ABSTRACT

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

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

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Introduction

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

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

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

The 2009 Victorian Bushfires Research Taskforce

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

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

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

Method

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

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

Survey

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

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

Image: Bushfire and Natural Hazards CRC

Findings

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

risk. There was considerable evidence of last-minute planning and preparation once the fire threat was clear. Importantly, many of those who did plan and prepare found their preparedness level inadequate for such a severe fire.

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

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

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

In terms of actual responses, 53 per cent of survey respondents stayed to defend, 43 per cent left their homes or properties before or when the fire arrived and 4 per cent sheltered inside a house, another structure, vehicle or somewhere outside. More than a third of those who defended left at some stage during the fire (38 per cent), most commonly because of perceived danger, failure of equipment or utilities or because their house caught fire. More than half of those who left considered that they left too late (54 per cent) and most perceived the level of danger to be high or very high (80 per cent). The prevalence of late evacuations can, in part, be attributed to the failure of warning systems (see Teague, McLeod & Pascoe 2010); 62 per cent of respondents did not receive an 'official' warning from police, fire and emergency services. Most people did, however, receive an unofficial warning from family, friends or neighbours (63 per cent).

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

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

Subsequent research using the Taskforce data

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

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

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

2016). These patterns were evident in actual responses to the fires, with men more often staying to defend than women (62 per cent v. 42 per cent) who more often left before or when the fire arrived (54 per cent *v.* 35 per cent).

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

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

Blanchi *et al.* (2018) used Taskforce data to examine people's use of shelters and sheltering practices on Black Saturday. Initial analysis of the survey data found very few people sheltered throughout the fire (just four per cent) (see Whittaker *et al.* 2013). However, the survey response categories, which asked people to 'fit' their response to categories such as 'stay and defend', 'leave' and 'shelter', failed to account for shorter-term, periodic sheltering that may have been engaged in as part of property defence or evacuation. All 611 interview transcripts were searched for references to sheltering using a range of search terms. This process identified 315 interviews where shelters or sheltering were discussed, ranging from short-term sheltering undertaken while defending property to sheltering throughout the fire. Subsequent analysis found, despite limited planning and preparation specifically for sheltering on Black Saturday, many people protected themselves from the fire and its effects by sheltering inside houses, other structures and in open spaces. Most sheltered actively and carried out regular fire monitoring and actions to protect the shelter and its occupants. Some found sheltering challenging due to the heat, smoke and responsibilities for children, vulnerable household members or the incapacitated. A very small proportion of interviewees sheltered inactively, including in rooms with limited visibility and egress, such as bathrooms.

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

Research since Black Saturday

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

McLennan, Paton and Wright (2015) emphasise the need for caution when assessing changes in householder

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

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

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

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

An important development since Black Saturday is the greater extent to which animals are considered in bushfire research. Research has demonstrated the influence animals have on human behaviour and safety and has investigated how people plan, prepare and respond to protect animals. For example, Taylor and colleagues (2015) highlight the centrality of pets to household bushfire plans and responses. Their survey of pet owners impacted on by a range of hazards, including bushfire, found most people (over 80 per cent) kept their pets with them when they evacuated. Results suggest pets influence the mode of transport people use when evacuating, the time it takes to leave and the number of trips required. Responsibility for pets was also a factor in non-evacuation.

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

Conclusion

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

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

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

The Bushfire CRC and Bushfire and Natural Hazards CRC have commissioned 11 post-bushfire studies

using researchers from across Australia. As a result, Australia has a strong capacity for post-incident research, which is not limited to bushfires. Nevertheless, more work is needed to ensure the consistency of approaches, while maintaining flexibility. There is a need for greater consistency in questionnaire instruments to allow differences from fire to fire and community to community to be meaningfully compared and tracked over time.

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