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Experiences of sheltering during the Black Saturday bushfires: Implications for policy and research

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Abstract

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Disciplines

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Experiences of sheltering during the Black Saturday bushfires: implications for policy and research

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Abstract:

More than half of those who died in the 2009 Black Saturday bushfires in Victoria, Australia, were sheltering inside a house at the time of their death. This marks a shift in bushfire fatality trends, which previously saw most fatalities occurring outside while residents attempted to protect assets or evacuate. This paper presents findings from research that examined people's experiences of sheltering in and exiting houses, sheds, personal shelters and other structures on Black Saturday. Qualitative data were sourced from 315 semi-structured interviews with residents affected by the bushfires and 50 witness statements presented to the Victorian Bushfires Royal Commission. Results indicate that despite limited planning and preparation specifically for sheltering on Black Saturday, many residents protected themselves from fire by sheltering inside houses, other structures and in open spaces. Most sheltered actively, engaging in regular monitoring and action to protect the shelter and occupants. However, some found sheltering challenging due to heat, smoke and responsibilities for children, vulnerable household members and the incapacitated. Misconceptions persist about the safety offered by houses and, in particular, bathrooms during bushfires. Education and advice should emphasise the need to plan and prepare for active sheltering, regardless of whether people intend to stay and defend or leave. The paper offers recommendations to promote planning and preparedness for active sheltering and identifies areas for further research.

Keywords: bushfire, wildfire, sheltering, community safety, disaster risk reduction

1. Introduction

173 people died and more than 2000 houses were destroyed in the 2009 Black Saturday bushfires in Victoria, Australia. Initial police reports indicated that 113 people died inside houses, 27 outside a house, 16 in or near cars, 7 in garages or sheds, 5 on roadways, 1 in an open land reserve, and 4 at a location outside the fire perimeter (AAP, 2009). Subsequent research examined the activities civilians were engaged in immediately preceding their death, finding that 26 people died defending a house or property, 7 protecting livestock or other assets, 35 while evacuating, 41 while sheltering after attempts to defend a house or property, 47 while sheltering without attempts to defend, 3 in an indefensible shelter, and 3 in a shelter where activities are unknown (Blanchi et al. 2012).¹ The large proportion of people who died inside while sheltering on Black Saturday marks a significant shift in bushfire fatality trends, which previously saw the majority of deaths occur outside while residents attempted to protect assets or evacuate (Haynes et al. 2010).

The large loss of human life and property on Black Saturday led to the establishment of the 2009 Victorian Bushfires Royal Commission (VBRC) (Teague et al. 2010). A key concern for the Commission was the viability of the ‘Prepare, stay and defend or leave early’ (PSDLE) policy. Under this policy, Australian fire services advised residents to prepare to stay and defend their homes and properties or leave before a bushfire occurred in their area (AFAC 2005). The Commission observed that the phrase ‘stay and defend *or* leave early’ did not accurately reflect what people do in bushfires, noting many will delay making a decision until they are directly threatened. The Commission concluded that a comprehensive bushfire policy must accommodate the different scenarios people might experience by providing different advice and more options, including the possibility of sheltering. State and local governments responded by designating ‘Neighbourhood Safer Places’ as places of last resort, and the Australian Building Codes Board (2014) developed standards for the design and construction of bushfire shelters for private use. Anecdotal evidence suggests that residents of bushfire risk areas are increasingly constructing or converting existing structures into bunkers (e.g. Webb and Landy 2013). Fire services have recognised that people might want to install private shelters and are providing advice relating to sheltering. Importantly, this advice emphasises that sheltering should be planned for as a ‘last resort’ or back-up in the event that evacuation or defence is not possible (e.g. CFA 2016a).

¹ These figures exclude 4 of the 173 deaths attributed to Black Saturday. Three were not directly related to the effect of the fire and one occurred after February 7 during firefighting operations.

Figure 1: Areas of Victoria affected by bushfires during January and February 2009 (shaded dark grey)

Despite greater emphasis on sheltering as a back-up or last resort, there have been few detailed studies of resident sheltering practices in Australian bushfires. Research has tended to focus on the decision-making and behaviour of people who evacuate when threatened by bushfire and those who remain to defend homes and property (e.g. Wilson and Ferguson 1984; McLennan et al. 2012; Whittaker et al. 2013; McNeil et al. 2015). While some studies have highlighted dangers associated with ‘passive’ sheltering, usually in the context of fatalities (e.g. Haynes et al. 2010; Handmer and O’Neil 2016), relatively little is known about why and how people shelter.

In the context of bushfire, we consider sheltering as any action to protect oneself from the immediate effects of flames, embers, heat and smoke. People may shelter for short or long periods of time, as their primary response or as part of other responses, such as defending or evacuating. In this paper, we draw a distinction between active and inactive sheltering, which

are characterised, respectively, by the presence or absence of attempts to regularly monitor conditions inside and outside the shelter, as well as actions to protect the shelter and its occupants.

This paper presents findings from research that examined the circumstances and challenges people experienced when sheltering and exiting houses, sheds, personal shelters and other structures during the Black Saturday bushfires (Blanchi et al. 2015). The research entailed analysis of data related to resident decision-making and behaviour, and factors such as house design, fire behaviour and the surrounding landscape. This paper focuses on findings from a qualitative analysis of the Bushfire and Natural Hazards Cooperative Research Centre's (BNHCRC) interviews with residents collected as part of the '2009 Victorian Bushfires Research Taskforce' and lay witness statements to the VBRC (see Teague *et al.* 2010).

2. Sheltering during bushfire

Taking shelter is one of many options available to people seeking protection from hazards. While early evacuation is usually considered the safest option, numerous factors may prevent people from evacuating safely, including the inability to provide or receive an early warning (e.g. in cases of rapid onset or communication failure), road networks that prevent swift egress, and responses of citizens who may be unable or unwilling to leave (McCaffrey et al., 2015; Paveglio et al., 2008). Last minute evacuations are historically a major cause of bushfire fatalities in Australia (Haynes et al. 2010). Eight of the nine people killed in the 2005 Eyre Peninsula bushfires in South Australia, for instance, died in or near cars while attempting to flee the fire (Schapel, 2008). On Black Saturday, the large number of people who died inside houses has often overshadowed the fact that 35 people died while attempting to evacuate (Blanchi et al. 2012). The possibility that it may be safer to remain in a fire affected area than attempt last-minute evacuation is reflected in fire service emergency warnings, which may advise that it is too late to leave and that residents should seek shelter (e.g. AAP 2017).

While some research into bushfires has documented sheltering behaviours (e.g. Handmer and Tibbits 2005), most studies focus on the roles played by occupants when defending houses or evacuating. This research has underpinned development of the PSDLE policy, which is based on evidence that adequately prepared residents can protect houses from bushfires (e.g.

Lazarus and Elley 1984; Wilson and Ferguson 1984; Ramsay et al. 1987; Handmer and Tibbits 2005; Whittaker et al. 2013), and that a large number of deaths have occurred during late evacuations (e.g. Krusel and Petris, 1992; McArthur and Cheney, 1967; Wilson and Ferguson, 1984; Haynes et al. 2010). However, numerous studies document the tendency for people to ‘wait and see’ what a fire is like, or wait until they are threatened, before deciding to stay or leave (Rhodes 2005; Tibbits and Whittaker 2007; Whittaker and Handmer 2010; McLennan et al. 2012; McLennan et al. 2013; Whittaker et al. 2013; McNeil et al. 2016). This approach increases the likelihood that residents will be forced into dangerous responses, such as late evacuation, untenable defence and inactive sheltering.

Much early evidence of sheltering in Australia comes from the 1939 Black Friday bushfires in Victoria, where people working and living in the bush retreated inside structures such as houses, timber mills and dugouts to protect themselves from radiant heat and flames (Tibbits and Handmer 2005; Collins 2006). Judge Leonard Stretton’s (1939) Royal Commission into the fires recommended the construction of dugouts at all timber mill settlements, but noted that financial costs and liability fears had prevented their construction in the past. Research following the 1983 Ash Wednesday bushfires in Victoria found that many people remained at their homes to defend and/or shelter (Wilson and Ferguson 1984; Lazarus et al. 1984, Krusel and Petris 1992). The Bushfire Review Committee subsequently stressed the need to consider sheltering as an alternative to evacuation, observing that ‘a considerable number of people found communal shelter in large, well-constructed buildings and survived, even though the fire threat outside the buildings was acute’ (Miller et al. 1984, p. 162). The Committee proposed that the State Government construct or adapt school buildings for use as shelters ‘to mitigate the possibility of students being exposed to risk by being sent home ahead of an advancing fire front’ (Miller et al. 1984, p. 162).

A number of studies provide insights into sheltering behaviour in the Black Saturday bushfires. In a survey of populations affected by the bushfires, Whittaker *et al.* (2013) found that very few residents (4%) sheltered throughout the fire in houses or other structures, vehicles or somewhere outside. Importantly, the study did not consider shorter-term, periodic sheltering. McLennan (2010) studied residents’ uses of informal places of shelter such as ovals, fire brigade sheds and schools on Black Saturday. Some residents understood these places to be ‘designated’ places of assembly, while others ‘simply ended up there’ (McLennan 2010, p. 5). Very few people who sheltered on ovals or at CFA sheds made

preparations to shelter. Studies of fatalities in the fires also identified a lack of awareness and preparedness among many of those who died (Handmer *et al.* 2010; Blanchi *et al.* 2014). Handmer *et al.* (2010) report that 69% of those who died were sheltering at the time of death, but note that some of these people may have attempted to evacuate or defend prior to taking shelter.

In the USA, where evacuation is the primary strategy for managing human populations during wildfires, researchers have questioned whether leaving is always the most appropriate option (e.g. Paveglio *et al.* 2008; Cova *et al.* 2009; McCaffrey *et al.* 2015). Large scale evacuations are complicated by population growth, road infrastructure limitations, challenges associated with the provision of early warnings, and the capacities and intentions of citizens (Cova *et al.* 2013; McCaffrey *et al.* 2015). Numerous studies report some US homeowners, often in rural and resource-based communities, do not intend to evacuate during wildfires, choosing instead to stay and defend or shelter (e.g. Cohn *et al.* 2006; Paveglio *et al.* 2010a; Paveglio *et al.* 2014; McCaffrey *et al.* 2015). A study of five residential developments designed to withstand wildfires and enable residents to shelter inside homes in Rancho Santa Fe, California, found that few residents intended to shelter-in-place and few understood what to do in a wildfire (Paveglio *et al.* 2010b). Those who did intend to shelter were more likely to understand the building codes and landscaping that made their homes more likely to withstand fire. Importantly, the authors emphasise the affluence of the communities studied, noting that it may be difficult to achieve the physical standards required for safe sheltering in more established or less affluent areas. Australian fire services distinguish strategies of ‘stay and defend’ and ‘shelter’ to emphasise the need for active defence for those who choose to stay in a fire, even though staying to defend may require periodic sheltering.

In summary, Australian research has tended to focus on the decisions and actions of those who evacuate and those who stay to defend against bushfire, reflecting the ‘stay or go’ approach advocated by fire services. Consideration of sheltering is relatively limited, with studies largely focused on sheltering behaviours associated with fatalities. Further research is needed to examine people’s awareness and knowledge of sheltering as a protective response, as well as the planning, preparation and actions that are required to shelter safely during bushfires.

3. Research methods

The research aimed to examine the circumstances and challenges people experienced when sheltering and exiting houses, sheds, personal bunkers and other structures during the 2009 Black Saturday bushfires. Data were sourced from 611 semi-structured interviews with residents affected by the 2009 bushfires and 100 witness statements presented to the VBRC.

Residents were interviewed over a 12-week period beginning on 12 February 2009 as part of the BNHCRC's 2009 Victorian Bushfires Research Taskforce. The semi-structured interview guide comprised open-ended questions about residents' planning and preparation, the information and warnings they received, their intended and actual responses, and what they thought they might do in future fires (see Whittaker et al. 2009). Interviews began with participants being asked to discuss their experience of the fire, with follow-up questions exploring the subjects noted above. A key strength of semi-structured interviews is that participants' experiences and perspectives emerge more from their own understandings and personal narratives than from researchers' conceptualisations of research problems or important issues (Marshall and Rossman 2014). Thus, while sheltering was not an intended focus of the research, the semi-structured nature of the interviews allowed data on sheltering to be collected. Interviews were conducted at residents' homes or properties, typically lasted around an hour, were digitally recorded with each participant's consent, and transcribed. Unfortunately, detail of the demographic composition of the interview sample was not kept and was, therefore, unavailable to researchers. Nevertheless, examination of the interview data set reveals perspectives and experiences from a diverse array of people throughout the fire affected areas. Ethics approval for the interviews was obtained from RMIT University's Human Ethics Research Committee, with measures taken to protect the safety and rights of participants and researchers. Anonymity was assured to all participants, who gave their consent for aggregated data and quotes to be used in publications.

The 611 interview transcripts and 100 witness statements were searched for references to sheltering, producing a dataset of 315 interviews and 50 witness statements for analysis. These documents capture a range of sheltering experiences, from periodic sheltering as part of property defence to inactive sheltering throughout the fire. Interviews and witness statements where sheltering was not discussed were excluded; however, this does not mean that these residents did not shelter at some point during the fire. The semi-structured nature of the interviews meant that interviewees were not asked a consistent set of questions, including, for example: 'Did you take shelter at any point during the fire?' Consequently, the analysis

presented in this paper did not seek to quantify data gathered from the interviews or witness statements (see McPherson and Sauder 2015). Nevertheless, we use *verbal counts* to convey whether experiences and issues were common (i.e. occurring in more than 50% of the interviews) or not (less than 20%) using terms such as ‘many people’, ‘commonly’ and ‘few’ (see Sandelowski 2001).

NVivo v.11 (QSR International) was used to manage the large volume of data and to assist the analysis. The primary purpose of the interview and witness statement analysis was to provide detailed evidence of people’s experiences and understanding of sheltering during the bushfires. We employed a general inductive approach, whereby general categories are developed from the research aims and more specific categories emerge from multiple interpretations of the raw data (Thomas 2006). For example, ‘Intention to shelter’ was an initial category that, through the process of coding, was refined to include the sub-categories ‘as a primary strategy’ and ‘as a backup or last resort’. Similarly, the category ‘Future plans for sheltering (or not)’ was added after analysis of multiple transcripts. An ‘Emerging themes’ category was also included and later refined to include sub-categories for beliefs about the safety of houses, bathrooms, ‘safe houses’ and community refuges. The iterative and inductive process of coding led to the creation of categories that more accurately reflected the content of interviews, allowing important issues and themes to be identified and data to be more closely analysed (Bazely and Jackson 2013). Quotes have been selected to provide insights into interviewees’ experiences and understandings of sheltering.

-
1. Intention to shelter:
 - a. as a primary strategy
 - b. as a backup or last resort
 2. Planning and preparation for sheltering
 - a. before 7 February
 - b. on 7 February
 3. Factors and decisions leading to sheltering (or not)
 4. Experiences of sheltering and exiting
 - a. where people sheltered
 - b. how people sheltered, what they did
 - c. when people exited, and why
 - d. challenges experienced
-

e. things that helped

5. Examples of ‘active’ and ‘inactive’ sheltering

6. Health issues associated with sheltering

7. Future plans for sheltering (or not)

8. Emerging issues

a. Safety of houses

b. Bathrooms

c. Safe houses and community refuges

d. References to others’ sheltering

Table 1: Coding framework for analysis of interview and witness statement data

4. Research findings

4.1 Intentions, plans and preparations for sheltering

A small number of interviewees reported their intention to shelter throughout a bushfire.

These included people who intended to leave home for a nearby place of shelter, those who intended to shelter inside while others defended, and those who intended to shelter without attempts to defend. Most often, these people intended to shelter in a house while others defended. Men often intended to stay outside and defend while women stayed inside, often to care for children, vulnerable household members and visitors.

Some residents intended to shelter as a backup if they were unable to defend. There were very few instances where residents discussed sheltering as a backup if they were unable to leave. Those intending to defend often envisaged going inside during the main passage of the fire front and continuing defence once it had passed.

I'd always had instilled into me the basic plan of: you've just got to withstand that front. I think when the cloud came and it got dark, I think that's perhaps when people panic and get into cars and things, which I would never do... But here, that basic plan did work: protect yourself from the radiant heat of the front, and then get out. (Steels Creek)

Some residents identified where they would go if unable to shelter inside a house, including cellars, bunkers, sheds, dams, swimming pools, water tanks, cars and open spaces. Areas of burnt ground were recognised by some as a safe place to shelter.

Levels of planning and preparation for sheltering varied substantially. Most residents focused their efforts on measures to enable defence or safe evacuation. They rarely had a firm plan for where and how they would shelter, often envisaging themselves sheltering ‘somewhere outside’, in a dam or waterbody, or at a neighbour’s house. Others identified one or more specific locations where they might be able to shelter. A very small number of people rehearsed their plan for sheltering. Varied levels of preparedness for sheltering are evident in the following quotes:

If the house had caught early, I guess we would have found a space of refuge. But it’s hard to know because it seemed like for about two hours there were moments when there was a lot of smoke out there. So I guess we had our blankets, we could get out and go under the blankets. I don’t know... (Kingleake West)

We have an area under the house here, like a cellar, completely bricked in. And there are some air vents, but we had rags and things like that. If needed, we could block those... So the idea was that mum would go down there. We even did a little dummy run in the afternoon. I took her down there and sat her in the chair and said ‘If a fire comes, this is where you’re going to be sitting’. And we had our drinks, a little Esky [ice box] and things. We had a bucket with some wet towels... We had our dog... He was tied up under there. So that was all sort of ready. (Callignee)

Preparations made to assist in the defence of houses, such as clearing vegetation and blocking and filling gutters with water, undoubtedly increased the likelihood that residents could shelter safely, if only for a short period of time. However, some residents discussed preparations made specifically for sheltering. They filled baths, sinks and containers with water, and placed wet towels around the house. Some put shutters over windows or pulled down blinds, and some moved furniture and other flammable items away from the windows. Some had protective clothing to wear while defending and sheltering including woollen clothes, full-length overalls, work boots, masks, helmets and gloves.

We had put a hose onto the laundry, a hose connection, so we could have an inside hose. I now want one in the kitchen – I don't care how unglamorous it looks. And one in the bathroom, because that would give you the reach right through the house... We filled up the laundry sink, we filled up the bath. We had buckets all through, lined up. So in the house I was just mostly watering down all the doors throwing buckets at all the edges of all the windows. (Kinglake West)

Importantly, some residents were surprised by the arrival of the fire and had insufficient time to enact their final preparations. Typically, these residents undertook a significant amount of preparation on the day such as setting up fire pumps, wetting down houses and filling bins and containers with water. The unexpected arrival of the fire meant that some residents were not adequately prepared to actively defend or shelter.

4.2 Activity during sheltering

Based on our analysis of interview transcripts, a distinction can be drawn between active and inactive sheltering. Active sheltering is characterised by 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. Such actions include extinguishing fires, preventing the entry of smoke, and caring for vulnerable people. Inactive sheltering is characterised by a lack of regular monitoring and actions to protect the shelter and occupants.

Evidence suggests that the majority of residents who sheltered on Black Saturday sheltered actively. However, there were households where one or more people sheltered inactively, often children and the elderly, while others defended or actively sheltered. Cases of 'total' inactive sheltering were more common among those who had bunkers, and those who found themselves sheltering unexpectedly. In 325 cases of sheltering examined as part of the wider study (Blanchi et al. 2015) there were only 22 (6.7%) cases where all members of the household sheltered inactively throughout the fire. They survived because the house or structure they were sheltering in did not ignite or, as noted below, because others alerted them to the presence of a fire. Some did, however, suffer burns and smoke inhalation.

The vast majority of residents who sheltered described taking at least some protective action, and some sheltered in houses or structures that were defended by others. People who were more active described regularly monitoring the progress of the fire and the immediate

surrounds of the house. Interviewees described how they regularly ‘patrolled’ the exterior of the house to check for ignitions. Some also monitored the interior of the house, including roof spaces, for signs of fire. Preparation was important in enabling people to monitor effectively. Some residents brought ladders inside to access roof spaces, and had appropriate clothing and equipment to allow them to monitor safely outside.

We had the ladder propped up in the manhole. All I had to do was go up and stand at the top of the ladder, keeping watch on what was happening inside the roof, in case the sparks came in. They didn’t, but I would have been ready for them. I must say, the mining lamps were invaluable. They allowed us an excellent source of light... From time to time I came down and helped [my wife] in the task of patrolling from room to room, looking through the curtains. (Marysville)

Residents proactively wet down internal and external walls, doors and windows. As houses began to fill with smoke, some residents lay on the floor or knelt over the bath with wet towels or blankets over their heads (see Section 4.6 for discussion of sheltering in bathrooms).

Regular monitoring meant people were able to detect ignitions on, in and around the house, which they could then attempt to extinguish. In some cases, early detection meant fires were extinguished relatively easily. However, there were cases where undetected fires took hold or where residents were unable to go outside safely to extinguish fires. One interviewee, for example, had been sheltering inside a public building when onlookers alerted her to the fact that it was on fire, enabling her to exit safely. While some people exited immediately when their house caught fire, others tried to wait until the fire outside subsided. A number of interviewees described moving progressively through the house and exiting at the last moment.

[The fire] got me from the back of the house. Once it had caught, I was blocking off room by room in order to stay in long enough for the fire front to go through. Because I knew the southwesterly [wind change] was due. It was so due, so close to coming through. And at one point the house started to fill with smoke ... I realised at that point that if I didn’t get out of the house I was going to die ... So I grabbed my mobile, I grabbed my handbag, I tried to grab my files but they fell and burst open. And I

336 *grabbed the one dog that was near the door and I tried to get the others out and I*
337 *couldn't, they wouldn't come... My car was untouched. And I took a punt. (St*
338 *Andrews)*

339
340 Most people were able to recognise when fire had subsided and it was safe to go outside.
341 In a few instances, residents did not monitor the fire and remained inside houses that filled
342 with smoke or caught alight. The presence of others who were monitoring most likely
343 saved their lives. For example, one interviewee explained how her fear rendered her
344 impassive during the bushfire and was saved by another occupant who checked conditions
345 outside and persuaded her to exit. Monitoring also included checking on the safety and
346 wellbeing of people outside defending.

347
348 *The house filled with smoke and it got darker and darker until it was totally pitch*
349 *black. And I'm totally still believing the safest place is to stay in the house. Outside I*
350 *knew there were flames, so from my preparation... I was going to stay inside that*
351 *house. I'd have [died] with the smoke, because we were starting to pass out, and she*
352 *fortunately rushed out and said, 'No, come out here. It's perfectly safe... The smoke*
353 *was getting really easy, like it was like an anesthetic. It was just like I was starting to*
354 *really start going under ... So she saved my life by going out then. And it was clear –*
355 *it was so safe out there. (Steels Creek)*

356 357 4.3 Challenges associated with sheltering

358 People faced a range of challenges while travelling to a shelter and while sheltering. A
359 lack of visibility when the fire arrived made it difficult for some people to find and reach
360 their intended place of shelter. In some cases, limited visibility forced people to shelter at
361 locations they had not intended. Some described being affected by smoke, which impacted
362 on their health and decision-making. Smoke affected some people to such a degree that
363 they almost 'passed out'. Others were affected by heat and suffered from exhaustion,
364 dehydration and injuries. Lack of appropriate footwear and clothing accounted for some
365 injuries.

366 367 *Sheltering with children*

368 Interviewees reported that sheltering with children was extremely challenging. The presence
369 of infants and small children meant some adults were unable to assist in house defence or

regularly monitor inside and outside. Some sheltered with children in bathrooms, darkened rooms or other confined spaces in the house that provided protection from the fire but often with limited visibility or opportunity for egress. A very small number of interviewees left children unsupervised in these spaces, some with pets, and checked on them periodically.

We had a two-year-old baby in here too that was freaking out... So we had to come inside. We shut all the doors because smoke and everything was coming in... I got all the ice and stuff out of the fridge, put it on the floor, put the baby there. (Pheasant Creek)

[My daughter's] head, even though I had her in a woolen outfit, wet in the bath, her head was boiling. I just kept wetting her down and getting her to suck on a wet face washer. And [my son], he did really well for the first 24 hours and then he deteriorated with the smoke in the air. He had an asthma attack in hospital the next day. So we were very lucky. (Kingleake)

Sheltering with the incapacitated

A small number of interviewees found themselves caring for people who were injured in the fires, including those with major and minor burns, smoke inhalation and other injuries. They were often distracted from intended activities such as defending the house and actively sheltering. They played important roles in providing first aid and assisting the incapacitated, as well as caring for people who were traumatised.

We had the next door neighbours in, the people from across the road. Once they were in there, that's all we were doing... They were fully aware that [people in the house] were dead... [Name removed] was screaming a lot so I had to try and distract her all the time to keep her calm because I was worried about everybody else freaking out. And [name removed], I think he's twelve, was just wanting to get out and run, and so we had to try and keep him from going hysterical and running outside ... He was aware that [relatives] in the house had died... So yes, they were all fully aware of what was happening so you couldn't leave them for a second. And [name removed] wasn't breathing well so we had to keep her breathing and we had to keep everyone's liquids up... They had to be looked after constantly, so that's all we did. (Kingleake)

4.4 Beliefs about sheltering

Safety of houses

Analysis of the interviews revealed a number of beliefs about sheltering that may have influenced sheltering behaviour during the bushfires. Beliefs about the degree of relative safety provided by houses were paramount. Those who believed houses provide safe refuge often recited agency advice to shelter inside during the main passage of the fire front, then go outside and continue defending. A small number of residents strongly believed that houses are the safest place to be and did not exit even when the house was filling with smoke or burning.²

Some people questioned whether advice to shelter inside houses was sound in extreme bushfires. They often retold stories of houses that apparently exploded during the fires. These ‘explosions’ were often thought to be caused by the build-up of extreme heat or pressure.

I’ve been to CFA meetings over the years and they’ve said: ‘Houses don’t explode. It takes 18 minutes... for a house to really get up and burning. So you’ve got ‘this’ amount of time to stay inside, the fire front... You’ve got time to get out’. Well, clearly that isn’t the case. (Flowerdale)³

One interviewee explained how he opened windows in his house during the bushfire to prevent the build-up of heat inside, which he claimed would have caused the house to explode. Official advice during bushfires is to close windows, doors and other openings to prevent the entry of embers.

Years ago someone told me: ‘You’ve got to have at least a couple of windows open in your house’, because... the heat outside and the heat inside the house can’t escape. So it actually gets hotter than what it is outside... So I opened a couple of windows, and a couple of doors because I thought ‘Well, stuff the smoke’, and I know now in my own mind that if I hadn’t done that my house would have exploded from the inside out, because that’s what happens. (Hazeldene)

Safety of bathrooms

² See interview quote from Steels Creek in ‘Activity during sheltering’ section, above.

³ It is unlikely that this is an accurate recollection of CFA advice.

Bathrooms were seen by some as the safest room to shelter in, despite being a common fatality location within houses during bushfires (see Blanchi et al. 2012). The perceived safety of the bathroom appears to stem from the ready availability of water, particularly in the bathtub, the hard surfaces, and the contained nature of the room. It is noteworthy that children and pets were often confined to bathrooms, with and without the presence of adults.

I went into the bathroom with the boys, obviously the smallest place, the safest place in the house. I filled up the bath... We just stayed there. We had blankets, water, torches. [Names removed] stayed outside until the fire hit, and then they came into the bathroom.
(Castella)

We had the kids in the bathroom, had all the windows sealed with wet towels around the house. Filled the bath, because that's where the children were going to stay, in the bathroom, with the dogs. (Kinglake West)

A member of a local CFA brigade who participated in the search for survivors after the bushfires mistakenly believed it was official policy for people to shelter in bathrooms.

[Deceased persons] were in the bathroom exactly per the CFA guidelines... They were in the bathroom which has only one small external window, which she would not be able to get out of and, you know, it was in the back of the house and so the whole house would have been on fire... Why? Because they were in the bloody bathroom and the bloody bathroom hasn't got an external door, the bloody bathroom hasn't got a big enough window to get out of... (Marysville)

Importantly, many interviewees were aware of the dangers of sheltering in a room with limited visibility and options for exiting.

Existence of 'Community refuges' and 'Safe houses'

Analysis of the interviews and witness statements revealed a number of references to local, informally organised 'community refuges' and 'safe houses'. One so-called safe house in Kinglake West was the home of a CFA member who stayed to defend. It is unclear how residents identified the house as a place of shelter, and the occupant appeared unaware of people's plans to shelter there. She asked people who arrived in the early

stages of the fire to leave because she did not want to be responsible for their safety.

Residents who arrived during the peak of the fire did shelter at the house:

We went to two other houses on the right-hand side down the road. As they burnt, we grabbed the kids and that house's occupants and moved on to the next one. And [our neighbour's] place, the big brick one on the left-hand-side, that's where we finally took refuge. She had a room underneath the house... So we put all the kids in there, and all the animals. There were kids and dogs and cats everywhere. And we went out to help fight the fire. (Kinglake West)

A house in Kinglake was also identified as a local 'safe house'. A CFA assessment after the 2006 bushfire in the nearby national park had identified at least one house in the street as unsafe due to the proximity of vegetation surrounding the house. Another house in the street was apparently assessed as being safer because it was built of brick and had a generator, fire pumps, hoses and sprinklers. A number of people died at this house.

'Community refuges' where residents believed they could shelter during bushfires included open areas such as sporting grounds, as well as commercial or community buildings such as schools, pubs, CFA sheds, wineries and hotels. The desire for community refuges was most apparent in Marysville, where people often identified Gallipoli Park oval, the Marysville Golf Club and the Cumberland Hotel as places of shelter.

5. Discussion

Australian research on community responses to bushfire has tended to focus on decisions and actions associated with evacuation and property defence. Indeed, research on the 2009 Black Saturday bushfires classified 96% as staying to defend or evacuating, with just 4% sheltering inside a house or other structure, vehicle, or somewhere outside (Whittaker *et al.* 2013).

However, findings reported in this paper suggest that sheltering was far more common on Black Saturday. Most of those who sheltered did so for short periods of time during property defence or evacuation in order to protect themselves against flames, heat and smoke. Only a small number of interviewees reported sheltering inactively throughout the fire. These findings highlight the need for greater consideration of sheltering behaviour and advice in bushfire research and policy.

While numerous studies have highlighted the dangers associated with ‘passive’ sheltering (e.g. Handmer and Tibbits 2005; Haynes et al. 2010; Handmer and O’Neil 2016), few have considered the types of activity that might be required for people to shelter more safely. Our distinction between ‘active’ and ‘inactive’ sheltering more clearly communicates the need to regularly monitor the fire and conditions in and around the shelter, and to take action to protect the shelter and its occupants. Active sheltering was common despite limited planning and preparation for sheltering, suggesting opportunities to build on existing practices and knowledge to increase preparedness for sheltering. Education materials, warnings and other communications should use the term ‘active sheltering’ and convey the need for regular monitoring and protective actions. People must be able to monitor all rooms and building cavities for signs of fire, recognising that if a fire develops that cannot be suppressed then occupants should close off this region of the building and move towards an exit, then make a decision to exit based on a judgement of relative safety inside and outside the structure. Such advice is likely to be complex, and its application contingent on the unique circumstances and conditions people experience during a fire.

Our results indicate a limited degree of preparedness for sheltering on Black Saturday. While some residents had prepared for the possibility of shelter, most preparations appear to have been made to enable safe defence or evacuation, reflecting the ‘stay or go’ dualism identified by the Royal Commission (Teague et al. 2010). Preparations to enable defence are likely to have aided sheltering because they increase the probability of structure survival, particularly when occupants take action to protect or defend the structure (Ramsay et al. 1987; Blanchi and Leonard 2008; Stephens et al. 2009). Nevertheless, those who intend to stay and defend should be prepared for the possibility of shelter, whether periodically as part of defence or as a last resort if defence is unsuccessful. The finding that those who intend to leave were less prepared to shelter is consistent with previous research, which suggests that ‘leavers’ are often among the least prepared (Penman et al. 2013; Penman et al. 2016). Because they do not envisage themselves being home during a fire, they may not prepare their house and property to increase its chances of withstanding a fire and provide a place of shelter for occupants. Since Black Saturday, fire services have more clearly communicated the need for people to have back-up plans in case they are unable to leave or defend (e.g. CFA 2016b). Research is needed to investigate whether people are heeding this advice and whether their plans include provisions for sheltering.

Importantly, the research provides insights into challenges experienced by people while sheltering. Most notably, responsibilities for dependants, often children, prevented some people from enacting their plan to defend or sheltering actively on Black Saturday. Reflecting the gendered nature of bushfire response (e.g. Eriksen 2014; Whittaker et al. 2016), these roles were often fulfilled by women. It is particularly concerning that some children were left alone in confined spaces such as bathrooms with limited visibility and opportunity for egress. Where possible, arrangements should be made for infants and children to leave for a place of safety before a bushfire threatens. However, it may not be possible to leave and preparations should be made for supervised, active sheltering in a room that allows monitoring and swift egress. Research by Towers (2015) highlights children's capacities to engage in household discussions and planning for bushfire, suggesting opportunities to develop education materials specifically for children to encourage active sheltering. The potential for children to facilitate enhanced household bushfire preparedness should not be underestimated. There is also potential to tailor messages specifically for women, who, due to their often greater responsibilities for children and other dependants, may be more receptive to messages about preparing for active sheltering. The challenges of sheltering with those who are injured, suffering trauma or incapacitated are likely to be more difficult to plan for, particularly in situations where people arrive unexpectedly to shelter. Where the plan is to stay and defend, risks can be reduced by ensuring there are multiple, able-bodied adults available to defend (see Whittaker *et al.* 2013). This increases the likelihood that, should a person be diverted from defence or is incapacitated, active defence can continue.

Beliefs about the safety of houses and, in particular, bathrooms influenced sheltering behaviour on Black Saturday. People who stayed to defend often believed the house would provide safe refuge during the main passage of the fire front, enabling temporary shelter before resuming defence. This view firmly reflects official fire service advice about staying to defend, which emphasises the need to protect oneself from radiant heat by moving inside when necessary (e.g. CFA 2013). Others, however, saw the house as the safest place to be in a bushfire and did not exit even when the house became untenable. In some cases this reflected a belief in the safety of the house and in others appeared to be motivated more by a fear of the fire. Bathrooms were often perceived as the safest room to shelter in, primarily because of the availability of water and the contained nature of the room. Sheltering in bathrooms may discourage active sheltering, particularly as options for monitoring and egress

are often limited. The danger of sheltering in bathrooms is highlighted by Blanchi et al. (2014), who recorded 37 fatalities in these spaces (22% of all deaths) on Black Saturday.

Those who did not think houses provide safe refuge often believed that houses could ‘explode’ in bushfires. Belief in exploding houses appears widespread (Odgers and Rhodes 2002; Handmer and Tibbits 2005; Cohen et al. 2006). Scientific studies, however, maintain that houses do not explode (e.g. Ramsay et al. 1987; Leonard and McArthur 1999; Stephens et al. 2009). In any case, belief in exploding houses persists and may encourage risky behaviour (such as opening windows and doors) and sheltering outside in unsafe locations.

An important finding of the research is that many residents planned to shelter at local informally organised ‘community refuges’ or ‘safe houses’. Community refuges broadly align with the ‘informal places of shelter’ studied by McLennan (2010) including ovals, fire brigade sheds and schools. However, this study also examined people’s understanding and use of so-called ‘safe houses’ on private property. In some cases occupants of these houses were unaware that others considered it a safe house. Sadly, some of the houses did not provide the safety people sought. Fire services should facilitate greater discussion and planning for sheltering within households and at the neighbourhood scale. Such a process is likely to reveal people’s intentions about when and where to shelter, and may present opportunities to dispel misconceptions about local ‘safe houses’ and other intended places of shelter. Governments and fire services, in recent years, have developed and implemented place of last resort to provide protection from the effects of the fire such as Neighbourhood Safer Places (e.g. CFA 2012; RFS 2012). The dangers associated with finding a place to shelter at the last moment should be emphasised. Locally, fire services and community bushfire groups (e.g. Community Fireguard groups and Community Fire Units) may become aware of informally organised community refuges and safe houses, presenting opportunities to initiate dialogue about the suitability of certain places for shelter and the planning and preparation required for active sheltering.

The findings arising from this research suggest a number of opportunities for improving fire service communications to encourage preparedness for active sheltering. However, research consistently highlights the challenges of engaging the public in bushfire awareness and education campaigns (see McLennan *et al.* 2015). It is inevitable that some people will only

become receptive to bushfire-related information once they are threatened by an actual fire (McLennan *et al.* 2013; Whittaker *et al.* 2013). Therefore, in addition to awareness and education campaigns, emergency warnings should clearly communicate the need to shelter actively and provide basic information about how to shelter actively to people who may have limited awareness and understanding of bushfire.

Finally, our results suggest that preparations for sheltering are likely to be made on the day of a fire, once it is clear that a fire is threatening. On Black Saturday, the unexpected arrival of the fire meant that some people did not have time to enact their final preparations or reach their intended place of shelter. This highlights that even where structures such as bunkers or community refuges are available, people may not have time to reach them safely. There is a risk that the presence of shelters could give people a false sense of security, thereby encouraging a lack of preparedness and last-minute decision-making. A number of factors may prevent people from reaching their intended place of shelter, including a lack of awareness of the fire threat; underestimating the time needed for household members to reach the shelter; underestimating the severity of the fire and associated conditions (e.g. radiant heat and smoke); and unanticipated contingencies such as road blockages or destruction of the shelter. For these reasons, the presence of a bunker or other form of shelter does not negate the need for bushfire planning and preparation.

6. Conclusion

This paper provides insights into the experiences of people who sheltered during the 2009 Black Saturday bushfires. More than half of the interviewees in the BNHCRC Black Saturday data and witness statements recounted experiences of sheltering during the bushfires, suggesting that sheltering may be more common in bushfires than previous evidence suggests (e.g. Whittaker *et al.* 2013). Indeed, our study draws attention to short-term, periodic sheltering undertaken as part of property defence or evacuation, which has received scant attention in the literature.

Sheltering is a necessary consideration for people who live and work in areas at risk from bushfire, regardless of whether they intend to stay and defend or leave. Although results presented in this paper suggest a limited degree of planning and preparation for sheltering, preparations made by those who stayed to defend enabled many to shelter safely. Furthermore, this study found that the majority of those who sheltered during the bushfires

sheltered *actively*, engaging in regular monitoring and action to protect the shelter and its occupants. Education materials and campaigns to encourage planning and preparation for active sheltering are needed, but should emphasise that sheltering should not be planned for as a sole response. Initiatives should underline the importance of regular monitoring and actions required to protect the shelter and its occupants, including timely egress. They should also encourage local dialogue about the suitability of places of shelter, including informally organised community refuges and so-called safe houses.

There remains much to learn about sheltering during bushfires. With the exception of McLennan's (2010) study of informal places of shelter on Black Saturday, sheltering has not been an explicit focus of research. Research is needed to more fully investigate people's awareness and knowledge of sheltering as a protective response, their intentions and preparation for sheltering, and the actions they take to protect themselves during actual fires. Some residents declared their intention to rebuild houses or construct bunkers to enable sheltering after Black Saturday (see Blanchi et al. 2015). Research is needed to investigate the degree of protection offered by these structures. Similarly, other community shelters such as Neighbourhood Safer Places have been designated in most Australian States and Territories, yet little is known about how people understand and intend to use them. Such research will provide an evidence base for strategies that aim to increase preparedness for active sheltering.

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