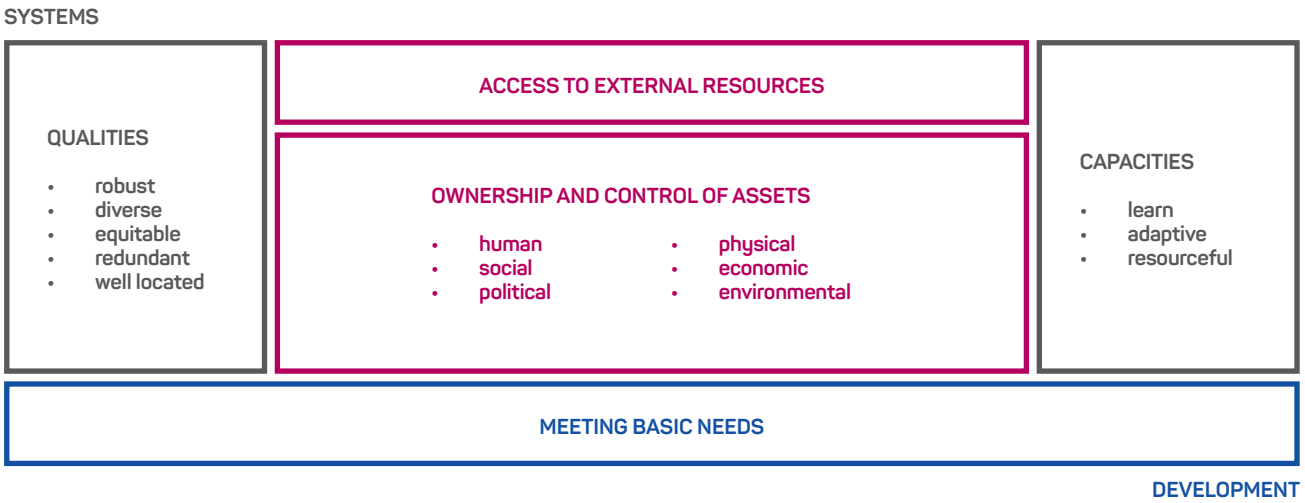

Figure 2: Conceptual framework for community resilience.

(IFRC 2012, copyright permission granted)

Conceptual framing

A review of literature since the 1970s reveals three conceptual framings of resilience (see Table 1). These framings of resilience are based on three disciplinary lenses:

- engineering (hard science)
- social science (soft science)
- socio-ecological (inter-relationships) (Vahanvati & Rafliana 2019).

Similarly, Handmer and Dovers (1996, p.495–96) proposed three typologies of resilience based on a society's response to threats or disturbance. These were:

- resistance and an inability to change
- change at the margins
- openness, adaptability and radical change to social and institutional structure.

These framings are represented in Table 1.

Conceptual framing 1: Engineering (hard science)

Engineering, or hard science, framing of resilience relates to the physical assets or a material's rate of return to a state of equilibrium after a small disturbance. Examples of engineering resilience include rebuilding of robust houses or building sea walls to protect coastal towns from inundation. The characteristics of hard science-based framing of resilience is a resistance to change. That is, resilience maintains one state of equilibrium, which is a linear view.

Conceptual framing 2: Natural (social science)

The resilience concept found its roots in natural science, informed by the work of the Canadian ecologist, Holling (1973) and later through the Resilience Alliance.[1] Holling (1973) defined ecosystem resilience as:

> *The capacity of a system to absorb and use or even benefit from perturbations and changes that attain it, and so to persist without a qualitative change in the system's structure.'*
>
> Holling (1973)

In natural sciences, resilience is a system's capacity to function either by withstanding or adapting to a changing environment by making minor changes. Essentially, ecosystem resilience is the ability of a species, flora, populations and overall systems to maintain functioning in fluctuating or adverse environments. The characteristics of ecosystem resilience are adaptive capacity, multiple equilibrium states and a non-linear view of achieving it (Handmer & Dovers 1996, Holling & Walker 2003). However, the 'rate' or 'magnitude' of change the system can withstand is questionable.

The social science framing of resilience differs from the ecological framing as humans can imagine, forecast and forward-plan due to an embedded 'social memory' (Folke 2006, p.253). Social resilience is the individual's or the collective ability to maintain functioning and also attain a 'desired' future trajectory by anticipation, planning and adaptation, which transcends spatial and temporal boundaries (Mulligan *et al.* 2016). The social sciences framing of resilience has come under lot of criticism, as it promotes a 'negative anti-community individualism' and 'self-reliance' (Davoudi *et al.* 2012, Mulligan *et al.* 2016, p.1).

1 Resilience Alliance, at: www.resalliance.org/about.

Table 1: Three conceptual framings of the resilience concept.

Framing of resilience	Typology based on response	'of who or what'	State and scale	'to what'	'when'
Engineering or hard science	To resist change Robust Well-located	'Hard' assets Physical assets	One stable state Linear	Hazards Rapid onset-disasters	Post-event Reactive Responsive
Social science **Natural science**	Change at margins Redundant Diverse system memory	'Soft' assets Human asset Social asset Natural asset	Multiple states Non-linear	Disaster Climate extremes	Pre- and post-event Anticipatory
Socio-ecological systems	Radical change Learn, adapt, transform Self-organise Resourceful	'Hard' and 'soft' asset interactions	Context specific Non-linear, cross-scale, dynamic interactions	General challenges Disasters Climate risk	Ongoing Adaptive Proactive

Adapted from Vahanvati & Rafliana (2019).

Conceptual framing 3: Socio-ecological systems

Socio-ecological systems framing is a recognition of inter-relationships between the social, ecological, economic and political systems. This resilience perspective 'enhances the likelihood of sustaining desirable pathways for development in changing environments where the future is unpredictable' (Adger *et al*. 2005, Folke 2006, p.254). Resilience to climate change is defined by the UN-Habitat (2014) as:

> *The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.*
>
> UN-Habitat (2014)

In this definition, socio-ecological systems resilience is the 'resilience to' climate-related disturbances and being able to maintain societal functioning when faced with disturbance or uncertainty. For example, a resilient socio-ecological system is a region that is ecologically, economically and socially sustainable. Socio-ecological systems resilience relates to (see Figure 2):

- meeting society's basic needs
- considering all asset types (human, physical, natural, economic, political and social)
- enhancing capacities to learn, adapt and change
- have qualities of robustness, diversity, equitability, redundancy and be well-located.

Operational framing of resilience

Implementing resilience for risk management are guided by international organisations such as the United Nations. Similar to academic discourse, the international inter-governmental and government discourse around resilience and risk management has progressed substantially since the 1994 World Conference on Natural Disaster Reduction. The emphasis has shifted from response to prevention and from short-term to continuous, long-term and multi-disciplinary efforts.

All levels of Australian government adhere to United Nations protocols and actions. However, the commitment to action has varied. In the 1960s, there was a shift in focus from war-affected to disaster-affected communities. In 2009, the National Emergency Management Committee was established by the Council of Australian Governments and in 2011 the *National Strategy for Disaster Resilience* (NSDR) was formulated to develop coordinated and cooperative efforts. While a 'multi-hazard', 'multi-agency' and 'whole-of-lifecycle' (Prevention, Preparedness, Response and Recovery) approach to disaster risk management (McEvoy *et al*. 2013) is advocated, the NSDR did not define resilience. Rather, the NSDR (Attorney-General's Department 2011, p.4) describes the characteristics of community resilience as:

- well-functioning under stress
- successful adaptation
- self-reliant
- social capacity.

The NSDR resilience characteristics as well as the Emergency Management Victoria definition of resilience (Emergency Management Victoria 2017, p.47) align with the social framing of resilience. Such framing can lead to governments devolving responsibility to communities.

Australian policy has come a long way from a narrow view of defending society during or following emergency events (i.e. post-event response) to pre-event (i.e. prevention). Yet there is a dominant focus on emergencies and response rather than prevention, which suggests an overall lack of focus on framing resilience from a socio-ecological-systems perspective and focusing on a whole-of-life approach to risk management.

Resilience as framed by the Tarnagulla community

To define resilience, the Tarnagulla community identified an agreed description of resilience; resilience to what, when, at what scale and of whom (Table 2). They also identified community strengths based on asset-based community development approach (Table 2).

Table 2 summarises the findings of what the Tarnagulla community valued and possessed. In response to resilience building 'when', 80 per cent of the Tarnagulla community participants proposed it as a continuous activity, not done before or after an event nor during times of need or prosperity. Participant quotes from the survey indicate the continuous nature of resilience activities:

> *The ability to manage the unforeseen in a manner that provides confidence to those effected and enables renewal in a purposeful manner that ensures that all concerns and all environmental aspects are considered.*
>
> (Project Leadership Group member)

> *Resilience is being 'Progressive in adversities'*
>
> (Participant)

In response to resilience 'to what', 80 per cent of participants agreed that the Tarnagulla community faces some pressing 'general' challenges as well as climate-related challenges. Figure 3 illustrates some of these challenges that include a declining and ageing population, unreliable amenities and infrastructure as well as long distances from business opportunities. In addition, one-third of the population is involved in caring for a family member.

Table 3 shows some of the 'certain' and 'uncertain' challenges facing the Tarnagulla community, both of which have 'general' and 'climate-related' challenges. 'Certain' challenges that relate to climate change include

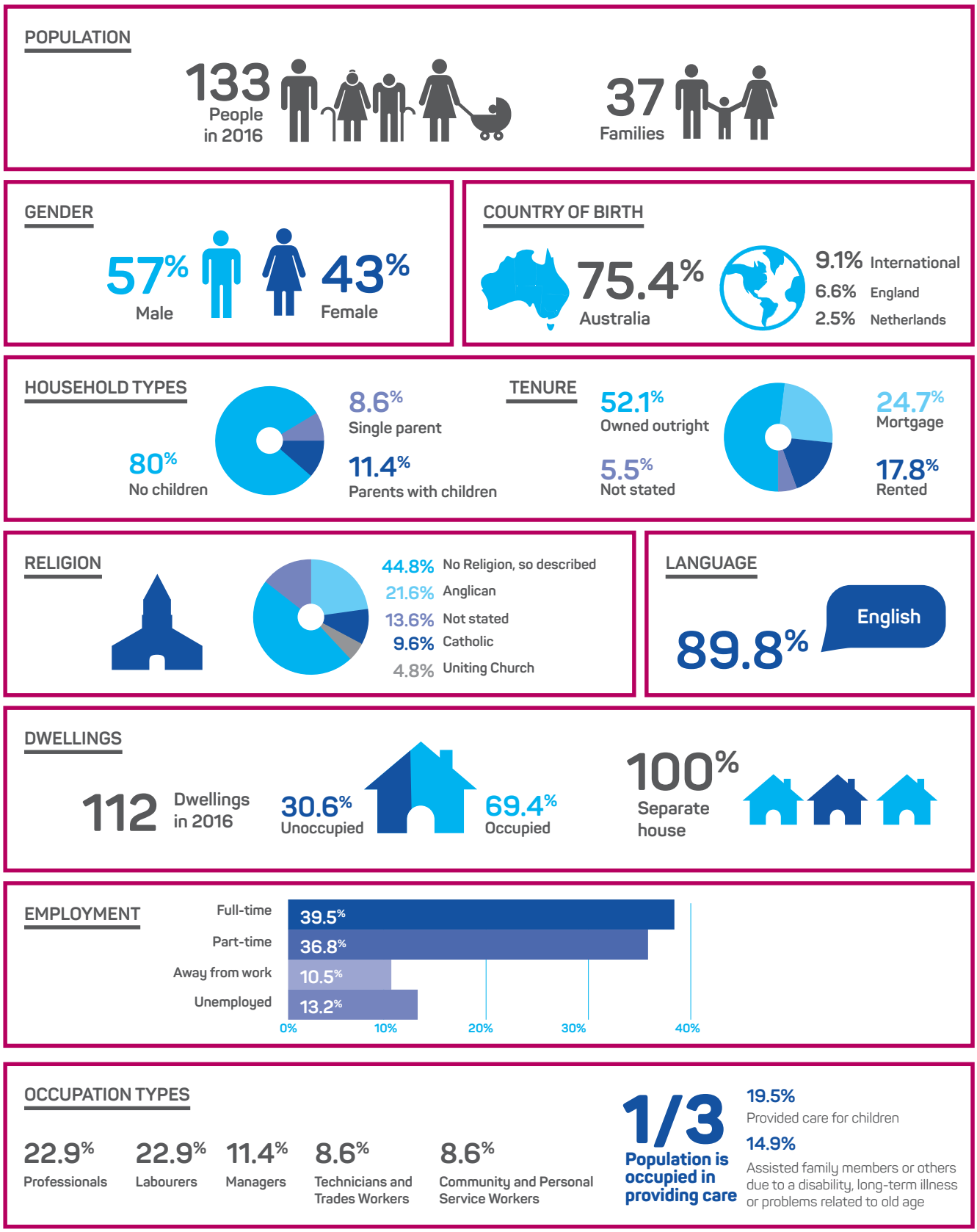

Figure 3: Infographic depicting the 'general' challenges facing the Tarnagulla community.

Source: Vahanvati and TAEG (2019).

Table 2: Framing of the resilience concept by the Tarnagulla community.

Resilience	Description	Percentage of response
Meaning and attributes of resilience (how)	Well-functioning	40
	Adapt, manage unforeseen situations, recover, bounce back Transform, renew, long-term, thrive, adapt	90–100
'to what'	Any expected or unexpected challenges (Table 3)	80
'when'	Continuous (during times of need and times of prosperity)	80
scale and state	Multiple scales (individual, community, town and regional)	90
'of who or what'	Social asset (Strong, trusting, informed and open-minded community, collective action)	100
	Physical asset	80
	Economic asset	80
	Natural asset	20
	Human asset	20

Source: Responses from 20 participants.

heat waves, increased bushfire risk, occasional floods, droughts and storms.

Participant response to 'of who and what' are illustrated in Figure 4. Social capital was the most important capital form to foster resilience. All participants said they valued their social capital and see it as important for resilience. For example:

> *Resilience is about the community trusting and respecting each other and working together to support those in need.*
>
> (Project Leadership Group member)

> *Personal view that refugees be invited [to settle in Tarnagulla]. Transport would be difficult although [there is a] weekly bus to and from Bendigo.*
>
> (Participant)

The Tarnagulla community is diverse in gender and age. Community members are active in volunteering and various community activities. They are open-minded and have welcomed refugees to settle in the town.

The community's physical capital is identified as the second most important capital form to build resilience. While 80 per cent of participants said they are proud of

Table 3: Resilience 'to what' challenges as defined by the Tarnagulla community.

Certain/Possible challenges	Uncertain/Probable challenges
Ageing population	Decrease in population Multiple committees but disconnected
Remoteness from amenities (health care, high school) School future (34 pupils at present and only reasonably secure) Buildings (houses rundown, low land value)	Lack of attraction to town, no reason to stop or visit
Heatwave period extended Average temperature rise (greater than 40°C)	Wetter (floods, rain, storms) Unreliability water source and supply Drier (fauna loss, frost)
Remoteness from employment opportunities Energy future uncertain Fuel cost increasing, limited public transport options	Farming futures

Source: Vahanvati and TAEG (2019).

their 1960s heritage buildings, they also acknowledge that these buildings are ageing with 30 per cent being unoccupied and not designed for a changing climate. For example, the houses are not designed to withstand bushfire embers nor storms and heatwaves. The survey revealed that very few residents have houses insured for climate extremities. Locals think that low reliability of basic services and infrastructure has made their town unattractive. Challenges related to services include energy (longer power outages), potable water (currently getting low-pressure, gravity fed piped water from neighbouring town) and sanitation (septic tanks as the only option). Infrastructure challenges include minimal public transport and healthcare services (ambulance can take up to 45 minutes to reach the town). This project led to 80 per cent of participants wanting to make their houses robust, improve their access to amenities and beautify the town to attract people to live in the area, as shown:

> *Preservation/upgrade of historical look of [the] main road. Businesses are needed to encourage tourism/ local economy.*
>
> (Participant)

> *More businesses/larger population/we need transport/medical and more help for the elderly.*
>
> (Participant)

> *Self-sufficient electricity supply or, at the least, some form of backup power.*
>
> (Participant)

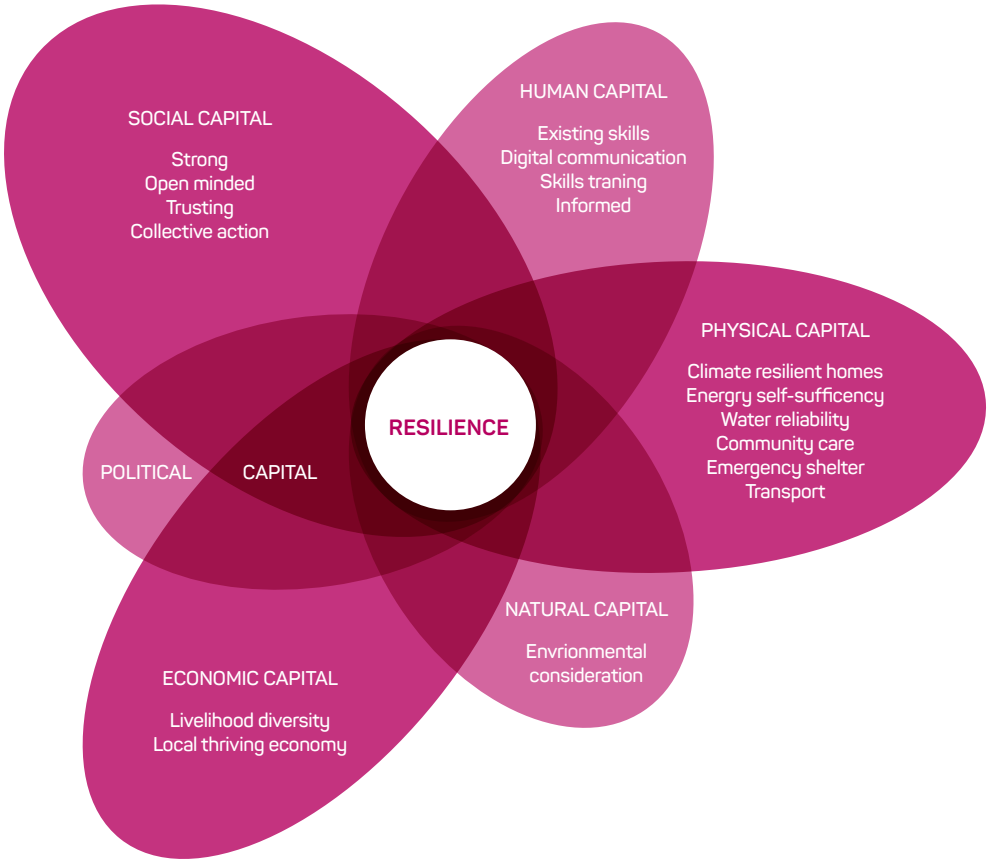

Figure 4: Resilience 'of who and what' as defined by the Tarnagulla community.

Note: the size of the oval indicates the amount of significance placed on that capital form by the community.

Economic capital was identified as an equally important capital form to the physical capital to build resilience. Survey quotes suggest that participants discussed physical and economic capitals together. A few householders have started diversifying their livelihoods (e.g. starting bed and breakfast businesses or farmers having multiple sources of income (sheep rearing and crops)). Even so, there is still more to be done to attain a self-sustainable and thriving economy.

The Tarnagulla community's definition and vision for the future, or what it would mean to be resilient, is:

> *The Tarnagulla community of the future will be different, and together we will work towards developing and sustaining a thriving town. We will have a strong social culture built on a diverse and connected population representing and welcoming peoples of all ages, status, ethnicities and interests. We will have a sustainable economy built on local agriculture, business, clubs, organisations and tourism. To be resilient we will have developed the necessary capabilities to confidently address our future.*
>
> (Project Leadership Group members)

This definition of what constitutes being resilient involves all capital forms. It is continuous and requires renewal of the town's economy and physical capital. This requires ongoing commitment to adapt skills and capacities to meet contstantly changing and uncertain futures since there is not one future. These definitions fit under socio-ecological systems resilience framing.

Implications

The findings confirm that the Tarnagulla community's framing of resilience is mature and rooted in place-based and lived community experiences. Despite this mature framing of resilience, the Tarnagulla community is constrained by what it can implement and achieve in the long term.

This project was supported by the Victorian Government under a climate change innovation grant as a gesture to help communities build their social capacity and be self-reliant. However, such short-term support, without follow-up longer-term support, can lead to a devolving of responsibility for communities to be self-reliant and build their capacities. Such framing can be classified as 'social resilience', whereby, government is ready to support communities in the short-term. This may only bring limited change or 'changes at margins'. For example, the community can manage strengthening their social capital (now and into the future) and making housing robust, however, improving the quality and reliability of roads, transport, water and power supplies to improve livelihoods is the responsibility of government. For true change, the Tarnagulla community would need external support (financial, logistical and research).

This project identified that the community lacks political influence and that government lacks longer-term commitment to work collaboratively for a sustained period of time. A change to this would enable the Tarnagulla community to implement priority actions to build resilience, that is, to adapt and thrive into the future.

Conclusion

The Tarnagulla community framed resilience based on lived experience. From the lens of strengths and capacities, participants identified and categorised their strengths into five capital forms. Their holistic framing of resilience meant that they intended to address and adapt to some of their 'general' ongoing and climate change related challenges. The comparison of resilience framing by the community and that in the literature reveals that the community's framing aligns with academic literature on holistic socio-ecological systems framing. However, there is some misalignment between the social resilience framing by government to socio-ecological systems resilience framing by the community. Such misalignment may hinder the Tarnagulla community's ability to transform. Inaction or marginal action by authorities may result in the demise of the town. Australians benefit from the skills and associated knowledge that exists in rural towns. There are 1700 small towns across Australia constituting 2.3 million people (9.7 per cent of the Australian population) (ABS 2018) who may face the similar fate as the Tarnagulla town. This paper calls for early investment in townships to sustain communities and help them be resilient now and to thrive into the future.

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ABSTRACT

The demands on teams coordinating emergency management at state and regional levels can be considerable. These teams may be supporting multiple incidents and are prioritising resources, liaising with other organisations and managing public interests. Also, during large-scale emergencies, teams will be working under conditions of stress and fatigue, which are known to impair cognitive processes such as memory and decision-making. This paper describes a checklist-based cognitive aid that can be used by teams to help retain their focus on tasks that need to be completed. This checklist is based on a hierarchical task analysis that was developed with emergency management agencies using observations, subject matter expert advice and prototype piloting. The checklist is a simple, straightforward set of prompts that help managers keep track of operational tasks and, thus, helps to reduce mental workload and improve cognition. The checklist can be used as a prompt to help emergency managers address the tasks they have oversight for, as a training and development resource, and as a diagnostic and monitoring tool to assess how well a control centre is operating. This can be assessed in real time and through the after-action review process. The checklist is a flexible tool that can help people better manage emergency response activities.

Based on a presentation at AFAC19 - the annual conference of AFAC and the Bushfire and Natural Hazards CRC.

Staying on task: a tool to help state and regional-level emergency management teams

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Introduction

Each year, Australian and New Zealand emergency management organisations coordinate the response to thousands of incidents. State- and regional-level emergency management teams play a central role in coordinating and prioritising the response to and resourcing of more complex incidents, particularly during periods of heightened incident activity. The demands on these state and regional teams can be considerable, requiring the coordination of multiple incidents, liaising with various organisations, assisting in the provision of emergency and public information, and monitoring and sense-making from a range of channels and information sources. Moreover, larger-scale incidents attracts political interest that requires careful management.

Emergency management organisations have generally responded to these challenges by providing clear role statements for key positions and corresponding guidance on responsibilities. However, these guidance materials have lacked systematic development. Scrutiny of emergency management activities over the last 20 years has at various points in time criticised performance. Coronial inquests following the 1998 Linton and 2005 Wangary bushfires highlighted problems with coordination between regional and incident management team (Johnstone 2002, Schapel 2007). In the case of the Wangary fire, there was also coordination issues between the regional and state authorities. The 2009 Victorian Bushfires Royal Commission identified various coordination issues at the state level noting 'confusion about responsibilities and accountabilities' (Teague, McLeod & Pascoe 2010, p.8).

An important question for emergency management organisations is how might they provide support to assist their personnel working in state and regional emergency management teams to operate more effectively? One possible approach is to take a systematic approach by using hierarchical task analysis to identify the tasks central to effective state- and regional-level emergency management. This analysis can be used to develop a checklist or *aide-mémoire*.

Paton and Owen (2013) describe the three layers of incident management in Australia and New Zealand. Each layer has different types of demands and decisions are bounded by differing time scales (Owen 2012). The first layer is the incident layer where first responders and frontline personnel work directly on the incident (e.g. flood or fire). The second is the tactical layer and involves a local incident management team (IMT) coordinating the response to contain and mitigate the incident. The third is the strategic layer that incorporates the activities that occur above the local operational and tactical levels and is undertaken by state or regional teams. These state and regional emergency management teams address issues that are strategic in nature and concern whole-of-government as well as communities. In addition, the state- and regional-level teams are required to consider consequence management for longer-term recovery.

In an address at the 2011 AFAC and Bushfire Cooperative Research Centre conference, the then Queensland Fire Commissioner, Lee Johnson, said that 'local incident management was well defined and supported by the AIIMS framework [Australasian Inter-service Incident Management System]. However, the strategic emergency domain is less well understood' (Owen *et al.* 2014, p.2). Since that time, further research has been undertaken at the strategic incident management level in Australia including Bearman and co-authors (2015), Brooks and co-authors (2018), Owen (2012) and Owen and co-authors (2014). Such research investigated how networks, information flows, coordination breakdowns and errors occur within the strategic levels of emergency management. State and regional teams need to operate in a structured and deliberate manner. At times, because of operational requirements, the team and individual resources are severely stretched and can break down leading to disruptions to team processes (Bearman *et al.* 2015). As such, Owen (2012) concluded that state and regional emergency management teams would benefit from appropriate tools to help maintain focus and keep track of activities.

Given the demanding nature of emergency management, a suitable approach is to provide cognitive aids to help teams identify tasks and the likely ordering and interdependencies between these tasks. Rosenthal and Downs (1985) describe cognitive aids as tools and techniques that 'help people detect, interpret, store and retrieve information efficiently' (p.1). Using such aids helps operators undertaking complex activities to reduce omissions and errors and to improve the speed and fluidity of their performance (Reason 1987, Roth, Mumaw & Lewis 1984).

The use of cognitive aids is also beneficial for people who are working under conditions of stress and fatigue. Working under pressure negatively affects an individual's thinking and perceptual (i.e. cognitive) processes (McLennan *et al.* 2014). Memory, a cognitive process central to performance in complex activities, is adversely affected by the pressure and fatigue inherent to incident management. Memory is important for allowing quick retrieval of appropriate knowledge and procedures as well as to remember to undertake tasks and activities in the future (known as prospective memory) (Matthews *et al.* 2000). The development of a cognitive aid provides a visual checklist that incident managers can use to remind them of the tasks that help to reduce mental workload and support prospective memory. This increases cognitive ability by partly embedding memory in the world rather than relying on mental processes.

A further advantage of cognitive aids (such as checklists) is that they frequently serve to make tacit knowledge that people have about a set of tasks explicit and able to be converted to procedures. Creating procedures allows others to gain insight into what is occurring versus what should be occurring in state and regional coordination centres. While it is reasonably easy to critique tasks that are observed, it can be difficult to identify things that are not occurring. Checklists have proven to be a valuable tool for observers who need to constantly and reliably assess the performance of teams against a standard set of criteria derived from best practice. This is an important tool for system management and continuous improvement.

Emergency management team operations can be assisted by cognitive aids to maintain focus and track key activities.

Image: Country Fire Service, South Australia

Checklist-based cognitive aids have been used in aviation since the 1930s when growing concerns about the complexity of aircraft prompted their introduction (Mellinger 2004). These tools help people make the most of their cognitive capabilities and can be used to enhance an individual's or team's decision-making abilities (Engel 2002). In addition to aviation, checklists have been widely adopted in acute medicine where research has shown that checklists improve patient outcomes by reducing time and errors (e.g. Chaparro *et al.* 2019, Marshall *et al.* 2016, Stiegler & Tung 2014). Checklists are also used extensively in the nuclear industry (Brooks *et al.* 2019).

To date there has been limited research on the use of checklists in emergency management. Brooks and colleagues (2019) considered how checklists used in other domains might inform the development and use of checklists in emergency management. The checklists commonly used in aviation, medicine and the nuclear industry tend to follow a prescribed sequence that users step though, completing one task before progressing to the next (Brooks *et al.* 2019). In contrast, emergency management operations tend to be more dynamic, less structured and non-linear in the way that incidents evolve and develop. Moreover, state and regional teams may be coordinating responses to multiple incidents. Some incidents may be well defined and under effective management, while others may be more chaotic, uncontained and less well understood. This means that checklists developed for emergency management should be guidelines rather than be too prescriptive with tasks able to be carried out in any order.

This study developed a cognitive aid (in the form of a checklist) that defined the key tasks to be carried out in state and regional emergency management organisations. As the checklist was designed to support state and regional management teams, particularly when the team is under pressure, it needs to meet the unique characteristics of individual environments.

Method

A hierarchical task analysis (HTA) was used to develop the checklist. HTA is an analytical tool that can be used for purposes including job design, interface design, error prediction and workload assessment (Stanton 2006). HTA assists organisations to understand fundamental goals, information processing and the cognitive activities that underpin complex activities such as those found in emergency management (Hoffmann & Militello 2014).

Shepherd (1998, p.1537) described HTA as:

> *a strategy for examining tasks aimed at refining performance criteria, focusing on the constituent skills, understanding task contexts and generating useful hypotheses for overcoming performance problems.*

HTA can play an important role in eliciting a deeper understanding of the expertise and cognitive processes at play within a team or system (Shepherd 1998).

Task analyses of state and regional coordination centre (SCC and RCC) helped identify the key tasks to be performed by teams to ensure their responsibilities are effectively considered and managed. The task analyses follows on from the work of Bearman and Bremner (2013) who identified the key tasks that needed to be performed at the incident-control level in a volunteer fire brigade. Bearman and Bremner (2013) used an incident controller task analysis to determine the high-risk activities that are carried out during incident control and identified some of the pressures that may result in poor decisions.

This research received Central Queensland University Human Ethics Research Committee ethics approval, reference no. H15/10-226. Preliminary state and regional tasks analyses were constructed and were developed from observations of state and regional coordination centres, the expertise of the authors and through discussions with agency personnel with experience working at the state and regional level.

The preliminary task analyses were translated into an observation tool, which was further developed and evaluated using an iterative human-centred design cycle approach in a set of four regional control centre exercises. The exercises were based on a full activation of the coordination centre and required the centre to response to one or more large-scale fires. Actors simulated external stakeholders and the radio traffic from the fire ground. Outputs (such as maps and warnings) were produced in the software packages set in training mode. State-level observers evaluated the performance of RCC participants throughout the exercise.

Two observers used the regional coordination centre task analysis to evaluate the performance of the RCC members. This evaluation contributed to the overall performance evaluation conducted by the state observation team. The two observers considered the extent to which each of the tasks in the task analysis were carried out and made comments alongside items where something noteworthy was observed. At the end of each exercise, the two observers met to discuss the tool and how it could be improved. This involved reviewing each of the activities, considering the notes and comments made during the observation, adding aspects that were not being captured and amending the wording of existing activities to better capture the underlying concept. In this way, the tool was improved through an iterative cycle of evaluation and development.

During operations, coordination centre personnel undertake a range of planning, monitoring, and reporting activities. Cognitive aids are used to evaluate and improve these processes.

Image: Country Fire Service, South Australia

Checklist for Regional Control Centres and State Control Centres

This tool is designed as a prompt to help regional and state-level incident management teams ensure they are undertaking the tasks important to their effective performance. The list is reasonably high level and identifies the key activities across five phases of incident management.

READINESS PHASE

Preparing for the likely escalation of incidents

- ☐ Understand what resources* are available for incident(s) vs. those likely to be required.
- ☐ Reviewed the current and forecast weather conditions.
- ☐ Reviewed relevant intelligence (e.g. planned community or other events).
- ☐ Reviewed the incidents currently underway and their respective status.
- ☐ Identified the potential risks to the community.
- ☐ Reviewed any precautions or restrictions in place (e.g. fire bans, road closures).
- ☐ Checked for existing information relevant to likely incidents (e.g. pre-action review).
- ☐ Ensured the control centre:
  - ☐ is suitably resourced (e.g. activation level, staffing and facilities)
  - ☐ is organised (e.g. personnel know their roles and are working in them)
  - ☐ is suitably configured (e.g. no significant constraints to information flow or collaboration).
- ☐ Ensured adequate liaison and coordination is occurring with the internal (e.g. other regions or state) and external parties (e.g. other agencies).
- ☐ Issued Chief Officer's or Commissioner's intent.

ESCALATION PHASE

Responding to escalating incident activity

- ☐ Reviewed the resources available for incident(s) versus those likely to be required (i.e. gap analysis).
- ☐ Reviewed the forecast weather conditions and other relevant intelligence.
- ☐ Reviewed the incidents currently underway and their respective status.
- ☐ Reviewed the potential risks to the community and identified the likely consequences.
- ☐ Ensured the control centre:
  - ☐ is suitably resourced (e.g. activation level, staffing and facilities)
  - ☐ is organised (e.g. personnel know their roles and are working in them)
  - ☐ is suitably configured (e.g. no significant constraints to information flow or collaboration).
- ☐ RCC – Ensure adequate liaison is occurring with the ICs in terms of the resourcing needs for their IMT, the incident or other support required.
- ☐ Ensured adequate liaison and coordination is occurring with internal parties (e.g. state and other regions).
- ☐ Ensured adequate liaison and coordination is occurring with external parties (e.g. other agencies, media) who we need to work with or keep informed.

COORDINATION PHASE

Coordination of resourcing and the response to the incidents

- ☐ Understand what is happening (e.g. prediction, situation reports, IMT reports, broader regional/ state intelligence).
- ☐ RCC - Understand the resourcing needs for incidents and liaise with State or other regions.
- ☐ RCC - Review trajectory and options developed by the IMT and consider implications, success and risk.
- ☐ Identified the likely risks and impacts posed by the incidents as well as by the response to the incidents.
- ☐ Implementing consequence management.
- ☐ Assure warnings and public information is accurate and being provided in a timely manner.
- ☐ Implemented a clear plan to coordinate, allocate, and procure resources (addressing any shortfalls).
- ☐ Ensured the control centre is adequately resourced, operating effectively (i.e. meeting task requirements) and is being appropriately briefed.
- ☐ Updating the SCC, Chief Officer or Commissioner with situation reports.
- ☐ Ensured adequate liaison and coordination is occurring with the internal (e.g. state and regions) and external parties (e.g. other agencies, media).
- ☐ SCC - Arrangements been made for any incident related investigations (e.g. arson, WHS, environment).
- ☐ Ensured WHS and wellbeing concerns are being adequately addressed (e.g. fatigue management).
- ☐ Review the plan in place to resolve the incidents and for de-escalation of the incidents.
- ☐ Ensured appropriate support is provided for planning community recovery and rehabilitation activities (e.g. share intelligence of the impact of incidents with other agencies).
- ☐ Ensured the collection of information required for a possible post-incident report or inquiry

DE-ESCALATION PHASE

Scaling back activities to match the requirements of current incidents

- ☐ Identified what level of activation is required to support the incidents in play.
- ☐ The control centre been appropriately reconfigured for the reducing workload.
- ☐ Ensured the control centre is operating effectively.
- ☐ Assure warnings and public information is accurate and being provided in a timely manner.
- ☐ Adequate liaison is occurring with the internal and external parties who we need to maintain dialogue with or otherwise keep informed.
- ☐ Ensured coordination with community recovery and rehabilitation activities.
- ☐ Ensured appropriate post-incident recovery (and rehabilitation) activities are planned for agency personnel (e.g. fatigue and stress management, injuries).
- ☐ Debriefs planned.

TERMINATION OR CLOSE THE RCC PHASE

Termination of SCC and RCC operations

- ☐ The appropriate debriefing for control centre staff has been completed.
- ☐ All required administration activities been completed.
- ☐ All other parties been informed that the control centre has been stood down or in the case of the SCC returned to standard operational duties.

*Note: resources might include SCC/RCCs/ICCs, general and specialist response resources (e.g. swift-water rescue, HAZMAT, heavy rescue, urban search and rescue), aviation (available and on standby), other agencies such as police, fire, SES, local government, health, environmental protection, agriculture, Bureau of Meteorology, Australian Defence Force and utilities (gas, electricity, water, sewage), communications, fire towers, control centre food supplies and backup power.

Figure 1: Checklist of the key activities required for state and regional-level incident coordination.

Results

The preliminary task analyses identified 75 tasks and subtasks at the state-level and 72 tasks and subtasks at the regional level. Two task analyses (one for state and one for regional) were developed with five phases of activity: Alert, Escalation, Manage Incident, De-escalation and Termination (or Close RCC). Under each of these phases, key tasks were defined that must be carried out to effectively coordinate an emergency at state and regional levels. Each phase has between 3 and 25 tasks or subtasks. These tasks and subtasks have been distilled into the checklist shown in Figure 1.

The first phase is the Alert Phase when the state or regional team is in place because there is an elevated threat of incidents. This period includes ensuring the SCC or RCC team is aware of and monitoring weather conditions, resources and has plans in place to scale up if required. During the Escalation phase the focus shifts to responding to developing incidents, ensuring that the state or regional teams anticipate likely developments and review appropriate resourcing. The next phase, Coordinate Incidents, is the most active period and has the most tasks with the requirement to coordinate multiple operations and to liaise with other agencies and to coordinate public information. The De-escalation phase covers the period of decreasing intensity of incident management activities. Although incident management operations are reducing, this phase requires careful sequencing of decisions to gradually wind down activities and resourcing. The final phase is Termination or Close of the coordination centre. This phase has the fewest number of tasks and focuses on wrapping up the centre's activation.

Figure 1 provides a checklist based on the key tasks and subtasks in the agencies that were studied. The actual tasks and subtasks required in regional and state coordination centres will be different depending on the agency to which the checklist is being applied. Figure 1 suggests a logical order in which to undertake the tasks and subtasks for each phase. However, given the evolving nature of incidents, it is most likely that managers will cycle through the checklist a number of times during each phase, especially if the situation is fluid or still emerging. Although the checklist suggests a logical sequencing of tasks and activities, the order in which some of these are tackled may vary depending on the particular circumstances. Checklist users may find it helpful to identify the status of each task by using a traffic light coding system of green (G) for good or in-hand, amber (A) for marginal or incomplete and red (R) for not yet addressed.

Discussion

The checklist-based cognitive aid presented in this paper assists incident managers by providing a framework of the key tasks required to coordinate emergency management activities at the state and regional levels. Further research could validate the checklist, however, it can be used by agencies in at least three ways.

Aide-mémoire

The simplest use of the checklist is as a prompt to help emergency managers check that they are addressing the tasks required to coordinate the control centre and the incidents they have oversight of. This is particularly important when the team is working under conditions of stress and fatigue and helps to reduce mental workload and increase cognitive ability.

The checklist is also useful for personnel developing their incident management capabilities and for personnel who have not worked in these roles recently. The experienced practitioners who used the checklist during the pilot phase identified its value in helping to stay on track with tasks and activities required.

It is evident that such tools are helpful in improving performance of individuals and teams (Chaparro *et al*. 2019, Marshall et al. 2016). This is especially so for complex tasks such as those required in state and regional-level emergency management (Brooks *et al*. 2019).

An important difference between emergency management and other sectors that use checklists is the fluid nature of an emergency situation. Emergency management teams operate in dynamic environments that are likely to have less structure. For example, the number, scale and complexity of incidents may rapidly change. Also, an emergency management team may be required to concurrently manage multiple incidents that may be at different points of development. These incidents may be the same hazard type or they may be different (e.g. a bushfire and a flood). Such conditions mean teams must work simultaneously across varying temporal and spatial scales (Brehmer & Svenmarck 1994). This means that some tasks within a phase of the checklist will be revisited multiple times and the various incidents may be concurrently managed using different checklist phases. It is strongly recommended that each incident has a separate checklist to allow for careful tracking of the phases of each incident. Such high tempo, complex and demanding workload conditions create an environment where important tasks might be overlooked or there is difficulty in sequencing interdependent tasks.

Emergency incidents can occur with no or little warning, which requires the emergency management team to operate from a 'cold' start. In such cases the incident starts from the Escalation phase rather than the Readiness phase. When this occurs, teams could overlook some of the tasks that are usually undertaken in the Alert phase. To address this issue the checklist can be used to identify the tasks in the Alert Phase not considered in the Escalation phase such as reviewing the precautions or restrictions in place and checking for existing information relevant to the current incidents.

Training and development resource

The checklist outlines several important aspects of emergency management and coordination.

- It outlines the phases of an incident and maps the tasks required.
- It captures the tasks required to coordinate the control centre and the incidents.
- It provides a suggested hierarchy of the likely sequencing and priorities for the tasks.

These aspects of the checklist can be used to improve instruction in regional and state coordination functions and in face-to-face and online training settings. Emergency managers, trainers and coaches can use the checklist as a diagnostic tool and to help structure feedback and discussion with personnel during exercises, warm starts and on the job. This can help new personnel to quickly transition through developing the skills and expertise required in their roles.

Continuous improvement

The checklist can be used to help consider how well an SCC or RCC is operating as part of continuous improvement programs. For after-action reviews, the checklist can be used to facilitate review and guide discussion of the arrangements made during a shift or period of activity for a control centre. The checklist can provide structure to discussion about the various aspects of a control centre's operation.

The checklist-based cognitive aid presented in this paper is a useful tool, however, there are a number of limitations. Brooks and colleagues (2019) highlight that while there is good evidence for the utility of checklists and other cognitive aids, effective implementation can be challenging. Highly skilled practitioners may feel that consulting a checklist might undermine how others view their competency and see no need to use checklists (Catchpole & Russ 2015). Brooks and co-authors (2019) suggest that it is important to distinguish between cognitive aids and the decision-making processes of users (Kim & Reeves 2007), noting that cognitive aids help facilitate decision-making that is based on the expertise of the practitioner, such as the intended use of the checklists presented here.

It has also been observed that some *aide-mémoires* may be overcomplicated or lead to a superficial tick-and-flick approach (Brooks *et al*. 2019). These observations can be addressed by good checklist design that is based on empirical investigation of the domain of intended use and an iterative design and evaluation method. Investigations by Alidina and colleagues (2018) of the organisational and contextual factors influencing the adoption of checklists during surgical crisis events also identified several barriers. These included factors such as a limited appreciation of the vulnerability of decision-making in stressful situations and organisational factors such as limited leadership support and inadequate training in the use of the aids.

The checklist presented here has received emergency management organisational support and has been incorporated into the South Australian Country Fire Service (CFS) standard operating procedures for conducting and managing real-time evaluations (SOP 12.4). The checklist has also been used to identify the functions of a CFS State and Regional Control Centre specified in Standard Operating Procedure 1.05 and 1.06. However, more work is required before the checklist is widely accepted and used across the organisation.

Conclusion

This paper describes the rationale for and the development of a checklist-based cognitive aid that was designed to support state and regional emergency management teams. The checklist is a description of the key tasks that must be carried out in state and regional coordination centres during an emergency. As such, it is a list of things 'that you just can't forget to do'. The checklist is designed to assist teams working under conditions of stress and fatigue. It can be used for training and development, it will benefit people who are new to working in state or regional coordination centres and can be used for the purpose of continuous improvement.

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The missing link in emergency management: evaluating community engagement

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ABSTRACT

Community engagement programs in Australia are widely adopted by emergency management organisations as one way to get communities to recognise hazards and risks and prepare for emergency events. However, evaluation of these programs remains a challenge. A study with 30 community engagement practitioners and managers from Australian emergency management organisations, councils and not-for-profit organisations was undertaken to examine how they use measurement and evaluation of community engagement for preparedness. The findings suggest that while community engagement teams understand the importance of measuring the effects of engagement efforts and preparedness activities, most still do not link engagement activities with higher-level engagement outcomes that influence communities.

Introduction

Helping people to recognise and prepare for natural hazards has become an imperative over the last decade. The states of Tasmania and Queensland were subject to unprecedented summer temperatures during Australia's hottest summer on record (Bureau of Meteorology 2019). They also suffered damaging bushfires in ecologies that were thought to be safe from fire damage (Blackwood 2019, Forbes & Tatham 2018). The negative effects of these and similar events around the world are growing. The United Nations Office for Disaster Risk Reduction reported that between 1998 and 2017, disaster-affected countries reported tangible losses worth $US2.908bn; an increase of $US932bn from 1978–1997 (Below & Wallemacq 2018). In Australia, tangible costs of disasters are, on average, $AUD13.2bn a year, which is expected to grow to $39bn a year without factoring in the cost of climate change (Deloitte Access Economics 2017). Intangible costs are expected to be even greater. Between 1987 and 2016, 971 people in Australia lost their lives, 4370 were injured, 24,120 lost homes and 9.02 million people were affected in some way by disaster (Deloitte Access Economics 2017, p.18).

The motivation for natural hazard prevention preparation by individuals and communities is generated from the emergency management sector and local government efforts, particularly community engagement teams. Community engagement programs are generally measured in two ways:

- headcounts or numbers of events detailing the number of people attending or spoken to (see emergency services agencies' annual reports of 2017–18)
- measuring the increases in preparedness levels of individuals, specific communities and state populations (such as those undertaken by Elsworth *et al.* 2010, Rhodes *et al.* 2011 as well as by agencies).

However, there is potential for measuring community engagement in a more meaningful way. Recent approaches to evaluation of community engagement take social or economic modelling approaches, employing a cost-benefit-analysis model to evaluate interventions (Coles & Quintero-Angel 2018,

Gibbs *et al*. 2015, Street & Carr-Hill 2008). These include measuring direct impacts of community engagement on health outcomes or even lives saved, as well as economic and social indicators. Complex outcomes have been measured, such as contribution of community engagement to social capital and social networks, identification of community influencers as motivator and collective valuing of community-led actions for preparedness (Street & Carr-Hill 2008). But these efforts are rare.

Community engagement for preparedness

A key change in disaster preparedness in the past 20 years has been in the application of community engagement frameworks for community outreach. Community engagement can be considered as a pattern of activities implemented by agencies to collaborate with, and through, community members. The aim is to address, respond to or mitigate issues that affect the health, wellbeing or social status of the community (Bowen, Newenham-Kahindi & Herremans 2010; Fawcett *et al*. 1995; Johnston 2010; Scantlebury 2003).

The Australian Institute for Disaster Resilience (2018, p.2) defines community engagement as 'the process of stakeholders working together to build resilience through collaborative action, shared capacity building and the development of strong relationships built on mutual trust and respect'. Community engagement facilitates community-to-agency relationships (Johnston *et al*. 2018) with a clear aim to build capacity in communities to contextualise and understand risk and take appropriate actions to prepare. Yet, evaluations of community engagement activities to achieve these aims are limited, leaving community engagement and emergency management practitioners with little information about the real contribution of engagement activities.

Evaluating community engagement

Evaluation is regarded as 'the systematic application of research procedures to understand the conceptualisation, design, implementation, and utility of interventions' (Valente 2001, p.106). Macnamara (2017) expands on the role of evaluation for governance and accountability, particularly around the use and reporting of publicly funded community engagement campaigns and the need to use meaningful engagement measures that 'involve cognition, emotional connection and participation in conversations, as well as even deeper levels of interactivity such as collaboration' (Macnamara 2014, p.17).

While evaluation models exist that offer insight for communication-based program planners (Macnamara 2015), there is general agreement that the foundation of any evaluation effort is to set measurable objectives and to measure meaningful outcomes including any effects (Watson 2012). Programmatic reporting of outputs, outcome and effects is regarded as best practice in evaluation (Argyrous 2018, Gregory & Macnamara 2019). However, Macnamara (2015) highlights several barriers to conducting evaluation that need to be resolved in practice. These include:

- a lack of budget
- a lack of knowledge
- a lack of standard measures
- a lack of interest by management
- that evaluation appears to be too complex for practice (Macnamara 2015, pp.374–375).

Emergency managers have been concerned with evaluation for some time. Gilbert (2007) raised the importance of evaluation of community engagement activities and found that measurement of impacts on communities was mostly absent in the areas of emergency management that were examined. The first national approach to evaluation was presented in the *Guidelines for the Development of Community Education, Awareness and Engagement Programs* (Elsworth *et al*. 2010) in which a realist synthesis approach to measurement was recommended. This important report also presented evaluations of activities and programs from across Australia and, for the first time, shared the evaluation techniques and results.

The *National Strategy for Disaster Resilience – Community Engagement Framework* (Australian Institute for Disaster Resilience 2013) outlined an approach to engagement reflective of the widely-used International Association for Public Participation (IAP2) model. The strategy framework included purpose, goals and loose objectives but provided no mention of, nor guidance on, evaluation or the need for measurement. For disaster recovery, the report, *A Monitoring and Evaluation Framework for Disaster Recovery Programs* (Argyrous 2018), provided a framework for evaluation of disaster recovery programs for effectiveness. However, since Elsworth and colleagues' (2010) guidelines, only periodic evaluations of some programs and activities have been shared by state emergency management agencies and local governments across Australia. This sharing has been by committed community engagement practitioners or the researchers they have connected with (e.g. Dean 2015, Phillips *et al*. 2016, Redshaw *et al*. 2017, Webber *et al*. 2017). Anecdotally, it appears that some emergency agencies are working towards or have achieved embedded programs of evaluation. However, currently, there is no universal guideline or imperative for emergency management sector community engagement practitioners to measure the effects of the activities and programs they undertake.[1] By improving the quality and consistency of evaluation, agencies and councils can better determine the effectiveness of their programs and also improve subsequent programs.

1 This may change. There is consultation underway for a review of the Australian Institute of Disaster Resilience Community Engagement Framework (Handbook 6).

Community engagement practitioners face challenges in measuring success of community engagement in developing individual and community preparedness. Practitioners need to share their findings with others to enable past practices to be assessed and better practices to become accepted and adopted (Astill *et al*. 2018). Evaluation data are valuable because they warrant claims about the outcomes and effects that have occurred because of the engagement activities. Community engagement in emergency management needs a similar initiative and can draw on work done outside the emergency management sector. For instance, work by Johnston and Taylor (2018) provides a roadmap for improved evaluation.

This study revealed three levels or tiers of measurement of engagement. The tiers span low-level manifestation or output indicators, mid-level understanding and connecting or outcome indicators and impact indicators, suggesting higher-level action and change (Johnston & Taylor 2018, p.7; see also Watson 2012). Table 1 provides a summary of the tiers for measuring engagement.

Table 1: Tiers of engagement.

Tier	Sample Measurements of Engagement
1 - Low level: Presence Occurrence Manifestation	Indicators of activity: • counts and amounts • social media (i.e. likes, page visits, click throughs) • monitoring of social media and traditional media • reading, viewing, visiting, impressions, awareness changes.
2 – Mid level: Understanding Connecting	Indicators of relationship qualities: • trust, reciprocity, credibility, legitimacy, openness, satisfaction, understanding • interaction quality • diffusion (patterns and networks) • dialogue Indicators of engagement dimensions at individual level measuring affective, cognitive or behavioural outcomes: • antecedent and outcome.
3 - Higher level: Action Impact	Indicators of social embeddedness: • of self and others • social awareness and civic (greater good) indicators • acknowledgment of others (diversity, empowerment) • action, change and outcomes at the social level • engagement in ecological systems • recognition of diverse perspectives • social capital • emergency agency and coordinated actions.

In Table 1, Tier 1 engagement measures or outputs are the lowest level of evaluation. Output evaluation measures and reports on activities such as practitioner tasks (the doing and creating), counts and amounts, website likes and visits and social and media monitoring (Johnston & Taylor 2018). Examples of Tier 1 measurement techniques can be seen in emergency agency and local government annual reports as well as in Dufty's (2008) evaluation of SES FloodSmart and StormSmart programs.

Tier 2 outcome indicators illustrate a higher level of attitudinal and behavioural results from engagement activities. Measurement assesses the types of connections and relationships. Community engagement seeks changes in knowledge and perceptions of efficacy and indicators identify behavioural changes such as families and communities creating and practising disaster plans. Foster (2013) demonstrated Tier 2 measurement and evaluation in a study on emergency agency home visits, as did Every and colleagues (2015) in their work on the South Australian Community Fire Safe program.

Tier 3 engagement measures the changes in behaviour (action), attitude and social networks. The impacts can be viewed as sustainable changes that help create resilience. Examples of impact indicators include participation in community based programs or social change and action as a result of engagement. Gibbs and co-authors (2015), in one of the few examples of economic modelling in emergency management, showed that the Victorian Country Fire Authority Community Fire Guard program prevented property loss worth $732,747 and there was a reduction in fatalities costed at $1.4 million per Fireguard group every 10 years. 'Even if the risk of major bushfire event in a region were one in 100 years, the estimated cost savings in a 100-year period is $217,116 per group' (Gibbs *et al*. 2015, p.375).

So how are Australian community engagement practitioners enacting evaluation? A research question that emerged from this review asks: 'How do community engagement practitioners understand the evaluation of engagement in an Australian emergency management context?'.

Answers to this question are important because organisational support for evaluation of community engagement and subsequent learning to guide decision-making strengthens both the outcomes from community engagement and the way it is valued (Stewart 2017). How community engagement is approached and measured can change how emergency services organisations operate. Effective community engagement can move organisations closer to their communities. Owen and colleagues (2017) found that organisations need to learn and change to develop a 'maturity' that allows the experiences to be generalised across the organisation and the sector.

Method

A two-stage qualitative research design used content analysis and in-depth interviews. Stage one included an analysis of documents supplied by emergency agencies, local councils and not-for-profit organisations. Content analysis examined community engagement policy, practice and implementation and the documents were searched for key performance indicators and reporting language against these indicators. Annual reports for 2017–18 were also examined.

Stage two included 30 semi-structured interviews with community engagement practitioners from participating agencies, local councils and not-for-profit organisations. Interview questions drew upon the findings of the first stage of data collection. The interviews were conducted from October 2018 to January 2019 by telephone and online using the meeting software, Zoom. Ethics approval was granted from Queensland University of Technology Human Research Ethics Committee, approval number 1800000931.

Purposive sampling was used; participants included 30 community engagement practitioners and operational staff (9 males and 21 females). Participants were recruited from a list of emergency services organisations across Australia, with additional snowball sampling used to recruit participants who could provide information about non-agency initiatives that staff thought worked well.

All states and territories were represented in the sample. Participants represented all non-metropolitan fire agencies and all but two State Emergency Services. It included three local councils, a nationwide aid agency and a local community centre. Sampling criteria were applied at three levels being disaster type, type of agency and location. The sampling was designed to capture perspectives from organisations that respond to one type of hazard and organisations that respond to many different types of hazards. Table 2 summarises the participant organisations represented.

Table 2: Types of organisations represented in the study sample.

Agency	Number
Emergency management agencies*	25
Local government area councils	3
Not-for-profit organisations and others	2
Total	30

* Includes oversight agencies.

Table 3 shows states and territories organisation representation.

Table 3: Numbers of organisations by state representation.

State	Number
Queensland*	10
Victoria	8
New South Wales	4
Western Australia	3
Tasmania	2
South Australia	1
Australian Capital Territory	1
Northern Territory	1
Total	30

* Includes local government that has emergency management functions in that state for mitigation, preparedness and recovery phases.

The interviews took between 40 and 80 minutes. They were recorded and transcribed (verbatim). Participants were asked questions about their role, their community engagement approaches, evaluation activities and how evaluation has helped them to identify what works and does not work.

Analysis

The analysis of the annual reports of 14 emergency services organisations and local government agencies as well as community engagement charter documents provided the content analysis sample. Interview data were analysed following iterative stages of thematic analysis of topic, analytical and interpretive coding (following Glaser 1992). Quality was maintained between two coders by using a coding guidebook.

Findings

Varying evaluation processes

An analysis of the data found that there were varying attitudes and approaches to evaluation. Most organisations used some type of monitoring and evaluation and practitioners expressed positive attitudes towards evaluation. Responses indicated that they recognised the role and importance of evaluation of community engagement for emergency preparedness but also indicated evaluation could be complex and was often a difficult or under-resourced function. Only a (very) few participant organisations had a formal, organised and scientific approach to evaluation.

Table 4: Key performance indicators included in community engagement reports and charters.

Annual report and community engagement charters	Number
Included specific community engagement key performance indicators and reported against these.	8
Included specific community engagement key performance indicators and did not report against these.	2
Did not included specific key performance indicators but reported some community engagement measurement.	2
Did not include specific key performance indicators and did not report.	2

Table 4 shows that very few documents included key performance indicators.

A range of evaluation techniques were used by the participants. For a few, evaluation of community engagement aimed at improving individual and community preparedness was comprehensive and systematic. Others used ad hoc measurements reflecting a Tier 1 approach of using counts, contacts, people attending events or other output-based activities. Very few practitioners articulated a comprehensive evaluation system that reported mid- and high-level outcomes and effects. Few participants made the link between evaluation and the achievement of higher-order strategic objectives.

It was evident that participating organisations had a commitment to evaluating and reporting community engagement activities at some level. Using Johnston and Taylor's (2018) tier typology, the commitment to measurement was analysed as it was shown in the annual reports and community engagement charter documents. From this, the approach of the participating organisations was classified according to the tier level.

Table 5: Community engagement evaluation tier most frequently used.

Tier level	Number of organisations undertaking activity at the tier level
Tier 1	11
Tier 2	2
Tier 3	1

Data collection for Tier 1 activities was the greatest as counting outputs such as numbers of people attending an event, people reached by door-to-door campaigns, website visitors, social media followers and other 'counting' approaches can be easier to quantify.

There were significantly fewer attempts to measure Tier 2 activities and outcomes. Examples included surveys to measure recall of campaign messages (using online or face-to-face formats), sustained knowledge and practice outcomes from training and qualitative interviews to gain insights into behaviour change.

Efforts to assess Tier 3 activities were ascertained by an 'after action review' following emergency events. These reviews occur when teams reflected on lives saved and how many people enacted their emergency plans. Some participants viewed qualitative data as 'very beneficial' when collected immediately after an emergency event. Two emergency agencies conducted large random-sample surveys of community preparedness levels at the state level.

Participants from several organisations noted that 'conversations' with members of the public were valuable tools to determine the overall success of community engagement programs. Conversations allowed for in-depth insights into the personal experiences of community members.

Evaluation: whose job is it?

The study data indicated that community engagement staff have access to varying capacities for evaluation. Some participants acknowledged that their agency was developing an evaluation framework. For others, evaluation was a new aspect to their function. Some indicated that previous attempts at evaluation had not delivered relevant information. A few participants pointed to the existence of specialist roles that had responsibility for evaluation. People in these roles supported the community engagement functions of the organisation. These specialist roles seemed to be tied to a person rather than job function or organisational capacity.

About one-third of participants noted that evaluation is linked to the overall community engagement strategy. They noted that evaluation was something the community development people, who are usually located in local councils, do or should do as part of their role. Many agreed that evaluation needed to be 'embedded into community engagement' activities for it to have meaning. Yet, many participants noted that 'evaluation is not our remit (job)' and 'we don't have the time, money or skills'. Some indicated that they did not operate at a program level that can be evaluated more easily. Additionally, participants indicated that their work with other organisations meant they were concerned that evaluation of their own specific contributions to community engagement would be difficult to tease out from cross-agency activities.

Some organisations are undertaking evaluation in a meaningful way. Organisations that win government grants often have budgets for an evaluation component albeit at the end of a project. External consultants are often commissioned to provide an objective account of a program's outcomes and effects. There was evidence of skilled evaluation 'experts' joining some organisations bringing a greater evaluation perspective. However, most of the 30 participating organisations did not have a

dedicated monitoring and evaluation specialist. Collecting data can be overwhelming. Some participants noted that they need ways to systematise data (or intelligence) that comes informally to the project.

Participants also noted that 'closing the loop' is important (Hurst & Ihlen 2018). Closing the loop means at least two things. First, closing the loop means using the results for improved organisation learning for community engagement. Second, participants also wanted to use the results to inform community engagement at the strategic planning level.

Adaptable, scalable evaluation tools

All participants reported that they wanted to improve their evaluation capacity, even those working in organisations with evaluation experts. They indicated that adaptable, scalable tools and toolkits would assist them to undertake meaningful evaluation.

To succinctly present these perceptions of tools and approaches, participant answers were used to create a word cloud. The word cloud reflects participant interview information relating to evaluation tools and approaches. The findings show that participants recognised the importance of finding ways to authentically understand what people actually think – their focus on people and engagement, were linked closely with concepts such as 'need', 'think' and 'communities'. Practitioners were also focused on what 'processes' 'work', couched in terms of understanding community requirements and actions.

Key points raised in the word cloud reflect the importance of processes and planning related to evaluation and how the outcomes of engagement are reflected over time. Research tools such as surveys were featured, but not in a dominant way. This suggests that practitioners understood the importance of evaluation, but tools for evaluation were either not accessible or not used. Very few participants detailed specific evaluation tools or methods.

Participants noted that they wanted better survey methods to measure attitude and behaviour change. Others wanted adaptable and scalable field tools to measure the outcomes of events such as workshops, training and community engagement activities. Interviews, surveys and post-incident reports can be time consuming tasks. Monitoring and evaluation templates may help organisations build capacity, standardise evaluation approaches of community engagement programs and provide practitioners a suite of tools that are easily accessible and appropriate.

Figure 1: Word cloud of themes related to community engagement evaluation.

Discussion

Based on the document analysis and the practitioner answers to the research question, three ways were identified to measure community engagement contribution to emergency management.

First, practitioners can use community engagement to quantify levels of community preparedness. Preparedness levels have a significant impact on operations during an emergency response phase. Second, it allows the community to understand its own level of preparedness. Finally, measuring the effects of programs for preparedness provides tangible evidence of the economic and social impacts from community engagement investments such as quantifying lives and property saved (as shown in Coles & Quintero-Angel 2018, Gibbs *et al*. 2015).

The interview data suggest that community engagement practitioners want a clearer link between the organisation's strategic plan and its monitoring and evaluation of outcomes. Two solutions could provide guidance: create a culture of evaluation of community engagement and establish clear strategic connections to community engagement functions.

Astill and colleagues (2018) argued that community engagement needs to take a 'community of practice' approach. Such an approach brings 'together complementary knowledge and skill sets of research teams that included disaster management, geo-spatial mapping, health impact assessment and community resilience with the wide range of stakeholders planning for, preparing and responding to events when they occur' (p.51). Creating a culture of evaluation is one way to bring about the benefits of community engagement activities.

Organisational cultures are based on shared values, experiences and behaviours. Evaluation of community engagement activities needs to be part of that culture. It needs to be routinised and internalised. Organisations need to collect data from their activities and learn from those data.

Taking a strategic approach to community engagement is also needed. The first step in evaluating community engagement is to identify the baseline of the community's level of preparedness. Good program evaluation begins with gathering baseline data before the start of a project. Baseline data allows for planning and assessing subsequent progress and levels of success (or not) against the original aims. Baseline data can describe the existing level of community preparedness in both quantitative and qualitative terms.

The next step is to set engagement goals. Goals are broad, general statements of a desired future state. Projects, programs or campaigns may have one overarching goal or several modest goals. Goals can be abstract, however, objectives are the concrete and measurable steps needed to accomplish goals. Influencing or changing people's behaviours, knowledge and attitudes are sometimes difficult objectives but they are central to effective community engagement. Objectives set the evaluation criteria that allows for the measuring of community engagement achievements.

All strategy objectives should be SMART: specific, measurable, achievable, relevant and time-bound. Community engagement objectives are best when they are measurable, action or outcome specific, audience specific and achievable by a specific date or timeframe. Levels of impact objectives can be informational (knowledge), attitudinal and behavioural outcomes that can also be measured. Therefore, conducting baseline research and articulating goals with SMART objectives are the foundation for evaluation of community engagement.

The findings suggested a level of discomfort among some practitioners with evaluation processes and tasks, either because of the time it would take or because they did not have a sound knowledge and skills base in this area. This points to a need for team structures to factor in measurement and evaluation and then to recruit to ensure the team has the skills and commitment to these aspects of the job. The patchy inclusion of key performance indicators relating to genuine evaluation of community engagement programs in Australian emergency agency and local council annual reports subject to this study reinforces this point. Inclusion of such key performance indicators in the annual report would indicate the organisation's commitment to community preparedness and enable teams to devote resources to measurement and evaluation.

Conclusion

This study aimed to understand how community engagement evaluation is conceptualised and undertaken in Australian emergency management practice. Findings suggest that evaluating community engagement activities may be missing from current engagement programs and determining effectiveness and value of engagement is problematic. Study participants recognised the importance of evaluation and its role in demonstrating the level of impact their efforts have on communities. However, they recognised that evaluation is often undervalued and under-resourced or reported as outputs. Standardisation of evaluation and monitoring practice would support the resourcing and reporting of community engagement outcomes, as would support of measurement and evaluation in future preparedness and recovery doctrine for the sector.

This study is a starting point to enhance evaluation in preparedness activities. However, the study has limitations. Participants varied widely in experience and qualifications and reported a variety of community engagement evaluation approaches. Future studies would benefit from an increased sample size to reflect this diversity. In addition, future research could focus on evaluation of participatory or co-design frameworks of community engagement, where community members, stakeholders, organisations and other relevant groups co-create and design of emergency preparedness and participate in the evaluation stage.

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Out of the Storm: extreme weather resilience for community homelessness

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ABSTRACT

This paper reports on the outcomes of a collaborative, strengths-based program developed to improve the preparedness of people experiencing homelessness during extreme weather in South Australia. The program, Out of the Storm, provided resources for dealing with heat, cold and storms that were co-designed by people experiencing homelessness, emergency services and health provider representatives and volunteer graphic designers. The program employed peer outreach workers who delivered 278 emergency kits and maps and who conducted 466 conversations about extreme weather with other people in experiencing homelessness in South Australia. This paper outlines the Out of the Storm program, including how principles of Trauma-Informed Extreme Weather Resilience Education were incorporated. This evaluation demonstrated that the Out of the Storm activities gave people access to relevant information and weather-protection items and built confidence, opportunities and social connections within the community and with emergency services organisations and health providers.

Research on extreme weather and homelessness

As the sun goes down and the storm clouds gather, people experiencing homelessness hunker down where they can with any supplies they may have to hand. People experiencing homelessness have developed skills to get through the vagaries of storms and hot and cold weather. However, such adaptation conceals a myriad of hardships, including isolation (walking to services becomes impossible with a 20 kg backpack in the heat), mosquito bites from sleeping outdoors, food that spoils and losing medication because it cannot be kept cool or dry (Cusack *et al*. 2013, VCOSS 2016). Severe weather like extreme cold, heatwaves, large storms, floods, cyclones and bushfires have even greater impacts on those in homeless communities. In 2017, an Australian study (Every, Richardson & Osborn 2019) found that:

- 39 per cent of people lost their home (tents, temporary structures, safe sleeping spaces) during severe weather
- 37 per cent experienced worsening or new mental health issues and of these, 30 per cent experienced trauma
- extreme weather was a factor in the pathway to homelessness for 16 per cent of people.

People experiencing homelessness are not well prepared physically or emotionally for protecting themselves from the economic, social and health effects of weather. They face significant challenges preparing for extreme weather, particularly social isolation, mental health issues and limited funds to purchase emergency supplies (Every, Richardson & Osborn 2019; Edgington 2009). Compounding these challenges are the gaps in access to preparedness resources. There is few specialised and targeted education materials about these risks, with 45 per cent of homeless services in Australia having no access to appropriate extreme weather hazards information (Every, Richardson & Osborn 2019).

Resilience education for homelessness communities

A multi-level approach of structured, educational and individual actions that can be taken is required to build resilience for people who are homeless. Education about extreme weather and how to cope helps to reduce inequality

and exposure to risks as does providing housing and health care. Homelessness is a complex and systemic social issue, and extreme weather education is effective when it is embedded within, and builds upon, current intervention models used in homelessness prevention and support. Use of trauma-informed care offers is one approach for the provision of hazard resilience education (OASPR 2012). It emphasises agency, autonomy and respect, non-hierarchical relationships and an individual and systems focus on avoiding re-traumatisation (Mental Health Coordinating Council 2017, Jennings 2004). Trauma-informed care is a lens through which to understand the experiences and needs of people in homeless communities as well as specific challenges people face during extreme weather events (VCOSS 2016). Using this base, Every and Richardson (2018) developed principles of Trauma-Informed Extreme Weather Resilience Education with people experiencing homelessness. Table 1 summarises these principles.

The Out of the Storm program put the principles of Trauma-Informed Extreme Weather Resilience Education into practice. The program allowed for an evaluation of effectiveness in helping people understand their risks and potential actions to take.

Putting the principles into practice

The Out of the Storm program was a collaborative response to improve resilience to extreme weather events within homeless communities in Adelaide, South Australia. The project brought together people experiencing homelessness with local emergency services organisations and health providers to identify and develop appropriate information and materials that help people stay safe in cold, stormy or hot weather. People with a lived experience of homelessness ('peer workers') assisted by distributing this information and resources to other people experiencing homelessness in the Adelaide city area and surrounding suburbs. The objectives were to improve people's knowledge about extreme weather hazards and what they can do, provide good material resources and social connections as well as potential employment opportunities.

Co-design: dialogues and knowers and makers sessions

Prior to the winter and the summer of 2018–19, the Hutt St Centre, an Adelaide homeless service provider, and the Australian Red Cross held facilitated discussions on extreme weather possibilities ahead. Building on an initiative of extreme weather dialogues used in the United States of America, (National Health Coalition to End Homelessness 2017) current clients of the Hutt St Centre spoke about exposure to cold, storms and hot weather with emergency services and health provider representatives from the SA SES, Red Cross and SA Ambulance Service. Eleven people experiencing various forms of homelessness attended the winter dialogue sessions and 21 attended the summer dialogues. The

People experiencing homelessness hunker down where they can. Out of the Storm workers provided personal contacts and access to information and supplies.

Image: Alana Pedler

Table 1: Trauma-Informed Extreme Weather Resilience Education principles and implementation.

Principles	Implementation
Build safe relationships	Employ trusted people, including peers, to deliver extreme weather information. Build relationships with emergency services organisations.
Co-create, collaborate and partner Strengths-based	Resources reflect the shared knowledge of the homeless community and emergency services organisations. Activities that assist people to identify, develop and use skills and knowledge to respond appropriately during extreme weather events.
Empowerment	Develop plans and improve skills in relation to specific needs and specific hazards including knowledge of first-aid.
Provide essential material resources Be inclusive, non-discriminatory and non-judgemental	Distribute weather-protection items via emergency kits like beanies, water bottles, sunscreen, mosquito repellant and tarpaulins to address the ongoing effects of poverty on people's ability to respond safely. Acknowledge gender, age, sexuality, ethnicity, literacy standards and living circumstances that influence people's ability to prepare, respond and recover from extreme events.

participants were aged between 35 and 55 years. Only two women attended in winter, one frequently. This improved in summer with four women attending, however, the majority of people who attended were men. The people who attended the sessions were 'rough sleepers' and included a mix of people who were more confident in sleeping rough and those less confident.

The dialogue sessions promoted a relaxed atmosphere. The aim was for participants to work together to build knowledge about:

- access to messages about extreme weather events
- safe places when conditions are cold, wet or hot
- practical suggestions to keep warm and dry in winter and cool in summer
- resources available for extreme weather
- health concerns during extreme weather and what can be done
- assistance during extreme weather events.

The dialogues drew on the experiences and knowledge of people in the homeless community. These people shared their on-the-ground knowledge of the local area and showed innovative and practical skills for staying warm and dry in winter and cool in summer. They also explained how they support and assist each other during difficult times.

The dialogues were followed by four 'knowers and makers' creative workshops. In the workshops, between one and six people who had attended the dialogues worked with graphic designers who volunteered to transform the information into posters, an extreme weather guide map and summer and winter emergency kits. For example, based on the dialogue with the SA Ambulance Service, people attending the knowers and makers sessions developed the message 'Drink 4 of me each day' to be printed on water bottles.

The dialogue sessions informed what to put in the emergency packs. In the summer, people talked about being bitten by mosquitoes and needing a lot of sunscreen to use when outside. This led to insect repellent wipes (which are more transportable) being included in the kits and a refillable sunscreen scheme was adopted. In winter, people shared how difficult it was to stay warm. This led to handwarmers and a thermos being included in the kits.

Co-designed resources

Three resources for extreme weather resilience were developed through the dialogues and the knowers and makers sessions. These were posters, a local map and emergency kits.

Posters were displayed at homeless service provider locations throughout Adelaide. Posters included tips for staying warm and dry in winter and cool in summer as well as contact details for weather information and homeless support services.

Figure 1: Posters covered tips on what to do during times of extreme weather.

Extreme weather guide maps of the city were distributed to people experiencing homelessness through homeless service providers and through peer outreach activities. The maps showed:

- flood-prone areas
- cool places to stay in hot weather
- accessible water fountains
- public toilets
- free bus routes
- free electronic device charging stations
- doctors who bulk bill
- areas of free wifi coverage
- contact details for homeless service providers including place to eat, shower and find accommodation
- weather information sources
- extreme weather safety messages (e.g. places to avoid in storms and staying in contact with friends).

Emergency preparedness kits were put together by people with a lived experience of homelessness who were employed as part of the project. The kits were distributed through peer outreach activities. The kits included items to help people experiencing homelessness deal better with extreme weather conditions.

Peer delivery: the peer outreach program

The Out of the Storm program employed nine peer outreach workers (people with a lived experience of homelessness); four in winter and five in summer. Employing people with a lived experience of

homelessness contributed to the project's principles and its success. The aim was to facilitate people's preparedness by drawing on peer's existing knowledge and the relationships they had with people in the community:

> *A lot of people I know from [my time on the streets] so that helped a lot. From [that experience] I know how to deal with people and when to talk to people, when not to talk to people.*
>
> (Peer worker)

The peer outreach workers went out in teams of two for three hours a day between one and three days a week. In winter, outreach was conducted during June and July 2018 and in summer from November 2018 to the end of February 2019.

As well as distributing the emergency kits, the peer outreach workers spread the word about responding to extreme weather. The talking points they used were developed during the program's discussions and creative sessions. Peer outreach workers could explain:

- the contents of the emergency kit, particularly things that might be unfamiliar to people (e.g. how to use the hand warmers, how to use the cool cloth and when to take the hydrolytes)
- the map, including places for warm meals and blankets in winter and cool places and water in summer
- the Code Red and Code Blue meanings (South Australian Government response to extreme weather during which some services stay open longer or overnight)
- how to contact homelessness service providers
- health safety, for example signs of heat stroke, staying safe in cars during hot weather and avoiding trees during storms.

Evaluating the project

The outcomes of the dialogues, creative sessions and peer outreach were evaluated against the project aims of increasing people's preparedness, social capital and empowerment.

Data collection and method

The data for the evaluation were collected during participatory observation and interviews and through peer outreach worker engagement-tracking lists. Observations were conducted at each of the dialogues and creative sessions, at a kit-making session and during

Figure 2: The Summer Extreme Weather Emergency Kit.
Hat, water bottle, refillable sunscreen container, small handheld motorised fan, SES cool cloth, first-aid kit, cooler bag, hydrolytes sachets, insect repellent wipes, umbrella, PVC document holder, SA Ambulance Service band-aid kit and sunscreen, SA Ambulance Service 'Call an Ambulance' card, city guide map.

Figure 3: The Winter Extreme Weather Emergency Kit.
Beanie, thermos, 2 x ten-hour hand warmers, wind-up torch, rain poncho, first-aid kit, dry bag, PVC document holder, carabiner clips for attaching items to backpacks, waterproof backpack cover, city guide map.

The Out of the Storm program employed peer outreach workers to distribute emergency kits and spread the word about responding to extreme weather.

Image: Alana Pedler

the winter and summer training sessions. This totalled approximately 30 hours. Data were also collected through 38 interviews with project staff (the Red Cross project officer and Hutt St Centre staff (11)), speakers and presenters at the dialogue and knowers and makers sessions (5), agencies that displayed the posters (2) and participants, peer workers and end users (17). Qualitative data were also collected at two group discussions with peer outreach workers in November and December 2019. The engagement-tracking checklists were completed by the peer workers in the field. These checklists recorded information on gender, approximate age of the person and the location of the interaction, brief details of what the peer worker provided to the person and what they talked about.

Findings

The Out of the Storm program successfully increased the reach of information of extreme weather events to people in the homeless community of Adelaide. Relevant information about extreme weather was provided directly to people via the information posters and through the conversations with the peer workers. Peer outreach workers documented 466 conversations about extreme weather with people experiencing homelessness and this format was a vital contribution to the positive evaluation of the project. Direct peer communication helped reach people who may not always interact with community services:

> *Some people are reluctant at first to talk to you, but as time goes on, they see you 'round a little bit, they see that you are trying to do some good and trying to help and it changes their way of interacting with you.*
>
> (Peer worker)

The emergency kits provided essential items to help physical preparedness. The peer outreach workers distributed 278 emergency kits. The response to the emergency kits was overwhelmingly positive:

> *I can use everything in here. I really needed one of these [the beanie].*
>
> (Person receiving an emergency kit)

> *People loved it [peer outreach and the winter emergency kits]. They really appreciated it because it was free and it was very helpful.*
>
> (Peer worker)

The co-designed map of the Adelaide CBD was particularly useful for people new to Adelaide. One peer worker noted:

> *[He] wasn't interested in the kit themselves but loved the idea, living in a car; came back to Adelaide hoping for work, took a photo of the map and wanted information where to shower.*
>
> (Peer worker)

The peer outreach also addressed some gaps in warnings about extreme weather and weather information by improving the timeliness and reach of messages. The dialogues highlighted that extreme weather information distributed via mainstream channels was not consistently reaching people who were homeless. However, through the peer outreach activities, information was available to people at the right time:

> *The notifications through winter were pretty good. The [Out of the Storm] crew cruising around were good. They started notifying people; they were talking to them everyday, letting them know if it was going to get worse, giving them equipment.*
>
> (Person receiving an emergency kit)

The Out of the Storm program also facilitated new social connections that enabled enhanced resilience of people in the homeless community. The program's training and

employment provided those involved with a sense of confidence and participation in the community:

> *The biggest benefit that we've had in terms of the clients has been increased participation and engagement in the community and what confidence that brings. That's expressed in all different ways. You've got some people who just naturally fit the role really well and you've got other people who started off quite shy and this has been a great opportunity to build communication skills.*
>
> (Homeless service provider staff)

The peer outreach fostered a sense of people being cared for and that there were trusted people to speak with. As the confidence of peer workers grew, they became more involved in how they could make a difference in people's lives:

> *There was a woman sitting at the bus station (she'd been there four days) and she had no idea; someone robbed her for her last two dollars and she had no idea what to do so [we] went back [to Hutt St Centre] and we got some things happening for her. There were a couple of other things where we could go the extra mile.*
>
> (Peer worker)

The growing confidence of peer workers had effects beyond the program. It altered how people saw themselves and their place in the world:

> *I knew I wanted to continue doing something. I've always wanted to do something, and this is gonna be my path in life. I can use all the shit that's happened and turn it into something positive, which is what I've always wanted to do. My family see me in a different light now. They see me as someone who's actually trying to do some things with their life.*
>
> (Peer worker)

As well as new relationships within the community and peer worker social networks, the Out of the Storm program also created relationships between people experiencing homelessness and the program developers – Australian Red Cross, the SES and the SA Ambulance Service as well as with the graphic design volunteers. The knowledge gained through the program has been fed back into preparedness operations:

> *From an emergency services perspective, being invited to come along and meet people is absolutely fantastic. It's great because we know that people are out there and we guess at how they might receive information or the actions they do or they don't take; what's available and what's not available, so it's absolutely priceless. I feed this information back into our operations section, the people who do warnings and also people who research our messaging. It's an excellent way for us to ground truth with a group that we look at as being really high risk.*
>
> (Session contributor)

How to facilitate an Out of the Storm program in your area

The basic structure of the program is to begin with the collaborative, knowledge-sharing sessions in the dialogues and knowers and makers sessions and deliver the resources through peer outreach. Each element fosters the principles of co-creation, collaboration and partnership, strengths and empowerment. These principles inform the practical, pragmatic, day-to-day facilitation of the program.

Pre-program: build relationships with partners

Spend time with service providers to plan the information-gathering sessions in ways that achieve learning from people's experience of homelessness; sharing knowledge and the expertise that the parties bring.

Facilitate the dialogues

There are lots of great ways to foster open dialogues. Some of the elements that worked for Out of the Storm in Adelaide:

- Hold the sessions at a homeless service provider's premises.
- Have staff (i.e. people who already have a trusted relationship with potential participants) talking with people in the lead-up to the program about what it's about and why we're doing it.
- Open the session with a brief introduction which sets the scene for the session for the participants to see themselves valued as experts.
- Use open and concrete questions that invite people to share their knowledge of good ways to respond to bad weather (e.g. How do you keep cool in summer? What are the hardest things about winter?).
- Use a map of the CBD with pens and pencils provided to draw on it. This provides a localised talking point that helps discussions about local knowledge of services, safe and unsafe places, water supplies, toilets and shaded areas.
- Create a list of items for an emergency kit by encouraging people to talk about what they and others may need (e.g. What do people currently use? What is too heavy? Do we need to include information on how and when to use some of the less familiar items like hand warmers?).

Facilitate the creative sessions

Facilitate the creative sessions by reinforcing key points from the discussion sessions and work out how to present these as messages. For example, consider 'top tips' for staying warm or cool. These come from the dialogue sessions and from existing education materials. For the Out of the Storm program, a brochure from SA Health was examined and participants determined what information was relevant to people experiencing homelessness, what might be re-written to improve its relevance and how it might be written simply or represented using images and symbols.

After each knowers and makers session, the volunteer graphic designer (who attended each of the creative sessions) drafted the materials that were reviewed by the group and re-drafted until a group consensus was achieved.

Peer worker outreach

The outreach activities were coordinated by Australian Red Cross and the Hutt St Centre. Hutt St Centre identified potential employees and provided support for job applications. Australian Red Cross and Hutt St Centre provided training, on-the-job support and mentoring.

A full guide for an Out of the Storm program, including training material, is available from Australia Red Cross in South Australia.

Conclusion

People who experience homelessness are exposed to vagaries in the weather as well as being among the most vulnerable in communities. Extreme weather resilience education for these people provides essential resources and targeted, relevant and timely information. The Out of the Storm program in 2018 used a collaborative co-design process, bringing together people experiencing homelessness, emergency services organisations and health service providers and graphic designers, to understand and identify activities and items that could improve resilience. The program design process resulted in posters, a city services map and emergency kits that reflected the needs of people exposed to extreme weather events. The program identified and provided relevant information, improved the timely delivery of important information and gave people some essential items to help their physical preparedness. The program changed the way that emergency services organisation thought about homelessness and how they provide information in ways that better support this section of the community. The project built social capital through collaborative discussions and fostered a sense within the homeless community of being cared for by people who understood their experiences. The Out of the Storm principles and process are a community-led approach to community resilience that has great potential to enhance the wellbeing of people experiencing homelessness.

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ABSTRACT

Social vulnerability is a widely recognised way of assessing the sensitivity of a population to natural hazards and its ability to respond to and recover from them. In the traditional approach to computing social vulnerability, the emphasis is mainly on the weaknesses only (e.g. old age, low income, language barriers). This study presents a strength-based social vulnerability index that identifies the strengths that communities have that help minimise disaster risk exposure. The strength-based social vulnerability index method is compared with the traditional approach using various statistical procedures like the one-sample T-test and the Wilcoxon signed rank test. This is performed through a case study measuring the social vulnerability for the 108 suburbs of Wollongong in New South Wales. The results show there is a significant difference between the values obtained from measurements using the strength-based social vulnerability index technique and those generated by the traditional approach. The implications of the results for emergency and disaster management are broadly discussed.

Social vulnerability to natural hazards in Wollongong: comparing strength-based and traditional methods

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Introduction

The risk of disasters is increasing globally due to the combination of factors, such as increasing exposure, high vulnerability and the frequency and intensity of hazards such as floods, fires, cyclones, hailstorms, earthquakes, tsunamis and volcanic eruptions (Alexander 2002). To reduce these risks, it is important to identify the vulnerable communities that would be disproportionately affected if not given the right priority in the preparation, response and recovery phases of emergency management (Paton & Johnston 2001, Garlick 2015).

The concept of social vulnerability has been widely accepted as a measure of the sensitivity of a population to hazards and its capacity to respond and recover from them (Cutter & Finch 2008). Based on the socio-economic and demographic characteristics of the population, social vulnerability assessments can help to highlight the spatial distribution of social inequalities by clearly identifying the communities or places with the highest concentration of vulnerable people.

The Vulnerable People in Emergencies Policy defines a vulnerable person as 'someone living in the community who is: frail, and/or physically or cognitively impaired; and unable to comprehend warnings and directions and/or respond to emergency situations' (Department of Health and Human Services 2018, p.6). This definition of a vulnerable person would typically include children (aged 0–4 years), the elderly (age 65 years and older), people living with a disability, low-income households, and people from culturally and linguistically diverse (CALD) backgrounds (Buckle, Mars & Smale 2000; Cornell, Cusack & Arbon 2012; King & MacGregor 2000). The traditional approach of computing social vulnerability has one major limitation: the indicators of vulnerability are determined based on weaknesses only (e.g. old age, low income, language barriers) with little or no attention paid to the strengths of communities, even as evident in their socio-economic and demographic profiles.

To address this limitation, a 2019 study proposed an alternative method of a strengths-based Social Vulnerability Index (SSVI) (Ogie & Pradhan 2019). The SSVI method is a balanced technique that aims to account for the strengths and resourcefulness of people within communities to self-organise and minimise their vulnerability to hazards (Ogie & Pradhan 2019).

The SSVI technique considers several aspects of social vulnerability being:

- income-specific SSVI - including low-income households
- CALD-specific SSVI - people from culturally and linguistically diverse backgrounds
- disability-specific SSVI - people living with disability or requiring assistance for daily activities
- children-specific SSVI - highly dependent children aged 0–4 years
- elderly-specific SSVI - the elderly population (Ogie & Pradhan 2019).

It is fair to say that the SSVI method is promising. For example, the SSVI technique identifies resources such as individuals with multilingual skills, high-net-worth philanthropists and others who can potentially provide support to help minimise vulnerability within their communities. However, little is known about how well the SSVI technique differentiates places based on the computed social vulnerability as compared to the traditional approaches. In other words, how well do the two methods agree in ranking the social vulnerability of different places? Can the two methods be used interchangeably?

Using a case study involving a comparative assessment of the social vulnerability of different places (suburbs) in the greater Wollongong metropolitan area of Australia, this research examines if there is a significant difference between the results from measurements using the SSVI approach and that obtained using the traditional approach. A broader implication of the results is discussed.

Method

Computing the Social Vulnerability Index

In the SSVI proposed by Ogie and Pradhan (2019), the strength within communities is considered as a moderator of the impact of natural hazards on vulnerable people. For example, places with high representations of able-bodied community-minded individuals are more likely to benefit from community strength through the contribution of time and efforts to support the vulnerable groups in minimising loss and hastening recovery from disasters (Ogie & Pradhan 2019). Community strength can also derive from high-net-worth individuals or people on high incomes who may be better positioned to contribute resources for rebuilding damaged facilities in the community (Ogie & Pradhan 2019). Language resources are also a strength to communities. While a place may have individuals from CALD backgrounds who may not be able to understand emergency warnings and messages, a high representation of individuals with multilingual skills can potentially help to a degree in facilitating communication and interpretation of messages (Ogie & Pradhan 2019). On these bases, Ogie and Pradhan (2019) proposed formulae to compute social vulnerability. These are compared with the equivalent formulae in the traditional approach (see Table 1).

Table 1: Comparing formulae for computing social vulnerability.

Measure of social vulnerability	SSVI approach	Traditional approach
CALD-specific	$(CALD_P/M_P) * (CALD_P/CALD_{TP})$	$CALD_P/T_P$
Income-specific	$(LI_P/HI_P) * (LI_P/LI_{TP}) * 1/P_S$	T_P/T_I (inverse of per capita income)
Children-specific	$(C_P/RoP) * (C_P/C_{TP}) * 1/P_C$	C_P/T_P
Disability-specific	$(D_P/RoP) * (D_P/D_{TP}) * 1/P_{DE}$	D_P/T_P
Elderly-specific	$(E_P/RoP) * (E_P/E_{TP}) * 1/P_{DE}$	E_P/T_P

Notation:

$CALD_P$ = the CALD population in a specific place, who either cannot speak the dominant language (English) or does so with very little competence. CALD groups are considered vulnerable because of language barriers, which often impair the interpretation and swift response to time-critical disaster warnings (Tapsell *et al.* 2010).

M_P = the multilingual population in a specific place who can communicate very well in English and in the language(s) better understood within CALD communities. The multilingual population can potentially help to minimise communication barriers by interpretation of emergency messages for vulnerable members of CALD communities.

$CALD_{TP}$ = the sum of CALD populations in all the places under comparative assessment who either cannot speak the dominant language (English) or do so with very little competence.

T_P = total population in a given place.

LI_P = low-income population in a specific place. Low income is considered to be yearly income less than $33,799 in the Australian context, including nil income and negative income. Nil income is when a person aged 15 years and over does not earn income while negative income includes business owners who report negative income due to losses incurred. People on low incomes are considered to be more vulnerable because they tend to live in hazard-prone buildings and neighbourhoods and have inadequate savings or resources needed for mitigation measures, insurance or swift recovery (Flanagan *et al.* 2011).

HI_P = high-income population in a specific place. High income is considered to be yearly income greater than $104,000 in the Australian context. As proposed by Ogie & Pradhan (2019), the high income and low income thresholds are based on both the minimum wage and an underlying methodology consistent with best practice in the Organization for Economic Cooperation and Development.

LI_{TP} = the sum of low-income population in all the places under comparative assessment.

P_s = the propensity to give personal resources such as time, money and other material items in support of community initiatives. Using volunteering data as a proxy, Ps is estimated as the proportion of the high-income population that volunteered in the 12 months prior to the 2016 Australian Census night.

T_I = total income in a given place.

C_P = children population (0-4 years) in a specific place. Children of this age group are considered vulnerable because they are physically and cognitively less able than adults to fend for themselves or make appropriate decisions during emergency situations (Peek *et al.* 2018).

C_{TP} = the sum of children in all the places under comparative assessment.

P_c = the propensity to provide unpaid care to another person's child. It is estimated as the proportion of individuals above the age of 15 years that provided unpaid care to another person's child.

D_P = population of individuals living with disability or needing assistance for daily living in a specific place.

D_{TP} = the sum of individuals living with disability or needing assistance for daily living in all the places under comparative assessment.

P_{DE} = the propensity to provide unpaid care to an elderly person or a person living with a disability. PDE is estimated as the proportion of people older than 15 years who provided unpaid care to a person with a disability, long-term illness or problems related to old age.

E_P = elderly population (65 years and older) in a specific place. The frailty, high healthcare dependence and relatively low social support network of this population make them vulnerable to psychological and physical effects (Whitton 2018, Marks 2019).

E_{TP} = the sum of the elderly population in all the places under comparative assessment.

RoP (the rest of the population) = $T_P - (C_P + D_P + E_P - CD_P - ED_P)$, where CD_P is the children population who are living with a disability, and ED_P is the elderly population who are also living with a disability.

Study area: Wollongong, Australia

Wollongong is a coastal city in the Illawarra region of New South Wales. Situated approximately 80 km south of Sydney (see Figure 1), the city is nested in a narrow coastal plain with the Illawarra Escarpment to the west and the Tasman Sea to the east (Flentje & Chowdhury 2005). The greater Wollongong metropolitan area is approximately 1296 km^2 with a population of over 293,575, made up of 50.8 per cent female and 49.2 per cent male (Australian Bureau of Statistics 2016). This makes it the third largest city in New South Wales and the 10th largest in Australia. Within the greater Wollongong metropolitan area, there are 108 suburbs spread across three different local government areas, namely the City of Wollongong, the City of Shellharbour and the Municipality of Kiama.

Figure 1: The study area was Wollongong on the southeast coast of Australia.

Legend

Wollongong suburbs Australia

Wollongong experiences a wide range of natural hazards such as landslides, heatwaves in the summer months, and damaging winds that sometimes exceed 100 km/h, but the biggest natural hazard threats remain flash floods and storms (Flentje & Chowdhury 2005). In the following section, we present the approach employed in order to compare the results of social vulnerability computed for Wollongong suburbs, using both the SSVI technique and the traditional method.

Approach for method comparison

The method comparison for the SSVI technique and the traditional approach of measuring social vulnerability followed a systematic process as depicted in Figure 2. Social vulnerability was computed for the various aspects investigated (i.e. income-specific, CALD-specific, children-specific, elderly-specific, disability-specific and overall). The SSVI technique was used followed by the traditional approach. This computation was done for all 108 suburbs in the greater Wollongong metropolitan area. It was observed that there were some new and sparsely inhabited suburbs with zero value results for the two methods. To ensure that the comparison results were not biased by these suburbs, the records were removed before conducting the comparison test. For disability-specific social vulnerability N=89 (19 zero value records were removed), for elderly-specific social vulnerability N=100 (8 zero value records were removed), for CALD-specific social vulnerability N=68 (40 zero value records were removed), for children-specific social vulnerability N=95 (13 zero value records were removed) and for income-specific social vulnerability N=103 (5 zero value records were removed).

The raw results of the two measurements were normalised by performing a logarithmic transformation (base 10) to obtain uniformly distributed datasets as required for parametric testing. For purposes of

comparison, the normalised results from the two measurements were standardised to have scores from 0–1.

Using the standardised scores, the difference between the two measurements were determined, that is, the value from the traditional approach minus the value from the SSVI approach. The difference was examined for uniform distribution using the Shapiro-Wilk normality test (Nahm 2016). If the difference was uniformly distributed, a one-sample T-test was conducted with test value=0. The one-sample T-test is a useful and robust parametric test for a method comparison study (Nahm 2016). The T-test essentially aims to answer one question: Is there a significant difference between the results from the two measurements (i.e. the SSVI approach versus the traditional approach)? To establish this, the T-test determined if there is a variation from zero of the difference between the two measurements across the suburbs investigated.

The null hypothesis was that there was no significant difference between the two measurements. If the difference between the two measurements varied significantly from zero (i.e. statistically significant), then the conclusion is that the two measurements do not agree. However, if the T-test result was not statistically significant, this would indicate some level of agreement between the two methods, in which case, we will proceed to determine the level of agreement using the Bland–Altman plot (Bland & Altman 2007).

However, if the difference between the two measurements was uniformly distributed, the non-parametric equivalent of the one-sample T-test would be used, that is, the Wilcoxon's signed rank test (Nahm 2016). The null hypothesis was that the median difference between the two measurements equalled zero. If the alternative hypothesis was true and the median difference between the two measurements varied significantly from zero (i.e. statistically significant), then the conclusion is that two measurements do not agree. However, if the test result was not statistically significant, this would indicate some level of agreement between the two methods, in which case, we will proceed to determine the level of agreement using the Bland–Altman plot.

Results

The results of the Shapiro-Wilk normality tests indicated that only the CALD-specific (p=0.242), elderly-specific (p=0.233) and children-specific (p=0.122) aspects of social vulnerability are uniformly distributed with p>0.05. The disability-specific, income-specific and the overall (composite) aspects of social vulnerability had p values of 0.000, 0.003 and 0.000, respectively. Hence, a one-sample T-test, with a test value of zero, was conducted for the CALD-specific, elderly-specific and children-specific aspects of social vulnerability. The results presented a 95 per cent confidence intervals, that is, statistical significance at the p<0.05 level. For the CALD-specific social vulnerability, the results showed that the difference in values measured by the two methods was significantly lower (-0.052±0.135) than zero, t(67)=-3.166, p=0.002. The results for the children-specific social vulnerability showed that the difference in values measured by the two methods was significantly higher (0.268±0.323) than zero, t(94)=11.751, p=0.000. For the elderly-specific social vulnerability, the results showed that the difference in values measured by the two methods is significantly higher (0.247±0.396) than zero, t(99)=16.047, p=0.000. Hence, the null hypothesis was rejected and the conclusion was that the two measurements do not agree for the CALD-specific, elderly-specific and children-specific aspects of social vulnerability.

The non-parametric Wilcoxon's signed rank test was conducted for the disability-specific, income-specific and the overall (composite) aspects of social vulnerability.

The disability-specific social vulnerability rendered a Z-score of -6.835, which was statistically significant (p=0.000) at 95 per cent confidence level. From the 89 suburbs involved in the test, there were 14 negative ranks that summed to 332 and 75 positive ranks that summed to 3673. A negative rank means the measurement from the traditional method is lower than that from the SSVI approach while a positive rank indicates the opposite. The higher the difference between the sum of ranks for the positive and negative ranks, the greater the difference between the SSVI method and the traditional method.

The income-specific social vulnerability rendered a Z-score of -6.448, which was statistically significant (p=0.000) at 95 per cent confidence level. From the 103 suburbs involved in the test, there were 24 negative ranks that summed to 718 and 79 positive ranks that summed to 4638.

Extensive fires in January 2020 in Victoria's east exposed many communities and holiday makers to the fire danger as well as loss of amenities and access to food. Members of the Melbourne-based Sikh Volunteers Australia travelled to fire-affected regions providing free meals to hundreds of people.

Image: Sikh Volunteers Australia permission granted

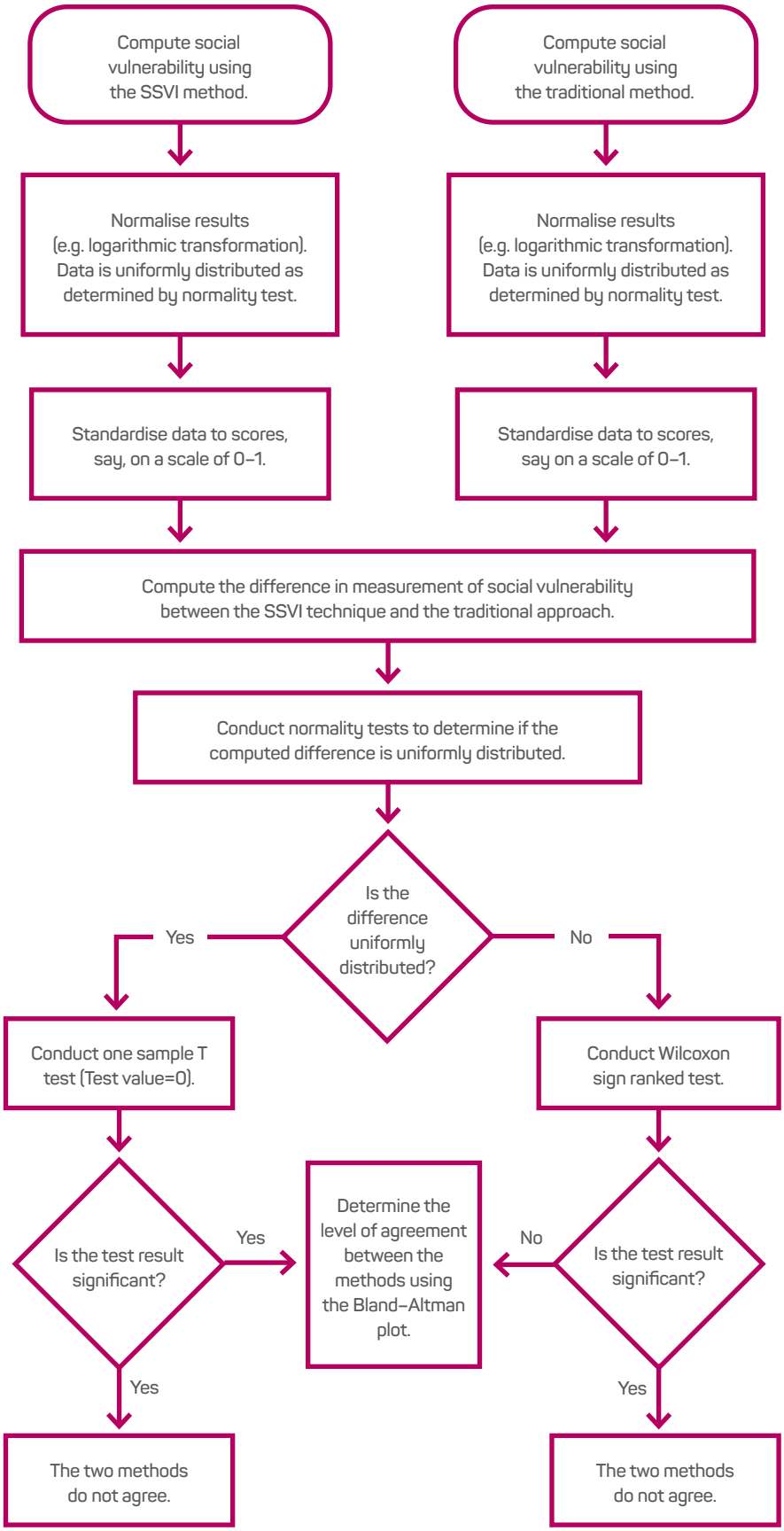

Figure 2: Methodology flow chart used to determine the social vulnerability index.

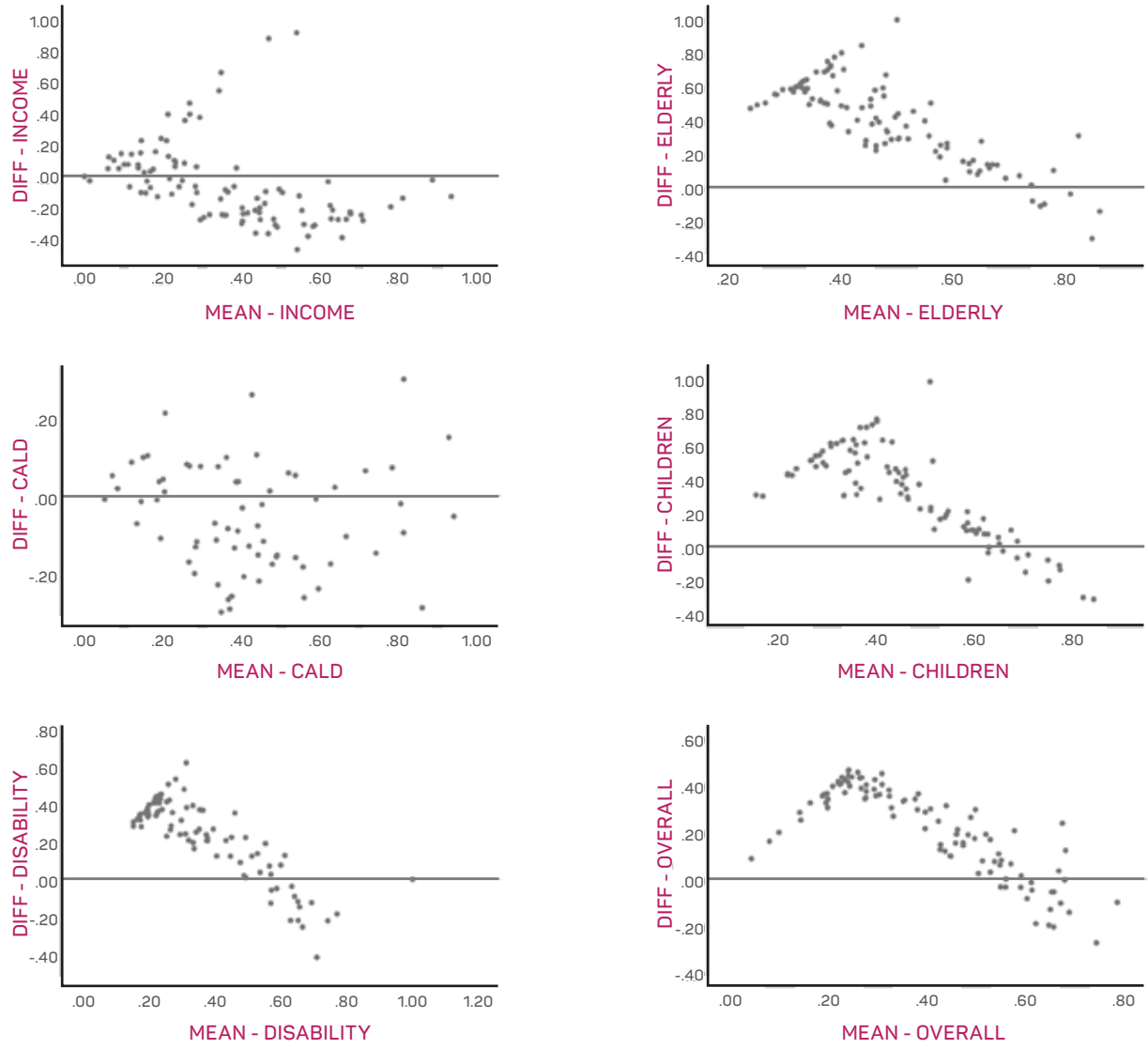

Figure 3: Scatter plots showing variations in the level of agreement between the SSVI and traditional method.

The composite or overall social vulnerability rendered a Z-score of -7.610, which was statistically significant (p=0.000) at 95 per cent confidence level. From the 103 suburbs involved in the test, there were 17 negative ranks that summed to 365 and 86 positive ranks that summed to 4991. Based on these results (i.e. p< 0.05), the null hypothesis was not rejected and the conclusion was that the two measurements do not agree for the disability-specific, income-specific and the overall aspects of social vulnerability.

A scatter plot in Figure 3 shows variations in the level of agreement between the two methods across the range of suburbs investigated, with the difference between the two methods plotted on the y-axis and the mean between the two methods plotted on the x-axis. The further away the points are from the zero line, the lower the level of agreement. In interpreting the social vulnerability scores, it is important to note that:

- 0.0–0.2=Very Low (VL) vulnerability
- 0.2–0.4=Low (L) vulnerability
- 0.4–0.6=Median (M) vulnerability
- 0.6–0.8=High (H) vulnerability
- 0.8–1.0=Very High (VH) vulnerability (Ogie & Pradhan 2019).

Hence, when the level of difference in Figure 3 is greater than 0.2, this would certainly warrant a disagreement in the category of vulnerability (e.g. H versus VH) to which a suburb is assigned. The maps are presented to highlight the difference in the results for only the best case (Figure 4) and the worst case (Figure 5) in terms of method agreement.

Discussion

Overall, the results show there is a significant difference in the outcomes obtained when the SSVI approach is used to compute social vulnerability as compared to when the traditional approach is used. The conclusion is that the two methods do not agree for measuring various

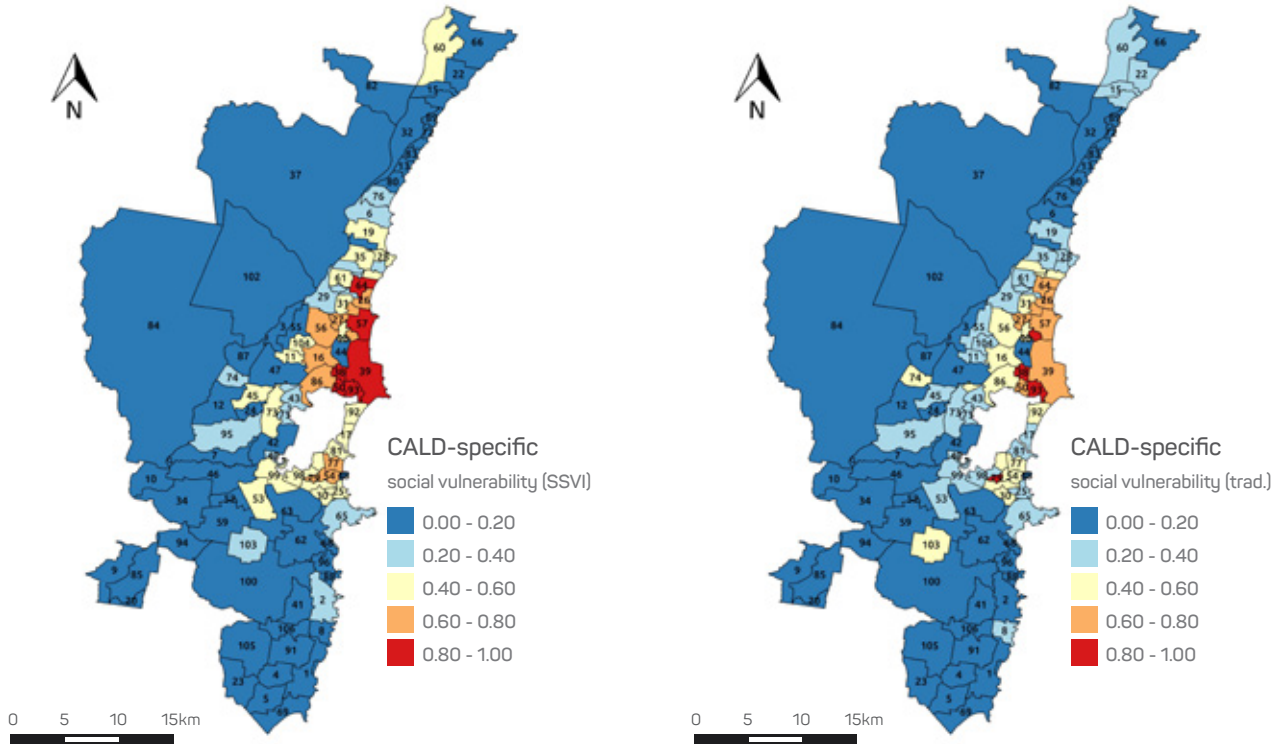

Figure 4: CALD-specific social vulnerability using the SSVI approach (left) versus the traditional approach (right).

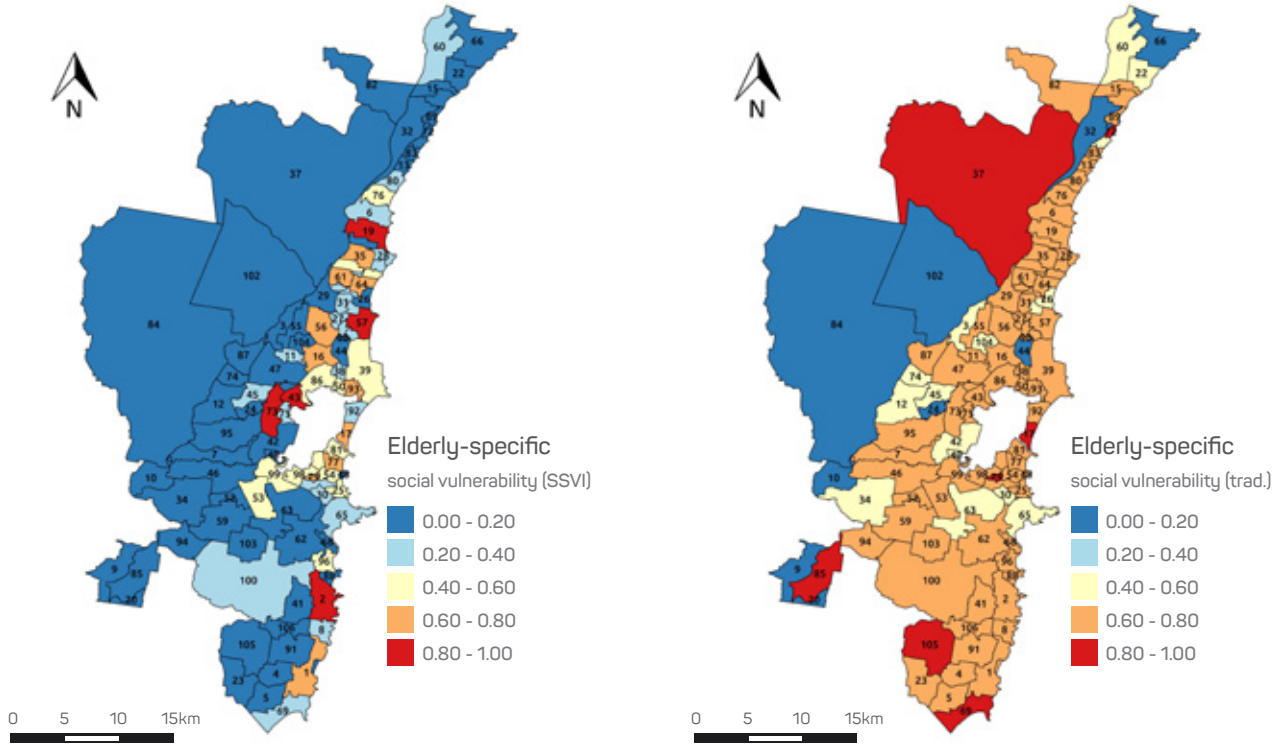

Figure 5: Elderly-specific social vulnerability using the SSVI approach (left) versus the traditional approach (right).

aspects of social vulnerability based on the results of several statistical tests, including the one-sample T-test and its non-parametric equivalent- the Wilcoxon's signed rank test. Figure 4 is the best case of agreement between the two methods, yet it is obvious that the SSVI approach highlights some additional suburbs (e.g. ID=57, 39 and 64) in the 'Very High' vulnerability category that are not captured in the same category using the traditional approach. Apparently, Wollongong (57) has the highest (15.34 per cent) representation of people from CALD backgrounds in the entire study area, while Port Kembla (39) and Fairy Meadow (64) have relatively higher numbers of people with limited English language proficiency as compared to their multilingual residents who could potentially help with the interpretation of emergency messages or warnings. The traditional approach could not capture these factors.

In Figure 5, the most striking contrast are in Cataract (37), Carrington Falls (85), Foxground (105) and Clifton (72). The traditional approach classified these four suburbs in the VH vulnerability category because the proportion of their population that is elderly is very high. However, when the population of the elderly across all the other suburbs is considered (as proposed in the SSVI approach), these four suburbs are ranked in the VL vulnerability category. The reason is because only a very small proportion of the elderly population in the entire study area live in these four suburbs. The SSVI method ranked Wollongong (57), Kiama (2), Kanahooka (43), Dapto (73) and Woonona (19) in the VH vulnerability category mainly because these suburbs have the highest elderly population in the study area, yet the propensity for the rest of the population to provide unpaid care to an elderly person is slightly below the average. For the same reason, Albion Park (53) would have been implicated in the VH category except that its elderly population is relatively smaller than the rest of the population that can potentially provide support in times of natural perils.

Implications for emergency and disaster management

The SSVI is quite different from the traditional approach of computing social vulnerability. Unlike results from the traditional approach that do not account for the strengths within communities, the SSVI technique facilitates fairer decisions about the most vulnerable communities. This could be prioritised in resource allocation to improve resilience and coping capacity. Practitioners and emergency services organisations can rely on the results from the SSVI technique in order to plan and determine the levels of preparedness, response (e.g. evacuation priority) and recovery effort required in different communities. During major hazard events, citizens, volunteer workers and donors of relief materials can rely on results from the SSVI technique to identify highly vulnerable communities that may require higher levels of specific supplies (e.g. baby food, nappies, mobility aids, etc.). The information related to vulnerability from the SSVI can also be used as an input in computing natural hazard risks (Boon 2013, Buckle 1999).

There are three main advantages to adopting the strength-based approach:

- It encourages authorities to recognise the strengths in communities rather than just the deficiencies or weaknesses.
- It can help to refocus resources that would have been lavished on experts to strengthen capacities within communities.
- It can encourage and empower citizens to take actions to support their communities rather than relying on overstretched resources and expertise from emergency services organisations.

Adopting the strength-based approach means taking the focus away from what is 'wrong' to what is 'strong' within communities; a position consistent with an emphasis on capacity over vulnerability (Handmer 2003). This helps to build resilient communities, not by virtue of sole reliance on external sources, but by helping communities recognise their inherent strengths and to act together. In other words, by adopting the strength-based approach, communities can potentially avoid 'secondary vulnerability', that is, vulnerability arising due to excessive reliance on external sources. This does not suggest that emergency services organisations will become less relevant to communities. Rather, it is highlighting the danger of undermining community resourcefulness due to over-reliance on emergency services organisations.

This can be problematic during major emergencies and disasters where too many communities are affected and the resources within emergency services are overstretched. It is important that, as part of implementing the strength-based approach, an enabling environment is created for community strengths to be harnessed. This requires equipping the able-bodied members of communities with the requisite knowledge and training to work alongside emergency services organisations. In the same vein, emergency service personnel should be trained to work alongside community members and other 'spontaneous' volunteers without perceiving them as threats. Emergency services organisations could consciously seek to understand the unique strengths of each community and develop workable plans to harness same during events. The SSVI technique offers ideas for where there might be community resources that could potentially be used to help minimise community vulnerability.

Conclusion

Natural hazards often have disproportionate impacts on different communities due to social inequalities that account for the difference in people's sensitivity to natural hazards and their ability to respond and recover. Social vulnerability analysis can help to improve understanding of those communities or places, which,

are most likely to suffer disastrous outcomes. In the traditional approach to computing social vulnerability, the focus has been on weaknesses (e.g. old age, low income, language barriers, etc.). However, the SSVI aims to account for the strengths and resourcefulness of people within communities to self-organise and minimise the effects of natural hazards. This study compared the two methods through a case study involving social vulnerability measurement for various suburbs in the Wollongong area of New South Wales. The results revealed that there is a significant difference between the values obtained from measurements using the SSVI technique and those generated by the traditional approach. This has implications for emergency management. Future studies can build on the SSVI technique by exploring additional factors or dimensions of social vulnerability, including institutional and cultural barriers. A consideration of hazard-related information and other place-specific factors can help to improve the relevance of the SSVI approach to other cities.

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ABSTRACT

When earthquakes and other natural hazards strike, it is not only humans that can become trapped in collapsed structures. This paper details current international practice of structural search markings used after disaster events. It also explores developing search markings to include markings for animals so that rescuers also take note of the presence and status of animals rescued from the location. Historically, companion animal owners have been known to consistently breach cordons to search for their animals. Currently, disaster search marking systems do not accommodate the rescue status of animals being removed or that are still trapped. An animal-specific search marking system is recommended and decision makers within search marking bodies should consider adoption or development of such marking systems. The availability of an animal search marking could reduce confusion during human-focused rescue efforts and contribute to the legitimisation of technical animal rescue as an independent discipline.

Standardised search markings to include animals

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Introduction

The International Search and Rescue Advisory Group (INSARAG) is established under the United Nations. The group oversees guidelines and minimum standards for urban search-and-rescue teams involved in international responses to earthquakes. One of the key outputs of this group is the production of methodologies, including a standardised marking system, to indicate that structures have been searched. These markings indicate the location, or potential location, of victims buried in collapsed structures.

There is a growing trend that animals are becoming an issue for search-and-rescue activities. Because search and rescue is an urban discipline that is focused on structural collapse response, teams often come into contact with animals, particularly companion animals, that also need to be rescued. This is in line with increasing public expectation and, in some cases, legal requirements.

INSARAG markings

INSARAG markings have undergone several revisions in the past few years, notably dropping the structural assessment marking (Figure 1) in favour of the worksite marking (Figure 2) and re-introducing the victim marking system (Glassey 2014). However, the current INSARAG victim marking system is not consistent with the Federal Emergency Management Agency (FEMA) equivalent marking system and irregularities include team identification and 'all victims removed' indication.

FEMA markings

The United States of America (USA), emergency services organisations do not subscribe to the INSARAG search marking methodology when operating domestically. Instead, they use USA-specific structures and hazards marking (Figure 3) and the search assessment marking system (Figure 4), as determined by FEMA.

In the USA, the FEMA structures and hazard marking is placed on the outside of damaged structures to indicate that the building has been assessed as at either low, medium or high risk of collapse. This is denoted with either no internal line, one diagonal line or two diagonal lines forming a cross, respectively. For example, in Figure 3, a structure has been assessed as at

Figure 1: Former INSARAG Structural Marking (United Nations 2006).

Figure 2: INSARAG Worksite Marking (United Nations 2015).

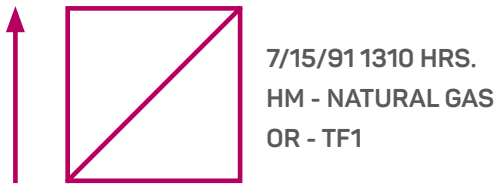

Figure 3: FEMA Structures and Hazards Marking (US Army 2016).

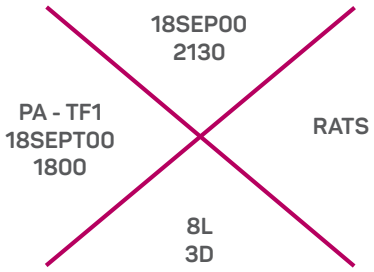

Figure 4: FEMA Search Assessment Marking (FEMA 2006).

medium risk of collapse by New England Task Force 1 on 28 June 2003. The marking also notes a hazardous material risk of natural gas. An arrow shows the direction to the safety point of entry to the structure (US Army 2016).

The FEMA search assessment marking (Figure 4) is placed on the street-address side of the building. The marking has a diagonal line with a team identifier (i.e. PA-TF1) and date and time of entry is added in the left quadrant. Hazards are noted in the right quadrant. When leaving the structure, the date and time of exit is updated and a second diagonal line is added (to create a cross). Information about any people deceased (D) and living (L) who were removed from the structure are indicated. Other minor variations for this marking are used in reconnaissance of structures where a search is not carried out (US Army 2016).

Including markings for animals

Under the USA National Incident Management System (NIMS), response team capability (also known as team typing) and position requirements are specified, now include technical animal rescue. Additionally, requirements to have credentialed animal-rescue personnel was reflected in the 2014 edition of the National Fire Protection Association (NFPA) standard on technical rescue, with animal rescue being legitimised as a new chapter and discipline within this consensus based standard (NFPA 2014). Both the NFPA and NIMS requirements for urban search and rescue responders require such operators to understand the national protocols for searching for people in collapsed structures.

Following Hurricane Katrina in 2005, the USA passed a federal law known as the *Pet Emergency and Transportation Standards (PETS) Act of 2006* that made provisions for the rescue, care and accommodation of companion animals rescued during emergency and disaster events. Federal funding covers the costs of companion animal rescue undertaken by urban search and rescue teams within the USA. It is the norm for urban search and rescue (USAR) teams to be actively involved in the rescue of companion animals (Fugate 2019).

In other countries such as Australia and New Zealand, the INSARAG marking systems are adopted. However, an analysis by Glassey (2013) showed their use and meaning were not well understood by users nor within the emergency management sector.

Search markings confusion

In April 2017, the town of Edgecumbe in New Zealand (population 1700) was flooded when flood-protection walls failed. Responders and the local community worked quickly to evacuate the entire township but approximately 1000 animals were left behind in the

cordoned area that contained roughly six-hundred houses. As no humans remained in the evacuated area, animal rescue teams (supported by volunteer response teams) carried out a massive operation to rescue the stranded animals. They applied the INSARAG rapid clearance marking (Figure 5) that requires the marking to be 'applied in the most visible/logical position on the object to provide the greatest visual impact' (United Nations 2015, p.90). The INSARAG rapid clearance marking was used to expedite search progress and minimise the damage to property left by marking.

However, local civil defence authorities did not understand the meaning of the marking and incorrectly advised community members that the 'C' in the diamond meant the structure was 'primarily condemned' (Stuff 2017) when, in fact, the marking showed the structure was 'clear' of victims. A corrective public announcement was subsequently issued (Glassey 2017). In addition, some of the markings applied were not compliant with the INSARAG guidelines, with some rapid clearance markings incorrectly marked with a 'C' in a triangle.

The application of markings is an emergency power under Section 92 of the New Zealand *Civil Defence Emergency Management Act 2002* and is protected under Section 110. However, the permanent markings caused damage to properties and angered some property owners. In the New Zealand Society for the Prevention of Cruelty to Animals (SPCA) report (Glassey 2017), it was recommended that a Low Damage Marking (LDM) system be used for future responses, consistent with earlier recommendations (Glassey 2014). The LDM system provides an alternative to permanent markings such as adhesive labels and waterproof paper stapled to structures. An added benefit of using alternate methods such as label sheets or placards is that they do not create fumes found in aerosol paints. Such paints can adversely affect search dogs undertaking their search activities (US Army 2016, p.25).

Other animal response organisations such as Animal Evac New Zealand produced their own LDM system due to the lack of existing marking systems for structures in regard to animal rescue (Figure 6).

Confusion around search marking systems also occurred during an EF-5 tornado in Greensburg, Kansas in 2007. During this event, it was observed that some responders marked structures clear of victims with a 'V', denoting it was 'vacant'. This conflicted with the FEMA victim marking for an unconfirmed victim location.

These examples suggest that work is needed to educate response personnel on disaster marking systems used in their respective countries. It also suggests that better alignment is required of marking systems between FEMA and United Nations systems.

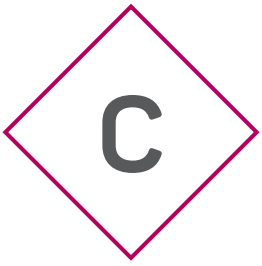

Figure 5: INSARAG Rapid Clearance Marking.

Figure 6: Animal Evac NZ Rapid Clearance Marking (Glassey & Andrews 2018).

Why animal rescue affects human rescue

A growing trend in urban search and rescue is the consideration of animals, in particular companion animals that are left behind during evacuation or in disaster-affected areas. Studies have highlighted the actions of pet owners who illegally enter or attempt to illegally enter cordon zones to search for and rescue their animals (Day 2017, Glassey & Wilson 2011, Heath 1999, Taylor *et al.* 2015, Travers, Degeling & Rock 2017, Whittaker & Taylor 2018). Of owners who leave their pets behind, 50–70 per cent are likely to attempt to return to rescue them (Heath 1999). In the 2017 Edgecumbe flood, 54 per cent of pet owners attempted to rescue their animals and 33 per cent illegally breached the cordon area, mostly to rescue their pets and/or retrieve medications (Glassey 2018).

In the context of urban search and rescue incidents, there have been cases of animal owners returning to

Specialist animal rescuers evacuate pets during Hurricane Harvey near Texas in 2017.

Image: Eric Thompson

earthquake damaged structures to save their animals. In the Haiti earthquake in 2010 that caused over 100,000 human deaths, animal owners returned to collapsed structures to search and to rescue their pets (Sawyer & Huertas 2019). This was also the case in 2011 following the earthquake in Christchurch, New Zealand (Potts & Gadenne 2014). This demonstrates the protective behaviour of animal owners that occurs.

The phenomena of pet owners illegally entering a disaster zone highlights the risks such owners are willing to take to protect their animals. As such, unaccountable and untrained members of the public within the cordon place their own safety at risk or risk the safety of rescue and security personnel who may have to intervene to remove them.

In the Edgecumbe floods, a woman was refused entry at the cordon to access her horse. In defiance, she swam across the flooded river unbeknown to safety officials. In effect, the cordon, which was meant to protect human life, negatively influenced this person to put her life at risk. To reduce such behaviour, responders carrying out door-to-door searches in the aftermath of the flood recovered deceased pets and passed them on to the local animal shelter to identify and reunite them with their owners. This removed the motivation of evacuated residents to return to find their pets. The early return of these animals to their owners before extensive degradation of the bodies minimised emotional harm to pet owners.

Animals left behind and trapped in collapsed structures may also create false flags for electronic and canine search teams. False alerts from trapped animals distracts human rescuers at a time when expeditious location and retrieval of people trapped is paramount. Addressing the issues of animal rescue improves the search and rescue of humans.

Recommendations

The lack of animal-inclusive search markings has been recognised as an issue for some time, both at the international level and within the USA (Glassey 2010, 2017). The lack of animal-inclusive search marking protocols has resulted in an animal-specific disaster search marking (Figure 7) for houses and structures by the Animal Search and Rescue (ASAR) Best Practice Work Group in the USA and is promoted by experts such as Green (2019). The marking is not issued or approved by FEMA, NFPA nor INSARAG but it provides a starting point to promote a common marking system to prevent confusion in the absence of direction on whether disaster search markings can be used for animal search-and-rescue or disaster response groups. However, the marking system is not universally accepted, it conflicts with historical INSARAG symbology and creates another marking system for responders to recognise and understand. Organisations such as FEMA, NFPA and INSARAG have an opportunity to include animal rescue elements in their existing marking systems, which will assist interoperability.

The ASAR animal search marking is a draft marking system for animal search and rescue as set by the International Technical Rescue Association (ITRA). The revised Animal Search Marking (Figures 8 and 9) is aligned to the former and discontinued INSARAG Search Assessment Marking. The key revision is that the outsides of the primary shape are not species-specific but indicate the rescued-alive, rescued-dead or remain (dead or alive) status of animals at the site. The circle around the primary shape in either the ASAR or ITRA Animal Search Marking and indicates that animals remain on the site or that the site was not fully searched and may require another team with additional capability to undertake the animal rescue or recovery. The horizontal

Figure 7. ASAR House Marking.

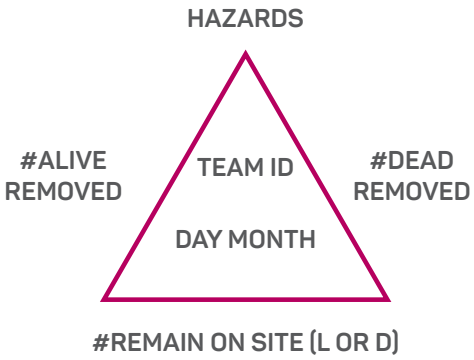

Figure 8. Proposed ITRA Animal Search Marking.

Figure 9. Draft ITRA Animal Search Marking.

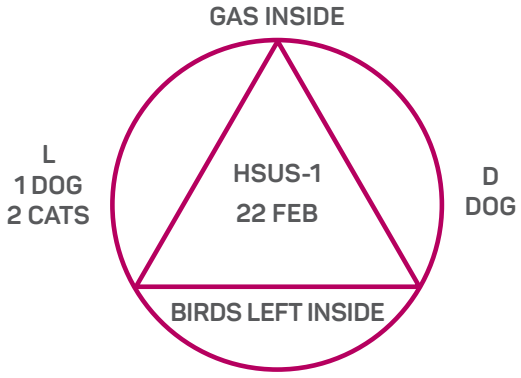

Figure 10. Draft ITRA Animal Search Marking denoting animals remain.

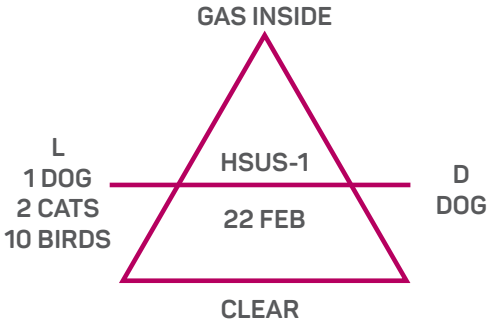

Figure 11. Draft ITRA Animal Search Marking denoting all animals removed.

line through the primary shape (Figure 11) indicates that all animals, both alive and deceased, have been removed from the site.

It is recommended the revised Animal Search Marking be adoption or be considered for further refinement by authorities including FEMA and INSARAG.

Conclusion

As greater emphasis is placed on the life of animals (in particular, companion animals) during emergencies and disasters, those leading urban search-and-rescue operations need to evolve search methodologies to reflect public expectations. Moving from a 'human life first' to 'saving pets, saves people' mentality will improve public confidence during future responses and minimise the compromised safety of pet owners. The introduction of an internationally recognised and interoperable animal search marking system will help with human and animal rescue symbology. This will require leadership and an inclusive approach to urban search and rescue at national and international levels.

There will be advantages in working towards an integrated response between animal rescue responders and USAR (human rescue) operatives given that animal rescue responders are often trained in human rescue and first-aid. Animal rescue responder capacities would act as a force-multiplier to expedite search efforts, reduce the duplication of searches and, ultimately, minimise public anxiety. Animal rescue would benefit from a standardised search marking system to avoid the proliferation of non-universal symbology that would lead to confusion and challenge search efforts.

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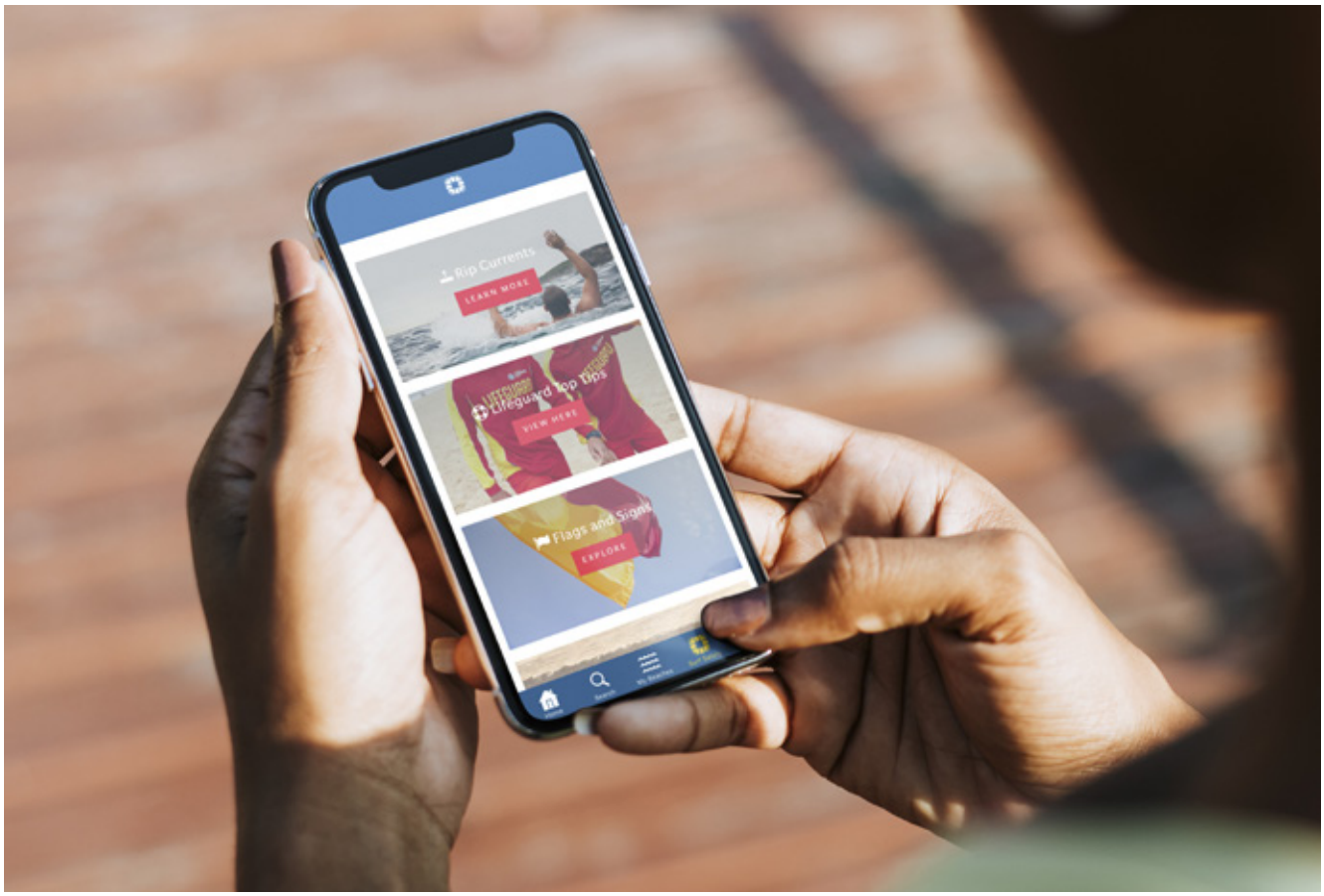

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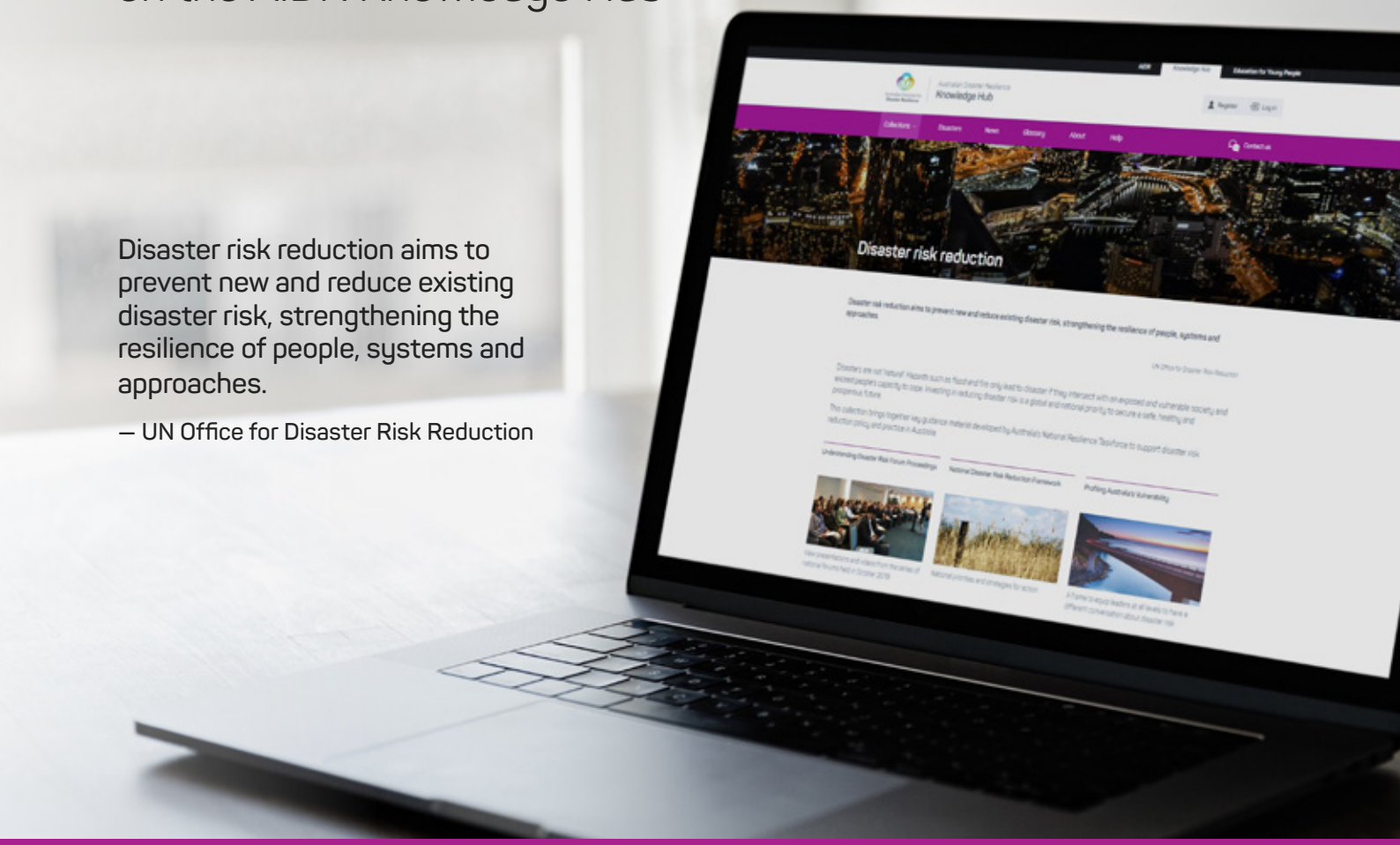

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