Public health and natural hazards: new policies and preparedness initiatives developed from an Australian bushfire case study

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In 2015 the Sendai Framework for Disaster Risk Reduction (SFDRR) was endorsed by the United Nations General Assembly. Sendai is a non-binding agreement that recognises the State has the primary role to reduce disaster risk but that responsibility should be shared with other stakeholders including local government and the private sector. It aims to substantially reduce disaster risk and loss of life, livelihoods and health in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries.[1]

The SFDRR has evolved beyond its predecessor, the Hyogo Framework for Action 2005-2015, to embrace human health and wellbeing, and in encompassing science and technology (for example, there were three references to 'technology' in the Hyogo Framework for Action and 19 in the SFDRR).[2] This includes connecting policy development and implementation with evidence and facilitating the transformation and transfer of research into practice. Three components of the SFDRR – health, economic development and climate change – demonstrate how public health is situated within Sendai, and how the boundaries between public health and environmental health are increasingly less distinct.[3] Public health as a discipline has accordingly expanded beyond responding to specific events: collaboration, capacity building and research need to be widespread

Abstract

Objective: Public preparedness for natural hazard events is low. With worsening severe weather events due to climate change, public health policy and practices must evolve to more effectively engage communities. This study's findings identify and suggest new strategic public health policies to shift the practice of all-hazards preparedness into routine, everyday life.

Methods: Semi-structured interviews, focus groups and Thematic Analysis were used to investigate the interactions between participant groups: emergency responders and animal owners.

Results: Three policies designed to improve human safety and well-being are proposed and discussed. These are (i) a new system of workplace leave, (ii) an innovative regime of financial incentives for fire-ready properties, and (iii) review of the use of firebreaks on farms and rural blocks.

Conclusion: Policies proposed in this research aim to proactively narrow the awareness-preparedness gap and build adaptive capacity to minimise risk to human health in all-hazards contexts. Further research could evaluate the efficacy of trialled public policy.

Implications for public health: These new policies seek to contribute to establishing and maintaining a culture of preparedness as a routine aspect of everyday life, and thus promote and protect public health in the short, medium and long terms.

Key words: bushfire, preparedness, public health policy, emergency responders, animal owners

and diverse to enable bottom-up innovation to meet top-down goals and ideals.[4-7]

Beneath Sendai's overarching principles, fire science explores an expanding spectrum of fire-related social, economic, physical and agricultural sciences. This knowledge contributes to the successful and dynamic management of increasingly complex fire problems that affect human populations in a changing climate. This study contributes to that knowledge base. Implementing

the SFDRR has clear benefits including improved preparedness, and discerning ways to translate risk mitigation and reduction strategies into standard, practical applications to curb human suffering.[8-10]

Objective

The aim of this study is to contribute to the goals of the SFDRR by improving protection of human life and wellbeing in bushfire and

other emergencies; to promote 'fire-fitness' (an original term coined by the lead author, described in detail on p3 of reference no. 11). This is achieved by establishing preparedness behaviours as routine – thereby reducing the awareness-preparedness gap (i.e. the mismatch between awareness and preventative action). From an economic perspective alone, the public cost of natural hazards in Australia is expected to "triple to US$17.7 billion by 2050"[19] (equivalent to $AU24.7 billion). Adaptive capacity building is required in communities around the globe.

At present, household levels of fire-fitness[11] in Australia and elsewhere are low, with fire-safe routines often assigned a lower priority than other competing complexities of everyday life.[12-14] Practising considered, timely and safe action – to be fire-fit[15-18] – within and outside the fire season is a present-day imperative.

The awareness-preparedness gap is narrowing disproportionately slowly compared with the magnitude of public resources assigned to help people attain readiness.[12,13,20-22] Making safe, potentially life-saving fire preparedness behaviours a routine element of daily life is one of a suite of lifestyle changes people need to adopt due to the escalating influence of climate change on natural hazards.[23] This paper proposes three areas of public health policy that aim to actively cultivate sustainable patterns of routine behaviours to better enable protection of lives and property, fortify psychological and physical preparedness and facilitate resilient and effective responses.

The emergencies literature currently lacks evidence from animal owners as a diverse whole. This study, with a combination of participant groups designed specifically to cross demographic boundaries, records and analyses some of the experiences, expectations and needs of communities who have 'lived through' bushfire emergencies, and expect to face this hazard again.

Emergencies can occur when people, property, the environment and other assets (including animals) intersect adversely with hazards.[4] Animals may be considered 'dependent others' and their welfare is frequently linked to human physical and psychological health.[24-26] For livestock farmers, an economic relationship does not exclude emotional attachment and both are considerations at the responder-owner interface.[20,24,27]

The presence of animals adds complexity to owners' preparedness and planning.[20,27] Incidents involving animals have been identified as a reason why people risk their own welfare and safety.[28-31] There is also an increasing understanding of the link between effective animal management in an emergency and the saving of human life, and a growing awareness of the longer-term adverse human health implications of losing animals in an emergency incident.[24]

Responding safely and appropriately to a fire emergency is a realistically attainable goal – though frequently thwarted by the magnitude of the awareness-preparedness gap.[20,27] To overcome this requires fire-fitness to be elevated to 'business as usual' status – as routine as buying groceries or fuelling a car. While the basic human urge to save a dependent other at the risk of personal safety may never be overcome, learned coping appraisals and adaptive responses, in combination with proactive preparedness routines as part of everyday living, could facilitate pre-hazard behaviours that overall reduce risk-taking while achieving a more effective response with less trauma and anxiety. Therefore, this paper's research question is: what preparedness initiatives can be learned from the emergency responder-animal owner interface in a bushfire at-risk community that can be usefully applied to generate new public health policy?

Method

Research participants were firefighters, police officers, rescue officers of the State Emergency Service (SES), farmers with farm fire units and animal owners (a diverse group owning from one pet to thousands of livestock). Study participants resided in a bushfire at-risk regional area in South Australia – 'the driest state in the driest continent',[32] chosen for its fire history.[33]

A situationalist orientation, i.e. the needs of the study govern a philosophical paradigm, indicated a pragmatic approach within a critical realist ontology and contextualist, experiential epistemology.[27,34-36] Active recruitment by the researcher was assisted by leaders in the responder groups. Local businesses with an agriculture or animal health focus were invited to participate. Local media helped raise awareness of the project, and information flyers were placed in public places such as the local Council offices, public library and some retail outlets.

Interested potential participants contacted the researcher and some invited others to join from within their own networks. Prior to taking part, all participants received information sheets covering ethics approval, privacy and contact details, and signed a consent form.

Data were collected from 67 participants via 12 semi-structured individual interviews and seven focus groups (n=55), each between 45 and 90 minutes duration. Gender distribution was 46.3% female (n=31) and 53.7% male (n=36). All participants were aged between 18 and 70 years. Approximately two-thirds of participants had experienced fire on their properties.

The interview guide was flexible according to group context and composition.[37] Major topics were: (1) hazard severity and likelihood; (2) fire-related animal issues; (3) information gathering, communication and trust; (4) uncertainty and confidence; (5) mitigation and self-efficacy; and (6) special circumstances and adaptive solutions.

Thematic Analysis (TA) was chosen because it is a flexible qualitative method independent of theory.[35,38] Extraction of experiential material from the data was inductive and contextualist: analysis moved from descriptive to interpretative and explored latent meanings. Data-driven coding yielded codes that were grouped into 'like' clusters and then organised into 10 themes. Data was managed using the Computer Assisted Qualitative Data Analysis Software (CAQDAS) system, NVivo 11, on a spreadsheet and a thematic map and table.[11]

Ethics approval for this research was granted by the Human Research Ethics Committee of Western Sydney University, approval number H11118. Names assigned to data extracts are pseudonyms.

Results and discussion

Of the 10 actively identified themes in the study, this paper examined data from the seminal 'preparedness' theme and from the 'farmers' theme. In summary, the themes were (1) animal owners and farmers; (2) Preparedness, fire-fitness; (3) Complexity of the social microclimate; (4) Trust; (5) Information gathering; (6) Responders; (7) Adaptive safe responses; (8) Maladaptive, unsafe responses; (9) The "tree-changers"; and (10) Recovery – and are discussed elsewhere in the published literature (tabulated themes

are described in concise detail on p 217 of Reference No. 11).[11,15,27]

A serious fire affecting people, their livelihoods and microclimates is a complex non-routine social problem that falls within the remit of the SFDRR.[39] Discerning how people and emergency managers and responders can better equip communities to protect themselves, and the things they hold dear, is an urgent requirement given the increasingly severe weather conditions that indicate a 'new reality'.[40] Effectively addressing this requires prioritising innovative preparedness initiatives.[40-45]

To achieve and maintain fire-fitness, it is necessary to understand and establish prerequisite conditions that precede and predispose towards successful preparedness messaging and action outcomes. This foundation, built on medium- to long-term strategies, will help develop a culture of preparedness and is required before a substantial shift in the implementation of preparedness practice is generally evident.

Preparedness – Be fire-fit: weekly is worth it!

The preparedness theme 'Be fire-fit: weekly is worth it!' was prominent in the data and is the subject theme of this paper because the implied corollary of being prepared (fire-fit), and of frequency (weekly), is a net benefit (is worth it). This theme is pivotal to addressing the awareness-preparedness gap and achieving fluency between knowledge and action among people at all levels – by linking science with policy and evidence with implementation.[1,4,27]

The academic literature exploring preparedness considers psychological and physical capability and suggests reasons why people do, or do not, prepare.[22,46-50] One contributing factor is the dilemma of competing superimposed tasks.[21] For example, the concurrent desire to save family *and* home and property can result in action inertia. The present study argues that by promoting preparedness as 'business as usual' both outcomes are achievable and could result in a healthier outcome experience with less physical and/or psychological trauma. In turn, safely protecting property, including animals, contributes to building confidence, resilience and well-being, as espoused in the SFDRR.[6,51,52]

There are some limitations: affording equipment is a potentially limiting factor as not everyone will have the disposable income or the resources to reach their ideal level of preparedness in one fire season, particularly in rural areas where income may be sporadic. However, a bushfire plan can dynamically map a strategy to attain the desired level of preparedness over a specified time frame. This leads to adaptive capability and confidence – self-efficacy and response-efficacy.[53,54] The challenge remains how to engage with those who elect not to prepare their homes, their properties and their social microclimate (such as family or workplace group). Complete consensus is unlikely and some people will remain unconvinced – the problem then is how to help people on adjacent land[49] and people who live on the outer peri-urban fringe because they prefer to live with less social interaction. Local knowledge in such instances can literally mean the difference between life and death.[55,56]

Bushfire prevention and preparedness is promoted in Australia and internationally as *everyone's* responsibility.[57-61] This is not intended to preference the actions of an individual over the involvement of community and collaboration between people. Both are important and mutually inclusive. Both benefit from shared communication and from the synergy achieved by collaboration among a group of people with a common goal.

Social connectedness and community engagement can reduce the negative outcomes of natural hazard emergencies.[12,46,62,63] Akama and Ivanka[30] discuss the need to understand and promote the real meaning of 'community'; the creation of sub-groups bonded by a common goal, and how self-empowerment can catalyse behaviour change.[12,51,64,65] Individuals, community groups, local, state and federal governments, workplaces and policy development can all contribute to and promote this change, increasing the status of a culture of preparedness and fire-fitness – to make investment in resilience "gainful".[66]

However, self-responsibility is the prerequisite building block for a strong community effort. Jayne explained:

> Protection is about self-help as much as it is about relying on the services that you've got … being bush fire ready isn't easy and simple and quick and cheap. It's not that hard … if you just want to pack and go. But being bush fire ready is no different to any other problem or complexity that people have in their life. So, and I'm really upfront with people, I will

say forget it. If you think you're going to do [everything] by tomorrow – no. So get rid of those unrealistic expectations … you can't do 20 or 30 or 40 jobs when you can smell the smoke, you can only probably do one or two.

The danger of 'waiting to smell the smoke' is described by Penman et al.[49] – late decisions are made under duress, with potentially fatal consequences.

The critical challenge is to first defuse the sometimes overwhelming nature of the preparedness task, and to facilitate the transition from knowledge and understanding to intention and action. Breaking tasks down into manageable steps and writing a 'bushfire action plan' to reduce the need for strategic thinking when an emergency situation arises is one way to achieve the former, and is already actively encouraged by fire authorities as part of ongoing multi-media public outreach. However, an environment conducive to achieving effective action must necessarily occur before preparedness can be substantially realised – before advertising and use of messages intended to motivate the target audience with fear or 'shock tactics', the effect of which can be short-lived.[67,68] This requires a cultural, paradigm shift, which itself can be created incrementally[3] via a foundation that preferences and facilitates routine, effective preparedness activities. Thus, hurdles such as lack of time, or the dangerous maladaptive responses of 'action inertia'[21] or acting impulsively without even a brief dynamic risk assessment can be overcome.

Shaping policy – cultivating a culture of preparedness

Future natural hazards are likely to increase in severity and frequency due to climate change.[45,69-71] *For this reason, a greater knowledge-base is urgently needed to shape policy for disaster preparedness and response*[48] (emphasis added).

Proactively promoting preparedness and the capability to effectively manage risk needs strategic awareness and a concurrent problem-solving approach.[12,30,64,72] At the local level, participants identified several common barriers to preparedness – including lack of time, resources, knowledge or information – as well as the problem of how to act appropriately on days that are declared catastrophic (or the equivalent jurisdictional nomenclature).[73-76] Although this terminology

can be shocking for people unfamiliar with Australian bushfire weather conditions, it realistically represents weather conditions that favour the ignition of potentially uncontrollable fires threatening public health and safety. As well, disaster literacy of vulnerable demographics and populations needs to be addressed. Programs aimed at broad acceptance and application need to be piloted and evaluated with respect to everyone in the community. The quality of public health emergency messaging must be rapid, accurate and useful.[77,78] Establishing a normalised culture of fire-fitness could arguably greatly assist in improving disaster literacy. Further commitment is needed from government to actively demonstrate a proactive approach to building a culture of preparedness from new, evidence-based initiatives by trialling and evaluating innovative strategies, as discussed below.

New policy – Catastrophic Day Leave (CDL)

This research proposes instigating workplace agreements to help narrow the awareness-preparedness gap. On days of high fire danger, people are faced with the dilemma of how to manage required tasks even if they have a well-written bushfire survival plan. Catastrophic Day Leave (CDL) could effectively assist to alleviate the dilemma. The concept of CDL is an analytic construct – where the analysis shifts to a more constructionist and critically interrogative style.[34,35]

Employer-employee negotiations could 'trade' other workplace leave for a certain number of CDL days, or work an extra hour a day for eight or nine days a fortnight to accrue CDL days. Wilkinson et al.[31] report varied and, at times, problematic employee experiences with employers when requesting leave of absence during the 2013 'Red October' bushfires in New South Wales, Australia. A formal contractual arrangement for CDL with employers could obviate this difficulty and promote shared responsibility with mutual workplace benefits. Initiating CDL as a new form of workplace leave would have the dual effect of elevating a culture of bushfire preparedness to 'business as usual' status, thus raising active awareness of the need to prepare well in the wider community and enabling employees to act safely in a timely manner. For these reasons it is important to name this proposed leave according to the purpose for which it is intended: generic

'personal leave', which may be made available to employees for many different reasons, does not satisfy this requirement. This type of initiative is representative of new policy, which will be necessary to manage the impact of climate-change induced, worsening natural hazards.[41,48,79]

Potentially, colleagues, workmates and neighbours encouraged by a CDL policy would be prompted to actively instigate shared plans and arrangements within their community networks. This could help build stronger productive relationships between communities and responders, and help communities better equip themselves to confront barriers to preparedness, and dismantle them step by step.[30,80,81] Subsequently, improved communication and safer decision-making between all parties supplements knowledge bases formulated cooperatively and collaboratively across government agencies, fire authorities, research findings and community members, depicting the synergistic interface of science and policy in the SFDRR.

Financial incentives and rewarding best practice

Financial inducement or reward can help achieve a societal shift towards establishing a culture of preparedness by implementing a system of rebates or discounts on insurance premiums, local government charges or other taxes,[82] and by actively rewarding 'best practice'. Sandy, in the business focus group, unhesitatingly commented, "*People respond very well to financial incentive. There needs to be an incentive for groups to actually come together and discuss things.*"

An example is the French *CatNat* scheme (Catastrophes Naturelles), a public/private scheme based on the principle of national solidarity: everyone pays for the benefit of the common good.[82,83] In France, household policies cover 'insurable' risk, and the *CatNat* scheme, created by law in 1982, is designed for events considered uninsurable, such as natural disasters. It is based on paragraph 12 of the preamble of the Constitution of 27 October 1946, which states: "The Nation declares all French citizens to be equal and united in solidarity when faced with loss resulting from natural disasters".[84]

Residents who are well prepared and fully insured need to be recognised and acknowledged for their contribution to public health. A scheme that rewards excellence in

preparedness and property management could be linked to an existing Local Government inspectorate authorised to issue fines for the reverse. Additional workload and costs would foreseeably be offset by savings given the high cost of recovery after an emergency event.[19,85]

A financial incentive for new residents needing to increase their bushfire knowledge for their own and their community's health and safety could be achieved by offering discounts linked to their attendance at non-compulsory community fire-safety information sessions. They could be encouraged to do so via an invitation accompanying their first Local Government rates notice, offering all attendees a meaningful discount to be applied to the second year's fees. To qualify, participation in a given number of fire information seminars would be required, which could be spread over a 12-month period to give maximum opportunity for people to attend. Senior firefighter Shane recalled an observation he often makes to newcomers to the community regarding shared responsibility, "I point out there are three fire trucks sitting in that shed and six hundred homes over that hill". Costs could be met by savings against recovery.[19,85]

In the longer term, public awards and recognition such as 'Bushfire Best-Prepared Towns', could attract additional funding from government or corporate sources and boost the local tourist economy due to increased publicity, or if preferentially considered as a holiday destination. Proactively promoting a culture of bushfire safety in this way builds community pride as well as strong relationships with emergency services.

Value-adding to properties at point-of-sale by making bushfire compliance a desirable, marketable commodity is another financial incentive. This could be achieved by adding a notation on advertising material identifying 'bushfire-safer properties' compliant with current relevant Standards,[86] and encourage others to similarly 'value-add'. This strategy would need to be aligned with a formal system of acknowledging eligible properties. Qualifying properties could be given the option of displaying a gateway notice, or participate in community 'fire-ready' open days, similar to the familiar 'open gardens', to showcase and educate others to do likewise.

Overarching jurisdictional in-principle support for strategies involving financial incentives is needed, but the success of

a scheme could well depend upon local knowledge and respectful local community consultation as strategies to build 'fire-fitness' may be best managed on a locally bespoke basis.[20] Whole-of-jurisdiction plans may not be functional if applied state-wide beyond the parameters of local conditions. This has been a failing in previous attempts to successfully apply discounts on insurance schemes, for example, and has been asserted as a reason not to pursue financial incentives. Desirable choices can be positively influenced by the magnitude of reward[89,90] and proactive, locally appropriate successful applications could motivate others in the area. This research asserts the need for such an initiative to be trialled and evaluated.[82,83,87,88]

Farming practices, fuel loads and firebreaks

Most farmer participants agreed that modern farming techniques could influence fire behaviour. Practices such as no-till cropping, greater crop productivity, density of crop per hectare, improved plant structure and reduced farm firebreaks have the potential to significantly compound the complexities of a fire. How these issues are managed is likely to influence preparedness strategies and tactics.

Sheep and wheat farmer Paul noted:

I think with our modern farming and agricultural techniques we're achieving crop yields that are way and above what we've ever been able to do in the past … in 30 years, I've seen cereal yields double, and what that means, of course, is that there's double the amount of crop residue over the summer period after the crops have been taken off, and the proportion of arable land going into crops has increased also.

Firebreaks have fallen out of favour, seemingly because of potential economic losses associated with decreased crop areas. Paul added:

There are fewer fire breaks across the landscape. Once upon a time, farmers were quite diligent about preparing firebreaks – they give you something to burn back to. This could be made mandatory with a council by-law, so everyone has to do it. A little bit of loss could mean that a lot of people are safer. It would be better to see more fire breaks across the landscape. I think that's something that we could consider … a by-law type of arrangement for strategic fire breaks.

Farmers who choose to implement effective fire breaks, whether or not required by regulation, could offset potential economic loss to some degree by being rewarded for on-farm best-practice preparedness, again motivating fire-fitness practice.

Conclusion and implications for public health

The outcomes of this study are intended to be transformative in that the new, public health preparedness initiatives proposed here aim to be practical and realistic. They seek to motivate the translation of knowledge into effective, adaptive actions attainable by all residents of bushfire at-risk communities. Making good preparedness behaviour and practices routine – and thereby narrowing the awareness-preparedness gap – requires all stakeholders to undertake a proactive reassessment of how to 'do' preparedness and become fire-fit. As evidenced by participants in this study, such a reassessment would help reduce hazard-related human mortality and morbidity and the associated negative social, economic and environmental impacts of natural hazard emergencies. The premise on which existing public resources are founded needs a proactive re-evaluation to help establish a culture of preparedness as 'business as usual' in society generally. Until that culture becomes established, this research suggests that more of the same messaging, however professional and sophisticated, will not significantly, nor sufficiently, narrow the awareness-preparedness gap without the help of additional, supplementary strategies. New social and workplace policies that are practical and achievable such as Catastrophic Day Leave, financial incentives such as rewards for 'best practice' and reductions in municipal fees, and mandatory fire breaks on farms have the potential to cultivate a more desirable culture of routine preparedness.

The implementation, evolution and efficacy of such applied preparedness initiatives and policy, broadly translatable across many societal groups, will need to be evaluated by future research – following preliminary scoping studies to assess acceptance within a community. Given the probability of increased fire weather and fire severity, and as documented in the SFDRR, the challenge of fortifying community wellbeing in a bushfire emergency requires a dynamic, problem-solving paradigm melded from science,

government and the at-risk communities themselves. Based on current findings, this paper concludes that implementing new practical and achievable policies that work across social and workplace contexts are steps toward achieving this goal.

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