



Bushfire resilience and bushfire behaviour

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Abstract

This paper is the first published output from a project considering the behavioural responses to these multiple crises (drought; bushfire; pandemic). The aim of this paper was to identify and summarise the existing literature on the behavioural responses to crises in general, and to bushfires in Australian in particular, as well as summarise analysis of new data on community functioning and bushfire-related behaviour. A key insight from the literature is the repeated gap, across a range of situations, between a person's stated intentions and the actions that they end up taking. A key driver of this intention-action gap is the very high discount rate people apply to the future, as well as the power of defaults. A second key finding from the literature is the importance of clear, well researched, impactful communication. This includes the information that is being presented, how the information is presented, as well as the trust in those who are communicating the message. A final key finding from the analysis in this paper and supported by the literature is the importance of the community functioning or resilience prior to a fire event and during the recovery stage. Investments in community functioning and resilience, even if they ostensibly have no direct relationship to bushfires, can in and of themselves reduce the incidence/costs of fires and perhaps more importantly increase the returns to other investments.

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**FIRE & FLOOD
RESILIENCE**

1 Introduction and overview

Australia has experienced three economic and societal shocks over recent months and years. Much of Australia has been experiencing severe drought conditions with 2019 reported as being the driest year since at least 1900, with average rainfall 40 per cent below the 1961-1990 average.¹ Many of the years leading up to 2019 had lower rainfall on average, and this has put significant strain on rural production and income, and has led to significant mental health and social challenges (Hanigan et al. 2016; Edwards et al. 2015).

Partly caused by the drought but also due to the fact that 2019 was Australia's warmest year on record, Australia experienced its most widespread and one of its most devastating summers of bushfires from September 2019 to February 2020, with more than 11 million hectares burned, significant loss of life, and more than three-quarters of Australians impacted either directly or indirectly (Biddle, Edwards et al 2020a). When predicting the costs of future bushfires, ANU researchers estimated that under various plausible climate change related scenarios, the costs of fires over the next 30 years will be considerable, up to \$2.2billion per year, or \$1.2billion per year in net present value terms. (Biddle, Bryant et al. 2020)

Most recently, Australia, along with the rest of the world, has faced a public health and economic shock unseen since the 1919 Influenza pandemic and the 1930-39 Great Depression. At the time of writing (18th December 2020), Australia has had 28,072 confirmed COVID-19 cases and 908 deaths. Infection and mortality occurred across two waves, with the first wave occurring in April and spread reasonably evenly across Australia's eight States and Territories, but the second wave (in July/August) being concentrated mainly in Victoria (and Melbourne in particular). Despite this second wave of infections, Australia is still at the lower end of the distribution across developed democracies with robust reporting of cases, alongside Taiwan, New Zealand, Japan, Singapore, South Korea, and Norway.

This relatively low infection and mortality rate has been achieved by strict and widespread physical distancing regulations, which have led to a dramatic slowdown of the Australian economy, with Commonwealth and State/Territory governments forced to provide unprecedented social assistance. The Australian Bureau of Statistics (ABS 2020) estimate that:

'A combined group of around 2.3 million people - around 1 in 5 employed people - were affected by either job loss between April and May or had less hours than usual for economic reasons in May' and that 'Women continued to be more adversely affected by the labour market deterioration than men. Younger workers have also been particularly impacted.'

The response to these multiple crises needs to be environmental, health, and economic. To recover from the current crises and better prepare for future ones, we also need to understand what the behavioural responses by individuals, communities and service providers have been, as well as how to support and encourage optimal decision making at these multiple levels. A behavioural response, in this context, is how attitudes and expectations have been shaped by the current crises, how individuals make decisions, and the extent to which specific biases impact the ability of individuals and communities to maximise their own wellbeing.

¹ <http://www.bom.gov.au/climate/current/annual/aus/#tabs=Rainfall>

This paper is the first published output from a project considering the behavioural responses to these multiple crises (drought; bushfire; pandemic). It provides a review of the existing literature as a building block for future empirical analyses, as well as a descriptive analysis of previously unpublished data collected in August 2020 on responses by individuals and communities to the Black Summer bushfire crisis.

The primary source of data for this paper is the August 2020 COVID-19 tracking survey (ANUpoll), which collected data from 3,061 Australians aged 18 years and over across all eight States/Territories in Australia, and weighted to have a similar distribution to the Australian population across key demographic and geographic variables. Data for the vast majority of respondents was collected online (94.1 per cent), with the remainder enumerated over the phone. A limited number of telephone respondents (17 individuals) completed the survey on the first day of data collection. A little under half of respondents (1,222) completed the survey on the 11th or 12th of August (largely online).

The contact methodology for offline Life in Australia™ members was an initial SMS (where available), followed by an extended call-cycle over a two-week period. A reminder SMS was also sent in the second week of fieldwork. The overall completion rate for the survey (those in the panel who completed the particular wave) was 78.7 per cent. However, taking into account recruitment to the panel, the cumulative response rate for the most recent survey is 7.8 per cent, a slight decline from previous waves of data collection in 2020.

In the next section, we outline the two frameworks within which the literature is placed – the disaster management framework; and the behavioural insights literature. In Section 3 we give our literature review methodology, whereas in Section 4 we provide a summary of the main finding from the literature and recommendations based on the literature. In Section 5 we provide a summary of the analysis of data from the August ANUpoll whereas Section 6 provides some concluding comments.

2 Frameworks for the literature review

2.1 Disaster management phases

The four stage approach of prevention, preparedness, response and recovery (PPRR) are consistently referenced in disaster management literature and practice, as the widely accepted phases of disaster or emergency management. The approach has been adopted in Australia and internationally and the Australian Government adheres to the PPRR approach within the Australian Government Crisis Management Framework and the National Strategy for Disaster Resilience (Elphick 2020; COAG 2011).

Figure 1 Disaster management phases



Source: Elphick 2020

Some criticism of the PPRR approach exists and states that it does not provide full consideration of all aspects of the disaster management spectrum, such as, ‘anticipation’ and ‘assessment’. Furthermore, Cronsteadt (2010) argues that ‘PPRR categorise available

emergency treatments rather than describe a continuum or cycle of events'. With this consideration in mind, the PPRR approach will be used in the following literature review to categorise areas for future behavioural research and possible intervention rather than as an analysis tool.

2.2 Behavioural economics/insights

We use behavioural economics or insights as our underlying model of decision making in this paper and the project more broadly. Many of the bushfire and COVID-19 responses and interventions in Australia have assumed individuals follow a reasonably narrow model of decision making, described in Koh (2012), as *Homo Economicus*. That is, people who are 'self-interested, rational agents. They analyze the costs and benefits of various options and choose the option that maximises their utility. They have stable, consistent preferences and the options they face are comparable to one another' (Koh 2012).

This model has a lot of utility, and considering how *Homo Economicus* would respond in a particular situation or context is a useful starting point. A key insight from the behavioural sciences though is that people are neither completely rational or irrational. Rather, people exhibit predictable biases that make it less likely they will achieve their own stated desires. There is a large and growing literature on these biases, outlined in detail in Akerlof and Kranton (2010); Kahneman (2011), Thaler (1999), Sunstein (2015), Mullainathan and Shafir (2013), Hardin and Banaji (2013), and Shafir (2013). These biases are summarised below:

- Bounded rationality and heuristics
 - We don't make the perfect decision, but a good enough decision
- Complexity, scarcity and cognitive load
 - Poverty increases the cost of bad decisions and makes them more likely.
- Loss aversion and the endowment effect
 - We care more about what we lose than what we gain.
- Framing and construal
 - We make decisions based on how the world appears, not how it is.
- Hyperbolic discounting and the power of defaults
 - We care about the present. A lot.
- Happiness and subjective wellbeing
 - Money buys happiness, but it gets more expensive.
- Identity, stereotype threat, social interaction and social norms
 - We care about how we see ourselves and how others see us.
- Fairness
 - We care about how much others have, not just how much we have

An understanding of these predictable biases, exhibited to varying degrees by most individuals, can be used to improve the design of existing and new interventions. The OECD defines using these behavioural insights as 'an inductive approach to policy making that combines insights from psychology, cognitive science, and social science with empirically-tested results to discover how humans actually make choices' (OECD n.d.). The use of behavioural insights to inform public policy has continued to grow, particularly in the last decade, and have demonstrated effective outcomes (Sanders et al. 2018).

The EAST framework developed by the Behavioural Insights Team in the UK provides a useful practical approach to implementing this research in a public policy setting arguing that to

‘encourage a behaviour make it Easy, Attractive, Social and Timely (EAST)’ (Service et al. 2014). Further explanation of these four pillars follows.

1. Make it **Easy**
 - Harness the power of defaults.
 - Reduce the ‘hassle factor’ of taking up a service.
 - Simplify messages.
2. Make it **Attractive**
 - Attract attention.
 - Design rewards and sanctions for maximum effect.
3. Make it **Social**
 - Show that most people perform the desired behaviour.
 - Use the power of networks.
 - Encourage people to make a commitment to others.
4. Make it **Timely**
 - Prompt people when they are likely to be most receptive.
 - Consider the immediate costs and benefits.
 - Help people plan their response to events. (Service et al. 2014)

Alternatively, the OCED has designed The BASIC Toolkit to guide practitioners and policy makers to assist in implementing behavioural insights into real world application. The BASIC Toolkit provides tools and methods from ‘beginning to the end of the public policy life cycle’, as described below (OECD 2019).

1. **Behaviour** - Identify and target crucial behavioural aspects of the policy problem.
2. **Analysis** - Scrutinise target behaviours through the lens of behavioural science.
3. **Strategies** - Identify and conceptualise behaviourally informed policy solutions.
4. **Interventions** - Design experiments to evaluate the effectiveness of the strategies.
5. **Change** - Plan for implementation, scale, monitoring, evaluation, maintenance and dissemination of results. (OECD 2019)

Within each of these steps are tools to assist with the analysis of a policy problem in the aim of achieving an ethical behavioural change.

In their widely popular best seller *Nudge: Improving Decisions about Health, Wealth, and Happiness*, Thaler and Sunstein (2008) Richard Thaler and Cass Sunstein (2008) outline the need for much greater policy focus on ‘choice architecture’ or the way in which choices and decisions are framed and constructed. They argue convincingly that decisions are influenced by what seem to be irrelevant features of the decision-making context and we can ‘nudge’ people by changing the choice architecture in a certain way that yields certain decisions. Indeed, the term nudges is an acronym which they use to summarise their main recommendations for choice architects:

- **iNcentives**: people have to feel they are getting something for their choice.
- **Understand mappings**: you have to understand how they see things.
- **Defaults**: make sure the ‘do nothing’ route is one of the best.
- **Give feedback**: investigate the rejected options, and experiment with them.
- **Expect error**: humans make mistakes, so well-designed systems allow for this.
- **Structure complex choices**: if it’s difficult, break it down into easier chunks.

Linnemayr et al. (2016) highlights that although previous application of behavioural economics to disaster preparedness and response is limited, ‘the low cost and potentially high impact of behavioral economics-based interventions warrant further investigation and testing’. Further limits of behavioural insights exist, as architects of behavioural insights were accused of advocating for paternalism and coercion through behavioural design. However, advocates argue that the theory encourages libertarian paternalism, as people have the right to choose yet are nudged towards the right direction in a complex web of decision making (Kuehnhanss 2019). Additionally, Kuehnhanss (2019) argues that policy makers need to be aware of the issues and difficulties associated with ‘pre-empting potential problems and different contexts in policy design’ and ensuring that ‘sufficient safeguards for issues such as legitimacy and accountability are implemented’.

Part of the reason for behavioural insights gaining such prominence in recent years and arguably one of the greatest contribution to public policy debates is the use and generation of robust causal findings from experimental and quasi-experimental interventions. That is, the field of behavioural insights/economics has led to a dramatic expansion in the evidence-base. For those involved in the medical sciences, it might seem unfathomable that a major new intervention would be administered to the general public without a rigorous trial and evaluation. The use of Randomised Controlled Trials (RCTs) in the health sciences is so ubiquitous, that it is easy to forget that up until the 50s, 60s and 70s, there was considerable resistance within the medical profession with expert judgement and experience given considerably more weight (Torgerson and Torgerson 2008). Now though, it would be near impossible to conceive of a new drug gaining acceptance without such a trial, described as follows:

‘we assemble a population for whom interventions is appropriate ...; we then allocate the participants to two or more groups and apply the intervention(s) to the groups formed by randomisation; at some pre-specified time in the future we measure the groups in terms of their outcomes – if there is differences between the groups, and assuming that the difference and the sample size are sufficient, we can infer a causal relationship between our intervention and the group differences’ (Torgerson and Torgerson 2008)

In 1953, Milton Friedman (1953) argued that ‘we can seldom test particular predictions in the social sciences by experiments explicitly designed to eliminate what are judged to be the most important disturbing influences. Generally, we must rely on evidence cast up by ‘experiments’ that happen to occur.’ This was arguably the mainstream view within the field of empirical economics up until the 1980s, and probably even later. However, Angrist and Pischke (2010) Angrist and Pischke (2010) were able to argue that ‘empirical microeconomics has experienced a credibility revolution, with a consequent increase in policy relevance and scientific impact’ and that ‘a clear-eyed focus on research design is at the heart of’ this revolution.

In many ways, it has been in developing countries and development policy that RCTs have had their greatest use. There are interesting political arguments as to why this might be the case – if funded by developing countries themselves, then there are much greater budget constraints, if funded by donor countries then there is much greater pressure for accountability. Banerjee and Duflo (2011) also make the point that in development policy the main reason why policies fail is often not because of some grand conspiracy or intractable incompetence on the part of policy makers and bureaucrats. Rather, it is because careful attention is not paid to the detailed design of policy.

Much of the more policy-relevant research related to behavioural insights/economics fall under the category of what are often called field experiments (Gerber and Green 2012). Social scientists have also made increasing use of the laboratory, borrowing techniques from psychologists, but asking slightly different questions. A large amount of this research is summarised in three best-selling popular texts – *Predictably irrational* by Dan Ariely (2008), *Freakonomics*, by Steven Levitt and Stephen Dubner (2010) and *Thinking fast and slow* by Daniel Kahneman (2011).

There has been some initial discussion of the behavioural responses to the COVID-19 pandemic. In an initial review of the literature, Van Bavel et al. (2020) concluded that ‘Because the crisis requires large-scale behaviour change and places significant psychological burdens on individuals, insights from the social and behavioural sciences can be used to help align human behaviour with the recommendations of epidemiologists and public health experts.’ Although the authors proposed a range of research topics to help inform a behavioural response to the COVID-19 crisis, there has been more limited empirical data to emerge from the crisis, particularly from high quality data collection that is representative of the populations of interest. Furthermore, although there has been some theoretical work on bushfires in Australia previously (Notebaert et al. 2014), there has been no new data to emerge from the Black Summer fires. The drastically increased scale of the 2019/2020 crises mean prior conclusions may not hold, or that new insights are more appropriate.

3 Literature review method

3.1 Search method

The key research question for the broader project is how can interventions be designed and adapted to consider the way individuals and communities behave in response to multiple crises? The literature review presented in this paper focused on gaining an understanding of existing and relevant literature, primarily regarding bushfires, to identify areas where further research is needed and possible behavioural interventions could be effectively applied.

The literature review has been conducted as a ‘rapid review’ with limited systematic review methods focused on assessing what core literature exists and the reoccurring themes present (Grant & Booth 2019). This method was chosen to gain a general overview of the literature within limited time constraints. Once saturation of issues and a general understanding of the literature was established, this allowed for certain areas of interest to be identified and then targeted more rigorously.

Key search terms identified and used were:

- Behavioural insights
- Behavioural economics
- Behavioural responses to bushfires
- Behavioural interventions in bushfires
- Systematic review of bushfire responses
- Disaster response and recovery.

Inclusion criteria applied for general guidance and to narrow the field of possible literature included:

- Journal articles
- Grey literature limited to normative documents and theses

- Published within last 20 years (2000 – 2020 inclusive).

It is also noted that literature searches on crises were primarily focused on bushfires and Australian literature.

Other parameters applied to direct the literature search involved consideration of the project's key research question and end goal. As previously mentioned, to improve crises management, the project aims to research and suggest possible interventions that employ behavioural insights. The following list was developed to guide the literature search. Proposed interventions will:

- aim to improve aspects of resilience, preparedness, wellbeing and mental health in areas that have already been affected by recent external shocks, and / or areas affected in the future
- be influenced by behavioural decision making theories
- possibly engage a nudge
- be focused on any or all disaster management phases
- be active at an organisational, a community or an individual level
- be influential across multiple crises (e.g. bushfires, drought and COVID)
- require further research and development, which can be contributed to by this project
- fit within the Minderoo Foundation's *Fire and Flood Resilience Blueprint* (2020).

The literature search was conducted primarily using the ANU Library and google scholar, as search engines, as well as gathering literature recommendations from ANU experts and project members.

3.2 Areas for further consideration

Following a brief overview of academic and grey literature, a broad range of areas that fit the majority of the above parameters were identified. These prominent themes were canvassed with key CSRM team members to confirm relevance and fit for the project. Selected themes were then explored further as a means for identifying possible future behavioural intervention. These areas were:

- Intention and action gap
- Communications
- Community resilience.

3.3 Limitations of literature review

There are several limitations of this literature review. Firstly, the broad ranging search method used, whilst being beneficial for this type of brief, may have resulted in certain articles and authors being missed. However, it is noted that saturation of themes was achieved before the search ended. Additionally, other areas for further consideration were identified yet are not explored further below for various reasons, including that they were less prominent in the literature or did not fit the intervention brief as well. A third limitation, is the possible need for a more refined and targeted literature search once a specific aspect for intervention is selected.

4 Overview of literature

A publication that provides an overview of key areas for further crises research relevant to this project is detailed below.

A Synthesis of Bushfire CRC Community Safety Research (2003-2013) including Post-fire Contact Surveys (Skinner and Skinner Consultants 2014)

This synthesis, published by the Bushfire Cooperative Research Centre (CRC) in Victoria, amalgamates 10 years of social research commissioned by the CRC. Key bushfire researchers were also interviewed, including Jim McLennan, Doug Paton, Joshua Whittaker, and John Handmer. Through this synthesis of research, six themes were identified.

1. Emergency services agencies do not understand community decision making regarding preparation and response.
2. Community members facing fires need to trust information sources, as source confidence needs to be established and maintained
3. A media conflict exists between the dissemination of information to respond to bushfires and news stories to engage audiences.
4. Community safety communications need to be tailored for the variety of groups within different communities.
5. 'Structured community profiling' can be used to enhance community and individual level communications and activities.
6. Engage with key lessons from 'research in other areas of risk promotion'.

Four gaps in knowledge were also identified.

1. Evaluations are needed to better understand the effectiveness of community preparedness and safety promotion.
2. Community safety interventions need to be evidence based
3. Future research needs to consider how competing agendas impact communities in bush fire prone areas'
4. Existing quality resources need to be better disseminated to and applied by practitioners.

Limitations of this study include:

- Exclusion of research produced post 2010
- No consideration of changes made as a result of this CRC research after 2010
- Only research directly funded by the CRC was included in this synthesis.

Further findings from the more extensive literature review are outlined below.

4.1 Intention and action gap

How people intend to plan or manage a crisis is often different to how they actually behave when a crisis occurs. This gap between intention and action (also known as the intention-behaviour gap) is prevalent in two of the four disaster management phases: preparedness and response.

In the preparedness phase, people are obviously encouraged to prepare in case of an emergency. For example, people that live in a bushfire prone area are encouraged to adopt a home insurance policy that considers this risk. However, as Paton et al. (2006) highlights 'despite the attention directed to achieving this, the goal of ensuring sustained levels of preparedness in communities susceptible to natural hazard impacts has proved elusive'. Further investigation into why people don't prepare and how to motivate them to take responsibility for being prepared and educated in case of disasters is needed.

From examining bushfire and earthquake threats, Paton et al. (2006) determined that choosing to prepare and not prepare involve 'two separate reasoning processes' and are 'predicted by different underlying attitudes and beliefs and sets of predictor variables'. Paton et al. (2006) explains that 'while those who form "intentions to prepare" are likely to convert them into actions, the formation of "intentions to seek information" appears to preclude the adoption of protective measures' as it 'represents a way of interpreting their relationship with a hazard that results in their deciding not to prepare'.

During the response phase, the gap between intention and action is highlighted in the literature when discussing people's decision to evacuate, or stay and defend a home. Despite intentions to evacuate or being told to evacuate by emergency services, people do not necessarily leave their properties. Understanding people's decision making process from intention to action during crises is not well understood. Johnson et al. (2012) discusses the need to better understand 'personal safety decision making' in emergencies and that decisions of whether to 'prepare, stay and defend or go early' are often more complex than perceived in policies. For example, Whittaker et al. (2016) explores the different female and male responses to choosing whether to stay or leave and the need for community safety initiatives to consider differing gender behaviours.

Complexities impacting why people choose to stay or leave also include 'confusion about what it means to leave early' and 'perceived false alarms' on Code Red days (Whittaker & Handmer 2010). Extensive field work following the Black Saturday fires showed that how safe people believed their house to be during a bushfire was central to deciding whether to stay or leave (Thornton 2011). In a working paper for Emergency Management Australia, Stopher et al. (2004) 'developed a method to predict evacuation decisions by residents from bush fires' through Stated Choice Experiments yet note the need for a more sophisticated evacuation behaviour model. Increasing understanding of how people make decisions when facing crises could better inform the development of emergency management policies and programs ensuring people make safer choices in crises.

4.2 Communication

Literature about bushfire and disaster response highlights the need to better and more impactfully communicate education and warning messages to communities during the preparedness and response phases.

Information about emergency preparation and response is not filtering through to communities in need. Parson et al. (2020) states that information access is a significant barrier to the capacity for disaster resilience in Australia, particularly in regional and remote areas' (Parsons et al. 2020). Why the multitude of available resources are not being used and, more broadly, why this information is not being received by its target audience requires further assessment. For example, emergency preparedness documentation encourages people to have a plan built into their lives and businesses in case of crisis. However, Whittaker and Handmer (2010) found that for the Black Saturday bushfires only 'around two-thirds of households in bushfire risk areas [had] fire plans', which variety considerably in quality.

Further research into the Black Saturday bushfires by Beatson and McLennan (2010) also demonstrates communication issues and reveals deficiencies in:

- (a) the receipt of and effectiveness of community education; (b) levels of planning and preparation by households; (c) the interpretation of warning*

information; and (d) stay and defend or leave' decision making (or lack thereof). With regard to community bushfire education, it appears to be the case that: (i) a significant portion of the population at risk lacks knowledge that is critical for adequate preparation; and (ii) among those who do have (at least some) knowledge about how to prepare for bushfires, that information is not always put to best use.

What is communication and becomes knowledge is not always engaged with correctly is further confirmed by Whittaker and Handmer's (2010) findings that 'around 60% of residents [understand] that 'Code Red' refers to the highest level of fire danger and ... to leave early on these days ... [yet] many residents intend to wait for advice from emergency services or until they are directly threatened before taking action'. This is further confirmed by field research by Whittaker et al. (2020) of the NSW bushfires in 2017, which showed that while people did understand warnings, 'many did not respond in ways intended by fire services' and instead people sort confirmation of the bushfire threat before acting.

Researchers suggest additional reasons for these communication barriers. Primary research undertaken by Dootson et al. (2019) showed that 'conflicting cues can affect information processing and risk perceptions, and therefore prevent people from taking appropriate protective action'. Additionally, Linnenluecke and Griffiths (2013) suggest that a current challenge is to gather and analyse the available information distributed across a range of different formats for different locations. They argue that it is not only the public that face these communication breakdowns but the emergency management response organisations.

To address communication barriers, various suggestions arise in the literature. Whittaker et al. (2020) states that 'rather than concentrating on attempts to reduce confirmation through enhanced messaging, it may be productive for fire and emergency services to give greater consideration to ways they might help people to confirm warning messages'. Whittaker et al. (2020) also suggests that 'warnings that are not personally meaningful to people are unlikely to motivate desired protective action, regardless of how they are worded' (Whittaker et al. 2020). Instead, it is suggested that 'warnings and advice that encourage people to evacuate as soon as a fire is threatening are more likely to be effective if they describe the threat posed, possible consequences, and how people can take action to reduce such consequence' (Whittaker et al. 2020).

To further enhance warning messaging, increasing trust in information sources is recommended by bushfire literature and Betsch et al. (2020) in regards to COVID. Betsch et al. (2020) states that information 'being easily understood and communicated through trusted and accessible channels, and when the necessary services are available, people are able to make informed choices, protect themselves, and comply with recommended practices'.

To enhance clarity and collection of messages, Linnenluecke and Griffiths suggest 'more informal and flexible mechanisms', which 'will require an integration of new technologies, "non-traditional" information sources (e.g., social networks), as well as media reporting, and also a preparation of the community to use, access, and possibly even provide information' (Linnenluecke & Griffiths 2013).

Building motivation and action from communications is also needed. Notebaert et al. 2014 advocates that further research is needed to 'investigate which cognitive bias modification paradigms are most effective at targeting health related prevention/protection behaviour, and which types of worry need to be amplified to fuel this adaptive behaviour'. Additionally,

Beatson and McLennan (2010) believe that the application of health promotion theories to bushfire safety communications offers insights. These theories include: 'Theory of Planned Behaviour; Extended Protection Motivation Theory; the Extended Parallel Processing Model; and the Terror Management Health Model... attribution theory' (Beatson and McLennan 2010).

4.3 Community resilience

Emergency response literature continually refers to the importance of resilient organisations, communities and individuals. Community resilience is central to the preparedness, response and recovery disaster management phases.

A wealth of resilience literature is available, and there are some key aspects of creating resilience that enhance crises preparedness, response and recovery. In Moreton's (2016) examination of four natural disasters in Australia, she identifies several pre-crises protective factors, which assist in strengthening community response, resilience and recovery. These are:

1. Planning and preparation
2. Community identity and connection
3. Community cohesion and social capital
4. Community leadership and action (Moreton 2016).

Moreton advocates for increased consideration of these elements in disaster policy and planning by governments, organisations and communities. Qualitative drought research in Queensland, NSW and Victoria currently being undertaken by the CSRM also indicates the importance of these factors in the disaster planning and response phase.

In regards to planning and preparation, Linnenluecke and Griffiths (2013) discuss how organisational and social resilience can help prepare areas for disasters with 'unprecedented severity', which continue to occur. They argue that 'emergency management is very much dependent on community-based vulnerabilities, risk perceptions, and local resources in addressing changing threats' (Linnenluecke and Griffiths 2013). Furthermore, the University of Melbourne's Beyond Bushfires Study (2016) showed that 'involvement in community groups was a protective factor', which also assisted in recovery (Gibbs et al. 2016). Using the examination of natural disasters in America, Sampson (2013) highlights the importance that social infrastructure, such as 'the shared willingness to intervene and civic engagement', to prepare cities for disasters.

The need for a focus on resilience is well explained by the Bushfire and Natural Hazard Cooperative Research Centre's (CRC) Australian Natural Disaster Resilience Index, which states that 'about 52% of the population live in areas with moderate capacity for disaster resilience, about 32% in areas with high capacity for disaster resilience and about 16% in areas with low capacity for disaster resilience' (Parsons et al. 2020). The CRC identifies factors that contribute to resilience, which align with Moreton's (2016) list above. These are community capital, social and community engagement, and governance and leadership (Parsons et al. 2020).

The importance of building resilient communities is acknowledged by governments of Australia. A National Strategy for Disaster Resilience (2011) has been developed by the Council of Australian Governments (COAG). It focuses on building disaster resilient communities, which is seen as the shared responsibility of 'governments, communities, businesses and individuals' (COAG 2011). The strategy identifies a resilient community as possessing the following characteristics:

- functioning well while under stress
- successful adaptation
- self-reliance
- social capacity
- share the importance of social support systems (COAG 2011).

5 Community functioning and bushfire related behaviour

5.1 Community functioning following the bushfire crisis and during the COVID-19 pandemic

Based on the literature review discussed above, it is clear that communities are key to effective prevention, preparedness, response and recovery to bushfires and other crises. In order to identify variation in community functioning across Australia, respondents were asked six questions about the functioning of their neighbourhood or community.

The first three questions were about whether someone agreed or disagreed with the following statements:

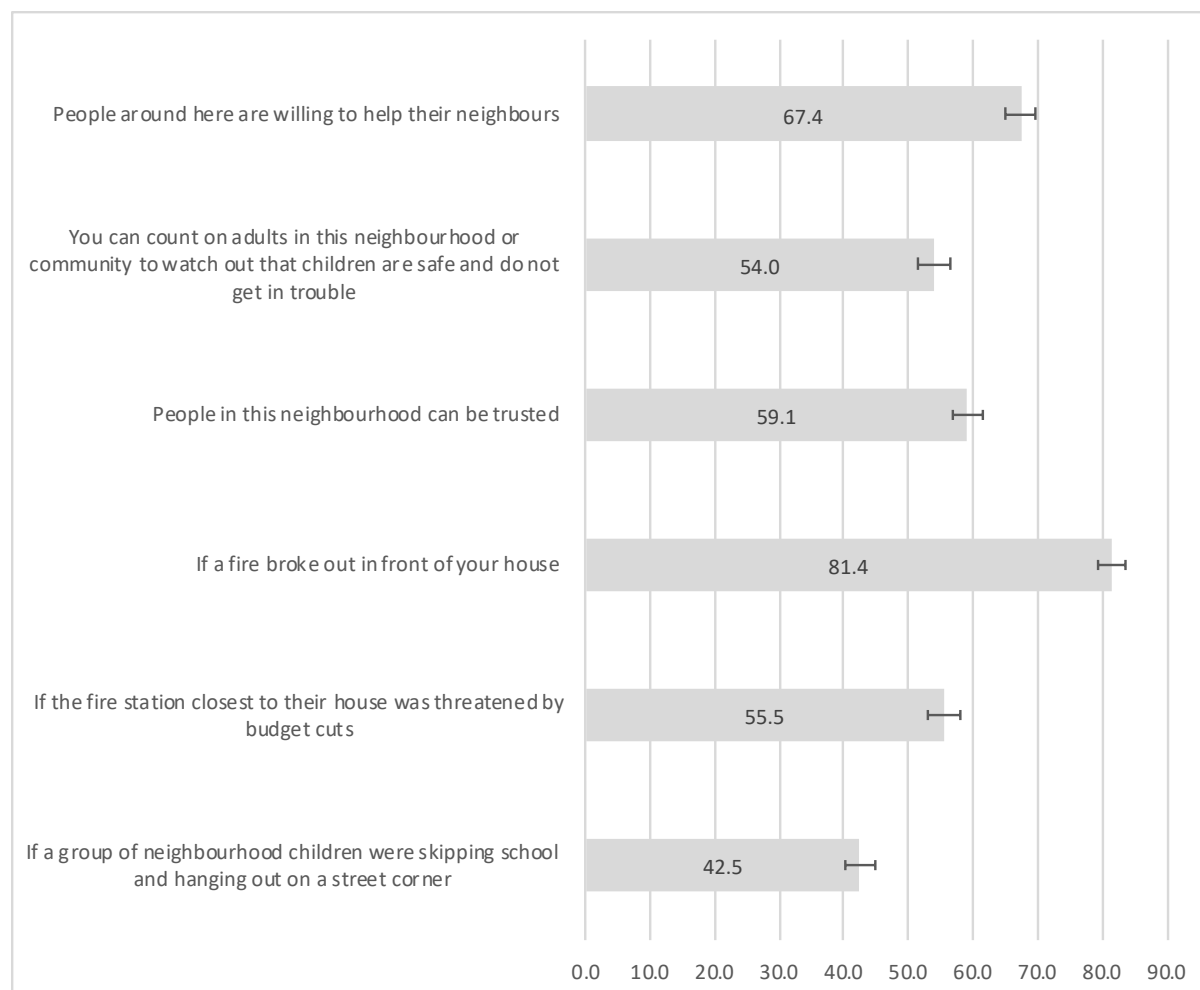
- People around here are willing to help their neighbours;
- You can count on adults in this neighbourhood or community to watch out that children are safe and do not get in trouble; and
- People in this neighbourhood can be trusted.

The second set of three questions were about how likely or unlikely someone in a person's neighbourhood or community would be to do something about the following:

- If a fire broke out in front of your house;
- If the fire station closest to their house was threatened by budget cuts; and
- If a group of neighbourhood children were skipping school and hanging out on a street corner.

Using the threshold of agree/strongly agree for the first three questions, and likely/very likely for the last three questions, the statement with the greatest level of support (Figure 2) is that someone in the neighbourhood or community would do something if a fire broke out in front of your house, whereas the statement with the lowest level of support is someone would do something if a group of neighbourhood children were skipping school and hanging out on a street corner.

Figure 2 Per cent of Australians who agree with statements with regards to their community or who think actions in their community are likely, August 2020



Notes: The “whiskers” on the bars indicate the 95 per cent confidence intervals for the estimate.

Source: ANUpoll, August 2020.

The results summarised in Figure 2 suggest a relatively strong degree of community functioning across Australia, with more than or close to majority support for the six statements. Importantly though, there was significant variation across Australia by demographic, socioeconomic, and geographic characteristics in terms of reported community functioning. While it would be possible to analyse each of the variables separately, to reduce the complexity of the analysis we create an index value that is continuous and captures variation in the six underlying measures. Specifically, based on a principle components analysis (eigenvalue for first component = 3.14, second component = 1.04) an index of community functioning was constructed with a mean of zero and a standard deviation of one.

We analyse the factors associated with this index across three models (Table 1). In the first model, we look at demographic, socioeconomic, and geographic variables only. In Model 2 we also control for three bushfire exposure measures (summarised in Biddle, Edwards and Makkai 2020), namely whether someone lived in an area affected by the 2019/20 Black Summer bushfires based on the ATO’s disaster relief areas, whether they reported direct exposure to the fires (property threatened/damaged or evacuated) or whether they reported more indirect exposure. In the final model, we also control for two COVID-19 exposure measures, namely

whether the person was anxious and worried about COVID-19 at some stage prior to August 2020, and whether they thought it was likely that they themselves would be affected by COVID-19 in the six months after August 2020.

Looking at model 1, older Australians (45 years and over, but particularly those 65 years and over); reported higher index values, or higher levels of community functioning. On the other hand though, those born overseas in a non-English speaking country (compared to those born in Australia) and Indigenous Australians had a lower index value. The way the questions are framed, that is related to the entire community/neighbourhood rather than fellow Indigenous Australians or migrants, mean that we are unable to capture the views of these two groups regarding those who share an ethnicity or migrant experience. We might get very different results if we asked explicitly about views towards the Indigenous/migrant community in which these individuals lived.

Geographically, those in relatively advantaged areas, and those living outside of a capital city had higher index values whereas those in relatively disadvantaged areas had lower values. Given the more direct benefits of living in an advantaged community (services and amenities), the relatively low levels of community functioning in relatively disadvantaged communities mean that those respondents may be doubly disadvantaged.

In Models 2 and 3 in Table 1, we control for these demographic, socioeconomic and geographic variables and also find that those who lived in an area affected by the 2019/20 Black Summer bushfires had a slightly higher index value. Unfortunately, we do not have index values from prior to the previous summer so we cannot tell whether it is exposure to fires that caused this greater level of functioning, but the result does give *prima facie* evidence that exposure to a crisis can help bring a community together.

The final finding from Table 1 of note is that those who were anxious and worried about COVID-19 (in August 2020) had a lower index value than those who were not. Once again, with cross-sectional/observational data it is very difficult to capture causal relationships. However, we could plausibly interpret the finding as an indication that living in a functioning community protects a person from being anxious and worried about an external shock (that is, as reverse causality).

Table 1 Factors associated with community functioning – August 2020

	Model 1		Model 2		Model 3	
	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.
Lived in bushfire affected area in January 2020			0.142	*	0.141	*
Direct exposure to 2019/20 Black Summer fires			-0.017		-0.023	
Indirect exposure to 2019/20 Black Summer fires			0.000		0.018	
Anxious or worried due to COVID-19 in August 2020					-0.107	**
Thinks it likely to be infected by COVID-19					-0.028	
Female	0.024		0.002		0.015	
Aged 18 to 24 years	-0.064		-0.088		-0.098	
Aged 25 to 34 years	-0.054		-0.053		-0.058	
Aged 45 to 54 years	0.193	**	0.183	**	0.167	**
Aged 55 to 64 years	0.313	***	0.295	***	0.284	***
Aged 65 to 74 years	0.551	***	0.519	***	0.505	***
Aged 75 years plus	0.663	***	0.655	***	0.642	***
Indigenous	-0.323	**	-0.309	*	-0.299	*
Born overseas in a main English speaking country	-0.044		-0.028		-0.031	
Born overseas in a non-English speaking country	-0.220	**	-0.130		-0.132	
Speaks a language other than English at home	0.109		0.043		0.055	
Has not completed Year 12 or post-school qualification	-0.126		-0.137		-0.147	
Has a post graduate degree	-0.094		-0.088		-0.076	
Has an undergraduate degree	-0.093		-0.103		-0.113	
Has a Certificate III/IV, Diploma or Associate Degree	0.009		0.002		-0.002	
Lives in the most disadvantaged areas (1st quintile)	-0.169	**	-0.154	*	-0.150	*
Lives in next most disadvantaged areas (2nd quintile)	-0.025		-0.016		-0.009	
Lives in next most advantaged areas (4th quintile)	0.216	***	0.207	***	0.212	***
Lives in the most advantaged areas (5th quintile)	0.383	***	0.365	***	0.376	***
Lives in a non-capital city	0.270	***	0.270	***	0.271	***
Constant	-0.368		-0.365		-0.303	
Sample size	2,865		2,615		2,601	

Source: ANUpoll, January and August 2020.

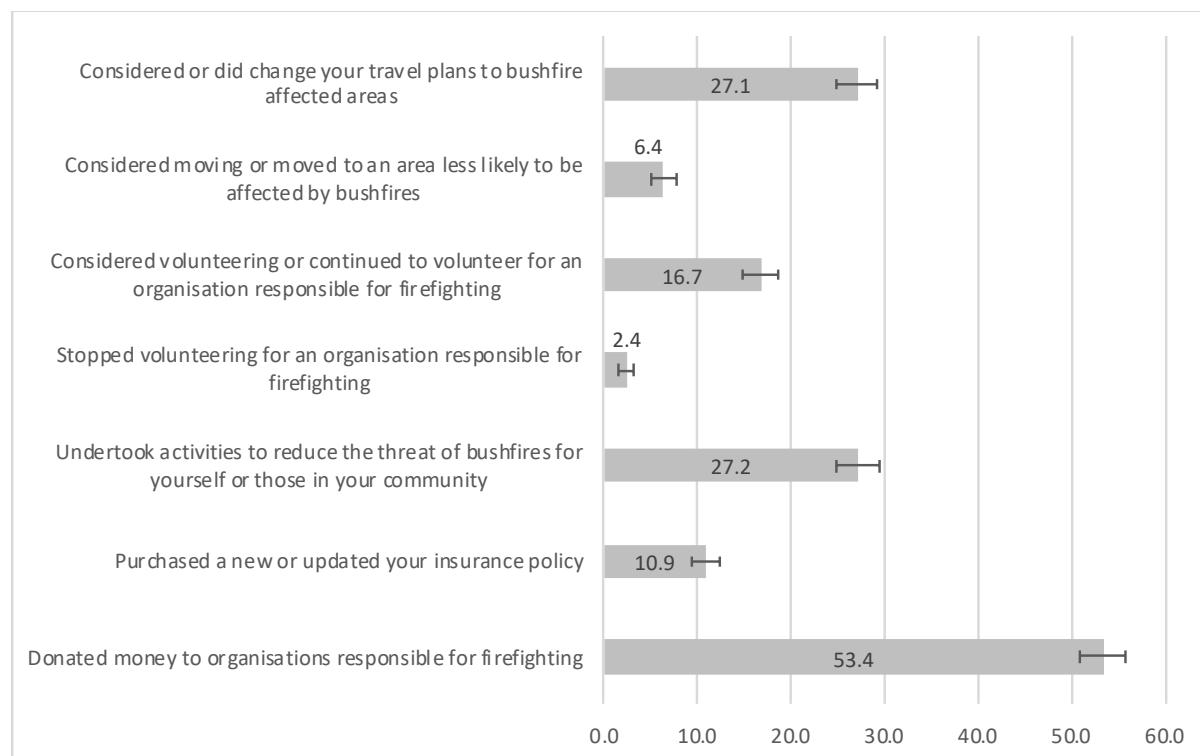
Notes: Linear regression model. The base case individual is female; aged 35 to 44; non-Indigenous; born in Australia; does not speak a language other than English at home; has completed Year 12 but does not have a post-graduate degree; lives in neither an advantaged or disadvantaged suburb (third quintile); and lives in a capital city. Coefficients that are statistically significant at the 1 per cent level of significance are labelled ***; those significant at the 5 per cent level of significance are labelled **, and those significant at the 10 per cent level of significance are labelled *.

5.2 Bushfire related behaviours

One of the ways in which a functioning community can help with crises like the 2019/20 Black Summer fires and the COVID-19 pandemic is through supporting behaviours and decisions that either prevent fires occurring in the first place, help communities and individuals be prepared, support rapid and effective responses and aid in recovery to bushfires. In the August 2020 ANUpoll, respondents were asked “The next questions are about your behaviour and decisions since the bushfires that occurred over spring and summer in Australia. Since the 2019/20 Black Summer fires, have you undertaken any of the following actions?”

Figure 3 gives the proportion of people who answered yes to each of the seven actions. The most common action was to have donated money to organisations responsible for firefighting. This was undertaken by more than half (53.4 per cent) of Australians, according to estimations from the August ANUpoll. Very few Australians (2.4 per cent) stopped volunteering, with a much larger per cent (16.7 per cent) considering volunteering or continuing to do so.

Figure 3 Per cent of Australians who undertook certain bushfire related activities, August 2020



Notes: The “whiskers” on the bars indicate the 95 per cent confidence intervals for the estimate.

Source: ANUpoll, August 2020.

For the first three questions in Figure 3, we asked follow-up questions of those who said they considered each of the behaviours. Of those who said that they considered changing their travel plans:

- 10.0 per cent said that they did not end up changing their travel plans;
- 57.9 per cent said they changed their mind and decided not to travel to bushfire affected areas;
- 13.2 per cent said they changed my mind and decided to travel to bushfire affected areas; and
- 18.8 said they still haven't made a decision.

Of those who said they considered moving to a less bushfire prone area:

- 14.7 per cent said they have moved;
- 8.0 per cent said they are in the process of moving;
- 32.1 per cent said they are still considering doing so; and
- 45.2 per cent said they have decided not to move

Finally, of those who said they had considered volunteering:

- 15.6 per cent said they were already volunteering for an organisation and have continued volunteering;
- 5.4 per cent said they have commenced or am in the process of commencing volunteering;
- 55.2 per cent said they were still considering volunteering; and

- 23.9 per cent said they had decided not to volunteer

In Table 2 we consider the factors associated with the six bushfire-related behaviours presented in Figure 3. We estimate a single model for each, including all the variables used in the estimations from earlier in this section, as well as the community functioning index (as an additional explanatory variable). As the variables are binary (yes/no) the relationships are estimated using the probit model.

Beginning with the demographic, socioeconomic and geographic variables, there are some population groups who were more likely to have undertaken the behaviours from the August ANUpoll. Females were less likely to have considered starting and stopping volunteering, but more likely to have donated money to bushfire related causes. Older Australians were more likely to have changed their travel plans, but less likely to have considered moving. They were also less likely to have considered volunteering, but more likely to have donated.

Living in an area in receipt of bushfire support was not associated with any of the bushfire related actions, controlling for the above characteristics. However, after controlling for demographic, socioeconomic and other geographic factors there was a very strong relationship between self-reported exposure to the 2019/20 Black Summer bushfires and bushfire-related behaviour. Those who reported direct exposure to the Black Summer bushfires were more likely to have considered moving areas, were more likely to have considered volunteering, were more likely to have stopped volunteering, were more likely to have taken actions to reduce the threat of bushfires, were more likely to have changed or updated their insurance policy, and were more likely to have donated to bushfire related causes.

In addition, those who reported indirect exposure to the Black Summer bushfires were more likely to have reconsidered their travel plans, were more likely to have considered moving areas; were more likely to have considered volunteering; were more likely to have taken actions to reduce the threat of bushfires, and were more likely to have donated to bushfire related causes. While this is not a causal model, these results do give some indication that bushfire exposure does change bushfire behaviour.

Highlighting the interaction between the multiple crises that have occurred in Australia in 2020, those who thought it likely they would be infected by COVID-19 were more likely to have reconsidered their travel plans, were less likely to have stopped volunteering; and were more likely to have taken actions to reduce the threat of bushfires. Those who were anxious or worried about COVID-19 were more likely to have reconsidered their travel plans, were more likely to have considered moving areas; were more likely to have considered volunteering, were more likely to have changed or updated their insurance policy, and were more likely to have donated to bushfire related causes.

Perhaps the most important set of findings from Table 2 relate to the community functioning index. Specifically, those who lived in a more functioning neighbourhood or community were more likely to have considered volunteering, were more likely to have taken actions to reduce the threat of bushfires and were more likely to have donated to bushfire related causes. This clearly demonstrates the potential additional benefits from supporting resilient communities.

Table 2 Factors associated with bushfire-related behaviour – August 2020

	Travel plans		Moving		Volunteer		Stop volunteer		Threat reduction		Insurance		Donated	
	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.
Lived in bushfire affected area in January 2020	-0.101		-0.154		-0.033		-0.308		0.034		-0.075		-0.065	
Direct exposure to 2019/20 Black Summer fires	0.152		0.428 ***		0.386 ***		0.540 ***		0.523 ***		0.234 **		0.222 **	
Indirect exposure to 2019/20 Black Summer fires	0.642 ***		0.331 **		0.306 ***		-0.015		0.420 ***		0.128		0.385 ***	
Community functioning index	0.043		-0.075		0.148 ***		0.006		0.155 ***		0.065		0.126 ***	
Anxious or worried due to COVID-19 in August 2020	0.188 **		0.351 ***		0.217 **		0.129		0.091		0.167 *		0.184 ***	
Thinks it likely to be infected by COVID-19	0.134 *		0.094		-0.031		-0.322 *		0.147 *		0.149		0.052	
Female	-0.061		-0.153		-0.428 ***		-0.523 ***		-0.036		-0.070		0.217 ***	
Aged 18 to 24 years	0.065		-0.007		-0.096		0.426		0.313		-0.455		0.085	
Aged 25 to 34 years	-0.046		0.092		0.126		0.483 *		-0.001		-0.139		0.137	
Aged 45 to 54 years	0.250 **		-0.209		-0.055		0.252		0.017		-0.068		0.126	
Aged 55 to 64 years	0.243 **		-0.365 **		-0.251 *		0.055		0.048		0.012		0.219 **	
Aged 65 to 74 years	0.144		0.034		-0.359 **		0.358		0.216 *		0.094		0.310 ***	
Aged 75 years plus	0.209		-0.301		-0.782 ***		0.607 **		0.095		-0.093		0.256 *	
Indigenous	0.198		0.156		0.025		0.041		0.239		-0.030		0.030	
Born overseas in a main English speaking country	0.000		0.282		-0.089		-0.098		0.049		-0.212		-0.032	
Born overseas in a non-English speaking country	0.195		0.568 ***		0.252 *		0.437 **		0.358 ***		0.052		-0.054	
Speaks a language other than English at home	0.231 *		0.199		0.217 *		0.138		0.077		-0.104		0.059	
Has not completed Year 12 or post-school qualification	-0.079		-0.045		-0.220		0.608 **		-0.004		-0.152		-0.235 *	
Has a post graduate degree	0.177		-0.171		-0.346 **		0.001		-0.017		-0.065		-0.249 *	
Has an undergraduate degree	0.159		-0.294		-0.245 *		-0.381		-0.163		-0.314 **		-0.106	
Has a Certificate III/IV, Diploma or Associate Degree	-0.070		-0.047		-0.131		0.134		-0.073		-0.156		-0.094	
Lives in the most disadvantaged areas (1st quintile)	-0.076		0.213		0.078		0.171		0.181		0.118		-0.084	
Lives in next most disadvantaged areas (2nd quintile)	-0.280 **		0.187		0.032		0.036		0.069		-0.184		0.012	
Lives in next most advantaged areas (4th quintile)	-0.050		0.162		0.074		0.071		0.040		-0.004		-0.076	
Lives in the most advantaged areas (5th quintile)	-0.169		0.062		-0.056		-0.295		-0.030		-0.170		-0.073	
Lives in a non-capital city	0.002		0.086		0.070		-0.304 *		0.210 **		-0.057		-0.096	
Constant	-1.382		-2.332		-1.126		-2.338		-1.375		-1.238		-0.460	
Sample size	2,597		2,595		2,597		2,590		2,597		2,599		2,598	

Source: ANUpoll, January and August 2020.

Notes: Binary probit model. The base case individual is female; aged 35 to 44; non-Indigenous; born in Australia; does not speak a language other than English at home; has completed Year 12 but does not have a post-graduate degree; lives in neither an advantaged or disadvantaged suburb (third quintile); and lives in a capital city. Coefficients that are statistically significant at the 1 per cent level of significance are labelled ***; those significant at the 5 per cent level of significance are labelled **, and those significant at the 10 per cent level of significance are labelled *.

5.3 Relationship between patience/risk and bushfire activity

In the literature review presented earlier in this paper, we showed how behavioural biases can be strongly related to behaviours and decisions that either prevent fires occurring in the first place, help communities and individuals be prepared, support rapid and effective responses and aid in recovery to bushfires. In this sub-section, we provide some empirical evidence that, although the relationship is quite complicated, there is some evidence to support targeting of different groups and different behaviours.

We replicate the models presented in Table 2 with four measures based on a series of questions in the April 2019 ANUPoll, adapted from questions in the Global Preferences Survey (Falk et al. 2018). Specifically, there are two self-reported measures based on a person's view on:

- whether they are 'a person who is generally willing to take risks, or do you try to avoid taking risks?' (with higher values indicating a greater willingness to take risk); and
- 'In comparison to others, are you a person who is generally willing to give up something today in order to benefit from that in the future or are you not willing to do so?' (with higher values representing greater patience)

There were two additional questions using the unfolding bracket or staircase methods. For the staircase questions, each participant was given a lottery choice sequence where the individual had to choose between winning a lottery x with some probability p or a sure payment y (for risk preference) or receiving a certain amount today or a higher payment in a year's time (for patience). Depending on a person's response to these lotteries/delayed payments, they were then given different values for the lottery/delayed payment in the subsequent question. Each person was given five lotteries and five delayed payments to choose from, and from these ten questions in total we were able to construct an index of risk and patience that had means of zero and standard deviations of one. Because we are reliant on risk/time preference from April 2019, our sample size is much smaller in Table 3 compared to Table 2, and we therefore only control for age and sex in our model as additional explanatory variables.

There are two behaviours in particular that (a) are important at the community level for bushfire risk and resilience and (b) are likely to be impacted by behavioural preferences. Looking first at those who undertook threat reduction activities, there was a strong, positive association with self-reported patience. This is perhaps not surprising as the benefits of such activities are likely to be felt into the future, whereas some of the costs are immediate. However, it does suggest some potential interventions whereby the benefits of such activities can be framed more in the short-term, and the short-term costs reduced.

The second finding of relevance is that those with higher risk levels (based on the ladder questionnaire) are significantly less likely to have purchased or updated a new insurance policy. Once again, this fits with the existing literature on insurance decision making. However, it also does suggest a different targeting of insurance information to those who are likely to be relatively risk seeking and, potentially, the use of default options to increase insurance coverage related to bushfires (as those who are risk seeking may be unlikely to obtain insurance themselves).

Table 3 Relationship between risk/time preference and bushfire-related behaviour – August 2020

	Travel plans		Moving		Volunteer		Stop volunteer		Threat reduction		Insurance		Donated	
	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.	Coeff.	Signif.
Self-reported willingness to take risk	0.043	*	-0.025		0.077	***	0.052		0.030		0.013		-0.042	**
Self-reported patience	-0.034		-0.071	**	0.022		-0.075		0.067	***	0.037		0.055	**
Ladder-based risk	-0.041		0.017		-0.017		-0.044		-0.046		-0.120	**	0.104	**
Ladder-based patience	-0.039		0.052		-0.053		0.167	*	-0.066		-0.016		-0.057	
Female	0.091		-0.228		-0.239	**	-0.023		0.064		0.111		0.309	***
Aged 18 to 24 years	0.016		0.240		0.596	**	.		0.154		-0.685		0.239	
Aged 25 to 34 years	-0.112		0.316		0.174		1.232	***	0.111		0.035		0.075	
Aged 45 to 54 years	0.062		-0.086		-0.006		0.560		0.154		0.244		0.052	
Aged 55 to 64 years	0.075		-0.124		-0.248		0.419		0.228		0.232		0.140	
Aged 65 to 74 years	-0.113		0.283		-0.392	**	0.727	**	0.361	**	0.387	**	0.313	**
Aged 75 years plus	-0.008		-0.161		-0.574	***	1.123	***	0.293	*	0.248		0.231	
Constant	-0.698		-1.095		-1.462		-2.601		-1.456		-1.832		-0.283	
Sample size	1,671		1,671		1,671		1,628		1,671		1,671		1,671	

Source: ANUpoll, April 2019 and August 2020.

Notes: Binary probit model. The base case individual is female; aged 35 to 44; non-Indigenous; born in Australia; does not speak a language other than English at home; has completed Year 12 but does not have a post-graduate degree; lives in neither an advantaged or disadvantaged suburb (third quintile); and lives in a capital city. Coefficients that are statistically significant at the 1 per cent level of significance are labelled ***; those significant at the 5 per cent level of significance are labelled **, and those significant at the 10 per cent level of significance are labelled *.

6 Concluding comments and research for this project

Responses to bushfires, drought and the current global pandemic start with the physical and health sciences. Fire suppression, fire detection, and flora/fauna maintenance are vital to reducing the incidence and costs of catastrophic bushfires. Australia is only likely to return to some form of pre-COVID normality if and when a safe and effective vaccine that is trusted by the general population is available in sufficient quantities and delivered to a sufficient number of people to generate herd immunity.

For both bushfires and public health emergencies, however, the effectiveness of any technological innovations will be determined in part by the way in which the general public and the relevant workforces make decisions. A vaccine for COVID-19 will be far more effective if people trust it and trust those who administer it. An early warning system for bushfires will be more effective if the warnings are heeded. Firefighting resources will be able to suppress more bushfire incidents if properties are well maintained and owners/residents are prepared prior to the height of the bushfire season.

The aim of this paper was to identify and summarise the existing literature on the behavioural responses to crises in general, and to bushfires in Australian in particular, as well as summarise analysis of new data on community functioning and bushfire-related behaviour.

A few key insights from the literature emerged, some of which were supported by the data analysis. First, a key insight is the repeated gap, across a range of situations, between a person's stated intentions and the actions that they end up taking. That is, there are a number of decisions that people are supportive of and agree are in the best interests of themselves or their communities, but nonetheless they do not follow. For example, updating an insurance policy to reflect changed circumstances or risk, or creating/updating a bushfire survival plan.

A key driver of this intention-action gap is the very high discount rate people apply to the future, as well as the power of defaults. The costs of action/behaviour are felt in the present and are known, but the benefits are uncertain and received into the future. There are other domains for which such intention-action gaps exist, including financial saving and health behaviour. And there are well evaluated interventions that help overcome these biases (Garza 2018). Carefully identifying defaults that are in the best interests of individuals and their community (as stated by them) has been shown to reduce the intention-action gap. So too have interventions that provide immediate rewards (not necessarily monetary) and frequent feedback on performance. We cannot assume that just because someone intends to take an action, and that action is in their own best interest, that they will end up doing so if the choice architecture isn't carefully constructed.

A second key finding from the literature is the importance of clear, well researched, impactful communication. This includes the information that is being presented, how the information is presented, as well as the trust in those who are communicating the message.

A final key finding is the importance of the community functioning or resilience prior to a fire event and during the recovery stage. Investments in community functioning and resilience, even if they ostensibly have no direct relationship to bushfires, can in and of themselves reduce the incidence/costs of fires and perhaps more importantly increase the returns to other investments.

Ultimately, in the absence of any other policy changes, climate change and population growth are both likely to increase the incidence and impact of bushfire events in Australia. All sciences, including the behavioural sciences, need to be employed to push in the opposite direction.

References

- Akerlof, G.A., & Kranton, R.E., (2010), 'Identity economics: How our identities shape our work, wages and well-being', Princeton University Press, Princeton.
- Angrist, J. D. and J.-S. Pischke (2010). "The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics." *The Journal of Economic Perspectives* 24(2): 3-30.
- Ariely, D. (2008). *Predictably irrational*, HarperCollins New York.
- Banerjee, A. V. and E. Duflo (2011). *Poor economics: A radical rethinking of the way to fight global poverty*, PublicAffairs.
- Beatson, R. & McLennan, J., (2010), 'Understanding community bushfire safety issues from social psychological perspectives – a discussion paper', La Trobe University, Bushfire CRC Extension Bushfire Community Safety & Decision Making Project (C9), Discussion Paper 2010: 1.
- Betsch, C., Wieler, L.H. & Habersaat, K., (2020), 'Monitoring behavioural insights related to COVID-19', *The Lancet*, Volume 395, Issue 10232, p.1255 – 1256.
- Council of Australian Governments (COAG), (2011), *National Disaster Resilience Strategy*, Commonwealth of Australia, Canberra.
- Cronstedt, M., (2002), 'Prevention, Preparedness, Response, Recovery - an Outdated Concept?'. *Australian Journal of Emergency Management*, Volume 17, Number 2, August, p.10-13.
- Dootson, P., Greer, D., Miller, S., & Tippet, V., (2019), 'Overcoming Ambiguity: Conflict Between Emergency Warning Messages and Socio-Environmental Cues', *Prehospital and Disaster Medicine*, Volume 34, Issue 1, p.S21-S21.
- Edwards, B., Gray, M. and Hunter, B., 2015. The impact of drought on mental health in rural and regional Australia. *Social Indicators Research*, 121(1), pp.177-194.
- Elphick, K., (2020), *National emergency and disaster response arrangements in Australia: a quick guide*, Law and Bills Digest Section, Department of Parliamentary Services, Research Paper Series 2019-20, Canberra.
- Falk A, Becker A. Dohmen T, Enke B, Huffman D & Sunde U (2018). Global evidence on economic preferences. *Quarterly Journal of Economics* 133(4): 1645–1692.
- Friedman, M. (1953). "The methodology of positive economics." *Essays in positive economics* 3(3).
- Garza, K.B., 2018. How do we close the intention–behavior gap?. *Journal of the American Pharmacists Association*, 58(3), pp.240-241.
- Grant, M.J. & Booth, A., (2009), 'A typology of reviews: an analysis of 14 review types and associated methodologies', *Health Information & Libraries Journal*, Volume 26, Issue 2.
- Gibbs, L., Bryant, R., Harms, L., Forbes, D., Block, K., Gallagher, H.C., Ireton, G., Richardson, J., Pattison, P., MacDougall, C., Lusher, D., Baker, E., Kellett, C., Pirrone, A., Molyneaux, R., Kosta, L., Brady, K., Lok, M., Van Kessel, G. & Waters, E., (2016), *Beyond Bushfires: Community Resilience and Recovery Final Report*, University of Melbourne, Victoria.

Gerber, A. S. and D. P. Green (2012). *Field experiments: Design, analysis, and interpretation*, WW Norton.

Hardin, C.D. & Banaji, M.R., (2013), *The nature of implicit prejudice: Implications for personal and public policy*, In E. Shafir (Ed.), *The behavioral foundations of public policy*, p. 13–31, Princeton University Press.

Hanigan, I.C., Schirmer, J. and Niyonsenga, T., 2018. Drought and distress in Southeastern Australia. *EcoHealth*, 15(3), pp.642-655.

Johnson, P.F., Johnson, C.E. & Sutherland, C., (2012) 'Stay or Go? Human Behavior and Decision Making in Bushfires and Other Emergencies', *Fire Technol*, Volume 48, p.137–153.

Kahneman, D., (2011), *Thinking Fast and Slow* Farrar, Straus and Giroux.

Koh, T.Y., (2012), 'Key Ideas in Behavioural Economics – And What They Mean for Policy Design', *Behavioural Economics and Policy Design*, pp.17-34, Singapore.

Kuehnhanss, C.R, (2019), 'The challenges of behavioural insights for effective policy design', *Policy and Society*, Volume 38, Issue 1, p.14-40.

Levitt, S. D. and S. J. Dubner (2010). *Freakonomics*, Sperling & Kupfer editori.

Linnemayr, S., O'Hanlon, C., Uscher-Pines, L., Van Abel, K., & Nelson, C., (2016), 'Using Insights from Behavioural Economics to Strengthen Disasters Preparedness and Response', *Disasters Medicine and Public Health Preparedness*, World Scientific, Volume 10, Issue 5, p.768-774.

Linnenluecke, M. K., & Griffiths, A., (2013), 'The 2009 Victorian Bushfires: A Multilevel Perspective on Organizational Risk and Resilience', *Organization & Environment*, Volume 26, Issue 4, p.386–411.

Minderroo Foundation, (2020), *We Rise Together: Lifting Australia to be the global leader in fire and flood resilience by 2025*, *Fire and Flood Resilience Blueprint*, Version 1: September.

Moreton, M., (2016), *A study of four natural disasters in Australia: how the human response to fire, flood and cyclone contributes to community resilience and recovery*, Doctoral dissertation, Australian National University, Canberra.

Mullainathan, S., & Shafir, E., (2013), *Scarcity: Why having too little means so much*, Times Books/Henry Holt and Co.

Notebaert, L., Chrystal, J., Clarke, P.J., Holmes, E.A. & MacLeod, C., (2014), 'When we should worry more: Using cognitive bias modification to drive adaptive health behaviour', *PloS one*, Volume 9, Issue 1.

Organisation for Economic Cooperation and Development (OECD), (n.d.) 'Behavioural Insights', accessed on 26 September 2020 at <https://www.oecd.org/gov/regulatory-policy/behavioural-insights.htm>

OECD, (2019), *Tools and ethics for applied behavioural insights: The Basic Toolkit*.

Parsons, M., Reeve, I., McGregor, J., Marshall, G., Stayner, R, McNeill, J., Hastings, P., Glavac, S. & Morley, P., (2020), *The Australian Natural Disaster Resilience Index: Volume I – State of Disaster Resilience Report*, Bushfire and Natural Hazards CRC, Melbourne:

Paton, D.; Kelly, G.; Burgelt, P.T. & Doherty, M., (2006), 'Preparing for bushfires: understanding intentions', *Disaster Prevention and Management*, Bradford, Volume 15, Issue 4, p.566-575.

- Sanders, M., Snijders, V., & Hallsworth, M., (2018), 'Behavioural science and policy: Where are we now and where are we going?', *Behavioural Public Policy*, Volume 2, Issue 2, p144-167.
- Sampson, R., (2013), 'When disaster strikes, it's survival of the sociable', *New Scientist*, Volume 218, Issue 2916, p.28-29.
- Service, O., Hallsworth, M., Halpern, D., Algate, F., Gallagher, R., Nguyen, S., Ruda, S., Sanders, M., Pelenur, M., Gyani, A., Harper, H., Reinhard, J. & Kirkman, E., (2014), *EAST: Four simple ways to apply behavioural insights*, The Behavioural Insights Team, London.
- Shafir, E., (ed.) (2013), *The Behavioral Foundations of Public Policy* Princeton University Press, Princeton.
- Skinner and Skinner Consultants, (2014), *A Synthesis of Bushfire CRC Community Safety Research (2003-2013) including Post-fire Contact Surveys*, Bushfire Cooperative Research Centre, 27 April, Melbourne.
- Stopher, P., Rose, J., & Alsnih, R., (2004), *Dynamic Travel Demand for Emergency Evacuation: The Case of Bushfires*, Working Paper July, Institute of Transport Studies, The University of Sydney and Monash University, Sydney.
- Sunstein, C.R., (2015), *Choosing not to choose: Understanding the value of choice*, Oxford University Press.
- Thaler, R., (1999), 'Mental Accounting Matters', *Journal of Behavioral Decision Making*, Volume 12, Issue 3, p.183-206.
- Thaler, R. H. and C. R. Sunstein (2008). *Nudge: Improving decisions about health, wealth, and happiness*, Yale University Press.
- Thornton, R.P., (2011), Short Communication on Research Response to the Black Saturday (7th February 2009) Victorian Bushfires, Australia, *Fire Technol*, Volume 47, p.295–301.
- Torgerson, D. J. and C. Torgerson (2008). *Designing randomised trials in health, education and the social sciences: an introduction*, Palgrave Macmillan.
- Van Bavel, J.J., Baicker, K., Boggio, P.S., Capraro, V., Cichocka, A., Cikara, M., Crockett, M.J., Crum, A.J., Douglas, K.M., Druckman, J.N. and Drury, J., 2020. Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour*, pp.1-12. <https://www.nature.com/articles/s41562-020-0884-z>
- Whittaker, J., Eriksen, C., and Haynes, K., (2016), 'Gendered responses to the 2009 Black Saturday bushfires in Victoria, Australia', *Geographical Research*, Volume 54 p.203–215.
- Whittaker, J., & Handmer, J., (2010), Community bushfire safety : A review of post-black Saturday research, *Australian Journal of Emergency Management*, Volume 25, Issue 4, p.7-13.
- Whittaker, J., Taylor, M., & Bearman, C., (2020), 'Why don't bushfire warnings work as intended? Responses to official warnings during bushfires in New South Wales, Australia', *International Journal of Disaster Risk Reduction*, Volume 45, p.1-10.