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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 **1. Introduction**

2 173 people died and more than 2000 houses were destroyed in the 2009 Black Saturday
3 bushfires in Victoria, Australia. Initial police reports indicated that 113 people died inside
4 houses, 27 outside a house, 16 in or near cars, 7 in garages or sheds, 5 on roadways, 1 in an
5 open land reserve, and 4 at a location outside the fire perimeter (AAP, 2009). Subsequent
6 research examined the activities civilians were engaged in immediately preceding their death,
7 finding that 26 people died defending a house or property, 7 protecting livestock or other
8 assets, 35 while evacuating, 41 while sheltering after attempts to defend a house or property,
9 47 while sheltering without attempts to defend, 3 in an indefensible shelter, and 3 in a shelter
10 where activities are unknown (Blanchi et al. 2012).¹ The large proportion of people who died
11 inside while sheltering on Black Saturday marks a significant shift in bushfire fatality trends,
12 which previously saw the majority of deaths occur outside while residents attempted to
13 protect assets or evacuate (Haynes et al. 2010).

14
15 The large loss of human life and property on Black Saturday led to the establishment of the
16 2009 Victorian Bushfires Royal Commission (VBRC) (Teague et al. 2010). A key concern
17 for the Commission was the viability of the ‘Prepare, stay and defend or leave early’
18 (PSDLE) policy. Under this policy, Australian fire services advised residents to prepare to
19 stay and defend their homes and properties or leave before a bushfire occurred in their area
20 (AFAC 2005). The Commission observed that the phrase ‘stay and defend *or* leave early’ did
21 not accurately reflect what people do in bushfires, noting many will delay making a decision
22 until they are directly threatened. The Commission concluded that a comprehensive bushfire
23 policy must accommodate the different scenarios people might experience by providing
24 different advice and more options, including the possibility of sheltering. State and local
25 governments responded by designating ‘Neighbourhood Safer Places’ as places of last resort,
26 and the Australian Building Codes Board (2014) developed standards for the design and
27 construction of bushfire shelters for private use. Anecdotal evidence suggests that residents of
28 bushfire risk areas are increasingly constructing or converting existing structures into bunkers
29 (e.g. Webb and Landy 2013). Fire services have recognised that people might want to install
30 private shelters and are providing advice relating to sheltering. Importantly, this advice
31 emphasises that sheltering should be planned for as a ‘last resort’ or back-up in the event that
32 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.



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

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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

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

55
56 This paper presents findings from research that examined the circumstances and challenges
57 people experienced when sheltering and exiting houses, sheds, personal shelters and other
58 structures during the Black Saturday bushfires (Blanchi et al. 2015). The research entailed
59 analysis of data related to resident decision-making and behaviour, and factors such as house
60 design, fire behaviour and the surrounding landscape. This paper focuses on findings from a
61 qualitative analysis of the Bushfire and Natural Hazards Cooperative Research Centre's
62 (BNHCRC) interviews with residents collected as part of the '2009 Victorian Bushfires
63 Research Taskforce' and lay witness statements to the VBRC (see Teague *et al.* 2010).

64

65 **2. Sheltering during bushfire**

66 Taking shelter is one of many options available to people seeking protection from hazards.
67 While early evacuation is usually considered the safest option, numerous factors may prevent
68 people from evacuating safely, including the inability to provide or receive an early warning
69 (e.g. in cases of rapid onset or communication failure), road networks that prevent swift
70 egress, and responses of citizens who may be unable or unwilling to leave (McCaffrey et al.,
71 2015; Paveglio et al., 2008). Last minute evacuations are historically a major cause of
72 bushfire fatalities in Australia (Haynes et al. 2010). Eight of the nine people killed in the
73 2005 Eyre Peninsula bushfires in South Australia, for instance, died in or near cars while
74 attempting to flee the fire (Schapel, 2008). On Black Saturday, the large number of people
75 who died inside houses has often overshadowed the fact that 35 people died while attempting
76 to evacuate (Blanchi et al. 2012). The possibility that it may be safer to remain in a fire
77 affected area than attempt last-minute evacuation is reflected in fire service emergency
78 warnings, which may advise that it is too late to leave and that residents should seek shelter
79 (e.g. AAP 2017).

80

81

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

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

95
96 Much early evidence of sheltering in Australia comes from the 1939 Black Friday bushfires
97 in Victoria, where people working and living in the bush retreated inside structures such as
98 houses, timber mills and dugouts to protect themselves from radiant heat and flames (Tibbits
99 and Handmer 2005; Collins 2006). Judge Leonard Stretton’s (1939) Royal Commission into
100 the fires recommended the construction of dugouts at all timber mill settlements, but noted
101 that financial costs and liability fears had prevented their construction in the past. Research
102 following the 1983 Ash Wednesday bushfires in Victoria found that many people remained at
103 their homes to defend and/or shelter (Wilson and Ferguson 1984; Lazarus et al. 1984, Krusel
104 and Petris 1992). The Bushfire Review Committee subsequently stressed the need to consider
105 sheltering as an alternative to evacuation, observing that ‘a considerable number of people
106 found communal shelter in large, well-constructed buildings and survived, even though the
107 fire threat outside the buildings was acute’ (Miller et al. 1984, p. 162). The Committee
108 proposed that the State Government construct or adapt school buildings for use as shelters ‘to
109 mitigate the possibility of students being exposed to risk by being sent home ahead of an
110 advancing fire front’ (Miller et al. 1984, p. 162).

111
112 A number of studies provide insights into sheltering behaviour in the Black Saturday
113 bushfires. In a survey of populations affected by the bushfires, Whittaker *et al.* (2013) found
114 that very few residents (4%) sheltered throughout the fire in houses or other structures,
115 vehicles or somewhere outside. Importantly, the study did not consider shorter-term, periodic
116 sheltering. McLennan (2010) studied residents’ uses of informal places of shelter such as
117 ovals, fire brigade sheds and schools on Black Saturday. Some residents understood these
118 places to be ‘designated’ places of assembly, while others ‘simply ended up there’
119 (McLennan 2010, p. 5). Very few people who sheltered on ovals or at CFA sheds made

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

125
126 In the USA, where evacuation is the primary strategy for managing human populations
127 during wildfires, researchers have questioned whether leaving is always the most appropriate
128 option (e.g. Paveglio *et al.* 2008; Cova *et al.* 2009; McCaffrey *et al.* 2015). Large scale
129 evacuations are complicated by population growth, road infrastructure limitations, challenges
130 associated with the provision of early warnings, and the capacities and intentions of citizens
131 (Cova *et al.* 2013; McCaffrey *et al.* 2015). Numerous studies report some US homeowners,
132 often in rural and resource-based communities, do not intend to evacuate during wildfires,
133 choosing instead to stay and defend or shelter (e.g. Cohn *et al.* 2006; Paveglio *et al.* 2010a;
134 Paveglio *et al.* 2014; McCaffrey *et al.* 2015). A study of five residential developments
135 designed to withstand wildfires and enable residents to shelter inside homes in Rancho Santa
136 Fe, California, found that few residents intended to shelter-in-place and few understood what
137 to do in a wildfire (Paveglio *et al.* 2010b). Those who did intend to shelter were more likely
138 to understand the building codes and landscaping that made their homes more likely to
139 withstand fire. Importantly, the authors emphasise the affluence of the communities studied,
140 noting that it may be difficult to achieve the physical standards required for safe sheltering in
141 more established or less affluent areas. Australian fire services distinguish strategies of ‘stay
142 and defend’ and ‘shelter’ to emphasise the need for active defence for those who choose to
143 stay in a fire, even though staying to defend may require periodic sheltering.

144
145 In summary, Australian research has tended to focus on the decisions and actions of those
146 who evacuate and those who stay to defend against bushfire, reflecting the ‘stay or go’
147 approach advocated by fire services. Consideration of sheltering is relatively limited, with
148 studies largely focused on sheltering behaviours associated with fatalities. Further research is
149 needed to examine people’s awareness and knowledge of sheltering as a protective response,
150 as well as the planning, preparation and actions that are required to shelter safely during
151 bushfires.

152
153 **3. Research methods**

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

158
159 Residents were interviewed over a 12-week period beginning on 12 February 2009 as part of
160 the BNHCRC's 2009 Victorian Bushfires Research Taskforce. The semi-structured interview
161 guide comprised open-ended questions about residents' planning and preparation, the
162 information and warnings they received, their intended and actual responses, and what they
163 thought they might do in future fires (see Whittaker et al. 2009). Interviews began with
164 participants being asked to discuss their experience of the fire, with follow-up questions
165 exploring the subjects noted above. A key strength of semi-structured interviews is that
166 participants' experiences and perspectives emerge more from their own understandings and
167 personal narratives than from researchers' conceptualisations of research problems or
168 important issues (Marshall and Rossman 2014). Thus, while sheltering was not an intended
169 focus of the research, the semi-structured nature of the interviews allowed data on sheltering
170 to be collected. Interviews were conducted at residents' homes or properties, typically lasted
171 around an hour, were digitally recorded with each participant's consent, and transcribed.
172 Unfortunately, detail of the demographic composition of the interview sample was not kept
173 and was, therefore, unavailable to researchers. Nevertheless, examination of the interview
174 data set reveals perspectives and experiences from a diverse array of people throughout the
175 fire affected areas. Ethics approval for the interviews was obtained from RMIT University's
176 Human Ethics Research Committee, with measures taken to protect the safety and rights of
177 participants and researchers. Anonymity was assured to all participants, who gave their
178 consent for aggregated data and quotes to be used in publications.

179
180 The 611 interview transcripts and 100 witness statements were searched for references to
181 sheltering, producing a dataset of 315 interviews and 50 witness statements for analysis.
182 These documents capture a range of sheltering experiences, from periodic sheltering as part
183 of property defence to inactive sheltering throughout the fire. Interviews and witness
184 statements where sheltering was not discussed were excluded; however, this does not mean
185 that these residents did not shelter at some point during the fire. The semi-structured nature of
186 the interviews meant that interviewees were not asked a consistent set of questions, including,
187 for example: 'Did you take shelter at any point during the fire?' Consequently, the analysis

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

193
194 *NVivo v.11* (QSR International) was used to manage the large volume of data and to assist the
195 analysis. The primary purpose of the interview and witness statement analysis was to provide
196 detailed evidence of people’s experiences and understanding of sheltering during the
197 bushfires. We employed a general inductive approach, whereby general categories are
198 developed from the research aims and more specific categories emerge from multiple
199 interpretations of the raw data (Thomas 2006). For example, ‘Intention to shelter’ was an
200 initial category that, through the process of coding, was refined to include the sub-categories
201 ‘as a primary strategy’ and ‘as a backup or last resort’. Similarly, the category ‘Future plans
202 for sheltering (or not)’ was added after analysis of multiple transcripts. An ‘Emerging
203 themes’ category was also included and later refined to include sub-categories for beliefs
204 about the safety of houses, bathrooms, ‘safe houses’ and community refuges. The iterative
205 and inductive process of coding led to the creation of categories that more accurately
206 reflected the content of interviews, allowing important issues and themes to be identified and
207 data to be more closely analysed (Bazely and Jackson 2013). Quotes have been selected to
208 provide insights into interviewees’ experiences and understandings of sheltering.

209
210

-
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
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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)

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

237
238 Levels of planning and preparation for sheltering varied substantially. Most residents focused
239 their efforts on measures to enable defence or safe evacuation. They rarely had a firm plan for
240 where and how they would shelter, often envisaging themselves sheltering ‘somewhere
241 outside’, in a dam or waterbody, or at a neighbour’s house. Others identified one or more
242 specific locations where they might be able to shelter. A very small number of people
243 rehearsed their plan for sheltering. Varied levels of preparedness for sheltering are evident in
244 the following quotes:

245
246 *If the house had caught early, I guess we would have found a space of refuge. But it’s*
247 *hard to know because it seemed like for about two hours there were moments when there*
248 *was a lot of smoke out there. So I guess we had our blankets, we could get out and go*
249 *under the blankets. I don’t know... (Kingleake West)*

250
251 *We have an area under the house here, like a cellar, completely bricked in. And there are*
252 *some air vents, but we had rags and things like that. If needed, we could block those...*
253 *So the idea was that mum would go down there. We even did a little dummy run in the*
254 *afternoon. I took her down there and sat her in the chair and said ‘If a fire comes, this is*
255 *where you’re going to be sitting’. And we had our drinks, a little Esky [ice box] and*
256 *things. We had a bucket with some wet towels... We had our dog... He was tied up under*
257 *there. So that was all sort of ready. (Callignee)*

258
259 Preparations made to assist in the defence of houses, such as clearing vegetation and blocking
260 and filling gutters with water, undoubtedly increased the likelihood that residents could
261 shelter safely, if only for a short period of time. However, some residents discussed
262 preparations made specifically for sheltering. They filled baths, sinks and containers with
263 water, and placed wet towels around the house. Some put shutters over windows or pulled
264 down blinds, and some moved furniture and other flammable items away from the windows.
265 Some had protective clothing to wear while defending and sheltering including woollen
266 clothes, full-length overalls, work boots, masks, helmets and gloves.

267

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

274

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

280

281 4.2 Activity during sheltering

282 Based on our analysis of interview transcripts, a distinction can be drawn between active and
283 inactive sheltering. Active sheltering is characterised by regular monitoring of the fire and
284 conditions inside and outside the place of shelter, as well as actions to protect the shelter and
285 its occupants. Such actions include extinguishing fires, preventing the entry of smoke, and
286 caring for vulnerable people. Inactive sheltering is characterised by a lack of regular
287 monitoring and actions to protect the shelter and occupants.

288

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

298

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

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

307

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

314

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

319

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

329

330 *[The fire] got me from the back of the house. Once it had caught, I was blocking off*
331 *room by room in order to stay in long enough for the fire front to go through. Because*
332 *I knew the southwesterly [wind change] was due. It was so due, so close to coming*
333 *through. And at one point the house started to fill with smoke ... I realised at that*
334 *point that if I didn’t get out of the house I was going to die ... So I grabbed my mobile,*
335 *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

370 regularly monitor inside and outside. Some sheltered with children in bathrooms, darkened
371 rooms or other confined spaces in the house that provided protection from the fire but often
372 with limited visibility or opportunity for egress. A very small number of interviewees left
373 children unsupervised in these spaces, some with pets, and checked on them periodically.
374

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

379

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

385

386 *Sheltering with the incapacitated*

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

392

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

403

404 4.4 Beliefs about sheltering

405 *Safety of houses*

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

413
414 Some people questioned whether advice to shelter inside houses was sound in extreme
415 bushfires. They often retold stories of houses that apparently exploded during the fires. These
416 ‘explosions’ were often thought to be caused by the build-up of extreme heat or pressure.

417
418 *I’ve been to CFA meetings over the years and they’ve said: ‘Houses don’t explode. It*
419 *takes 18 minutes... for a house to really get up and burning. So you’ve got ‘this’ amount*
420 *of time to stay inside, the fire front... You’ve got time to get out’. Well, clearly that isn’t*
421 *the case. (Flowerdale)³*

422
423 One interviewee explained how he opened windows in his house during the bushfire to
424 prevent the build-up of heat inside, which he claimed would have caused the house to
425 explode. Official advice during bushfires is to close windows, doors and other openings to
426 prevent the entry of embers.

427
428 *Years ago someone told me: ‘You’ve got to have at least a couple of windows open in*
429 *your house’, because... the heat outside and the heat inside the house can’t escape. So it*
430 *actually gets hotter than what it is outside... So I opened a couple of windows, and a*
431 *couple of doors because I thought ‘Well, stuff the smoke’, and I know now in my own*
432 *mind that if I hadn’t done that my house would have exploded from the inside out,*
433 *because that’s what happens. (Hazeldene)*

434
435 *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.

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

441
442 *I went into the bathroom with the boys, obviously the smallest place, the safest place in*
443 *the house. I filled up the bath... We just stayed there. We had blankets, water, torches.*
444 *[Names removed] stayed outside until the fire hit, and then they came into the bathroom.*
445 (Castella)

446
447 *We had the kids in the bathroom, had all the windows sealed with wet towels around the*
448 *house. Filled the bath, because that's where the children were going to stay, in the*
449 *bathroom, with the dogs. (Kinglake West)*

450
451 A member of a local CFA brigade who participated in the search for survivors after the
452 bushfires mistakenly believed it was official policy for people to shelter in bathrooms.

453
454 *[Deceased persons] were in the bathroom exactly per the CFA guidelines... They were*
455 *in the bathroom which has only one small external window, which she would not be able*
456 *to get out of and, you know, it was in the back of the house and so the whole house would*
457 *have been on fire... Why? Because they were in the bloody bathroom and the bloody*
458 *bathroom hasn't got an external door, the bloody bathroom hasn't got a big enough*
459 *window to get out of... (Marysville)*

460
461 Importantly, many interviewees were aware of the dangers of sheltering in a room with
462 limited visibility and options for exiting.

463
464 *Existence of 'Community refuges' and 'Safe houses'*
465 Analysis of the interviews and witness statements revealed a number of references to
466 local, informally organised 'community refuges' and 'safe houses'. One so-called safe
467 house in Kinglake West was the home of a CFA member who stayed to defend. It is
468 unclear how residents identified the house as a place of shelter, and the occupant appeared
469 unaware of people's plans to shelter there. She asked people who arrived in the early

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

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

472

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

479

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

485

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

492

493 **5. Discussion**

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

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

504

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

520

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

538

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

560

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

572 are often limited. The danger of sheltering in bathrooms is highlighted by Blanchi et al.
573 (2014), who recorded 37 fatalities in these spaces (22% of all deaths) on Black Saturday.

574

575 Those who did not think houses provide safe refuge often believed that houses could
576 ‘explode’ in bushfires. Belief in exploding houses appears widespread (Odgers and
577 Rhodes 2002; Handmer and Tibbits 2005; Cohen et al. 2006). Scientific studies, however,
578 maintain that houses do not explode (e.g. Ramsay et al. 1987; Leonard and McArthur
579 1999; Stephens et al. 2009). In any case, belief in exploding houses persists and may
580 encourage risky behaviour (such as opening windows and doors) and sheltering outside in
581 unsafe locations.

582

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

601

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

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

611
612 Finally, our results suggest that preparations for sheltering are likely to be made on the day of
613 a fire, once it is clear that a fire is threatening. On Black Saturday, the unexpected arrival of
614 the fire meant that some people did not have time to enact their final preparations or reach
615 their intended place of shelter. This highlights that even where structures such as bunkers or
616 community refuges are available, people may not have time to reach them safely. There is a
617 risk that the presence of shelters could give people a false sense of security, thereby
618 encouraging a lack of preparedness and last-minute decision-making. A number of factors
619 may prevent people from reaching their intended place of shelter, including a lack of
620 awareness of the fire threat; underestimating the time needed for household members to reach
621 the shelter; underestimating the severity of the fire and associated conditions (e.g. radiant
622 heat and smoke); and unanticipated contingencies such as road blockages or destruction of
623 the shelter. For these reasons, the presence of a bunker or other form of shelter does not
624 negate the need for bushfire planning and preparation.

625

680 **6. Conclusion**

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

688

689 Sheltering is a necessary consideration for people who live and work in areas at risk from
690 bushfire, regardless of whether they intend to stay and defend or leave. Although results
691 presented in this paper suggest a limited degree of planning and preparation for sheltering,
692 preparations made by those who stayed to defend enabled many to shelter safely.

693 Furthermore, this study found that the majority of those who sheltered during the bushfires

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

701
702 There remains much to learn about sheltering during bushfires. With the exception of
703 McLennan's (2010) study of informal places of shelter on Black Saturday, sheltering has not
704 been an explicit focus of research. Research is needed to more fully investigate people's
705 awareness and knowledge of sheltering as a protective response, their intentions and
706 preparation for sheltering, and the actions they take to protect themselves during actual fires.
707 Some residents declared their intention to rebuild houses or construct bunkers to enable
708 sheltering after Black Saturday (see Blanche et al. 2015). Research is needed to investigate
709 the degree of protection offered by these structures. Similarly, other community shelters such
710 as Neighbourhood Safer Places have been designated in most Australian States and
711 Territories, yet little is known about how people understand and intend to use them. Such
712 research will provide an evidence base for strategies that aim to increase preparedness for
713 active sheltering.

714
715
716

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728

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