

Review of fatalities in the February 7, 2009, bushfires.

Prepared for the Victorian Bushfires Royal Commission

April 2010

FINAL REPORT

Centre for Risk and Community Safety
RMIT University

&

Bushfire CRC

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By John Handmer, Saffron O'Neil and Damien Killalea.

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Project team members

John Handmer is Professor of Risk and Sustainability at RMIT. He leads the University's Centre for Risk and Community Safety and its Human Security Program. He is also Research Leader for the Bushfire CRC's Program on self-reliant communities and Convener of the National Climate Change Adaptation Research Network for Emergency Management. He holds adjunct professorial positions at ANU's Fenner School, Risk Frontiers at Macquarie University and the Flood Hazard Research Centre at Middlesex University in London. He works on the social and economic aspects of emergency management and disasters.

Damien Killalea is Director of Community Fire Safety at the Tasmania Fire Service. He is responsible for the development and implementation of policies, strategies and programs to increase community safety from fire. Damien is the Bushfire Cooperative Research Centre's user-leader for Program C, which focuses on community safety and resilience to bushfire. He is also a member of the Australasian Fire and Emergency Service Authorities Council's (AFAC) Community Safety Group, and plays a leading role in the development and review of national positions and strategies to improve community safety from fires in the built and natural environment.

Dr Saffron O'Neil is a Research Fellow in the Social Dimensions of Climate Change Adaptation at the University of Melbourne. She is also a Visiting Fellow at the UK's Tyndall Centre for Climate Change Research. Saffron conducts interdisciplinary research investigating the interactions between society, public policy, risk and the environment; especially concerning risk perception, risk communication and public engagement.

Executive summary

This report was prepared for the Victorian Bushfires Royal Commission by the Bushfire Cooperative Research Centre (CRC). The CRC commissioned a team lead by Professor John Handmer of RMIT to undertake the work.

Saturday 7 February 2009 brought the worst fire danger day in Victoria's history. Weather conditions were significantly worse than predicted, with a record high in Melbourne's CBD of 46.4 degrees Celsius and higher temperatures elsewhere, very strong winds, and very low humidity. As a result of the fires, 172 civilians perished on the day or subsequently from injuries received during the fires.

In accordance with the project brief, the project team relied solely on summaries prepared for each fatality by the Royal Commission drawing on material collected by the Victoria Police. These were used to examine the empirical basis for the community safety approach of "prepare, stay and defend or leave early", known in shorthand as "Stay or go". Previous studies of bushfire fatalities were reviewed, and results are presented in sections dealing with the vulnerabilities and preparedness intentions and actions of those who died, and the defendability of the buildings they occupied. The demographics of those who died are compared with historical bushfires and the population of the areas affected by fire in 2009.

The final part of the report is concerned with comparing results with previous understanding of bushfire fatalities, and the implications for advice from fire agencies to the community as well as general implications for community bushfire safety.

Note that the analysis is confined to the questions raised in the project brief and to the information provided by the Royal Commission on each fatality.

The dataset provided by the Royal Commission contains unprecedented detail on the circumstances surrounding each fatality, and presents an opportunity to examine in detail the circumstances surrounding each fatality, given the level of access to telephone records, SMS message records, forensic evidence and police statements. However, in any fatalities dataset there is an inherent level of uncertainty. The coding scheme developed for the analysis seeks to reduce the level of uncertainty. The first 40 cases were read and coded independently by two researchers. Differences and ambiguities were discussed and resolved case by case, and the coding scheme adjusted accordingly. All questions arising during coding of the 172 cases were discussed before final decisions were made. Nevertheless, other researchers might reach different conclusions on individual cases.

The idea of staying and defending property against bushfires has a very long history, especially in rural Australia. There is also a history of research into safety, people and houses, although there have been few formal investigations into how people died in bushfires. The history of the "Stay or go" approach and the underlying evidence has been examined previously by a number

of researchers, as well as a recent analysis of all bushfire fatalities over the last century. Essentially, earlier research reports have supported the “Stay or go” approach.

There is more than one way of interpreting the results of this new piece of research. One interpretation is that at a general level, the analysis confirms most aspects of the previous understanding of bushfire fatalities, and supports the broad basis of the “Stay or go” approach: sheltering passively is dangerous, and alert, mobile and well prepared people can save themselves and often their properties. However, there are many links in the chain of bushfire preparedness, and any one of them breaking can lead to serious consequences. So while the policy may appear sound on paper, implementation presents major challenges, particularly for very fast moving and intense bushfires.

A second interpretation could examine the results from the perspective of those who died. About 30% made some attempt at defending their property – although the level of defence varied greatly. Others who were sheltering were relying on this defence to maintain the structure which was protecting them. Over half the fatalities appeared to believe that by relying on their understanding of staying and defending, they were taking effective action in terms of their safety.

Another interpretation draws on the reality that most people who became fatalities did not, and often could not, respond appropriately to the risk that the bushfires presented for them on 7 February 2009. Rather than emphasizing the importance of preparation and staying and defending, this highlights the key role of clear advice tailored to people’s circumstances, timely and specific information and warnings, and of safe accessible places for people - including those with very limited mobility - to relocate to. It also suggests implications for policy-makers in the fields of land-use planning, development control and the management of bushfire fuels.

This highlights the challenges facing the successful implementation of community bushfire safety policies, as even good practice in planning and preparedness – as recommended before the February 2009 fires - at the householder level may not be sufficient to prevent fatalities.

Key findings

1. Among the fatalities, there was significant unawareness of the general fire risk, lack of appreciation that 7 February required a different approach due to the extreme conditions, and limited knowledge about what to do. Some were dismissive of the risk. Many had limited capacity to undertake preparation and property defence.
2. Although nearly half the fatalities had a fire plan, these were of very variable quality. Few fire plans were comprehensive addressing all issues necessary to cope with the conditions experienced on the day. There appear to be few cases of fatalities having a contingency plan for when their preferred course of action ceased to be viable.
3. Any approach to community safety needs to take account of the significant proportion of people in the community whose options may be limited by chronic debilitating conditions, disabilities resulting from accidents on the day, and issues arising as a result of extreme heat.

4. There appear to be some fundamental misconceptions about bushfire safety among many of those who died, including the belief that bathrooms provide a safe shelter, a failure to realize that active patrolling was needed at all times, and limited understanding about fire behaviour and the security of buildings, bunkers and underhouse shelters. For example, people died as a result of toxic gases in bunkers that were undamaged by fire.
5. A significant proportion of fatalities were taken by surprise by the fires. Others appeared to be waiting for an official warning before activating their plans. Many falsely assumed that they would receive a specific warning or that they could obtain help by calling 000 – few of the fatalities got through to 000 and fewer than 10% received a warning directly from officials.
6. Many of the fatalities waited almost until the flames could be seen before acting. People need to understand that decisions and actions critical to survival are essential well before fire reaches them.
7. A few people survived the fire itself, but were badly injured and subsequently died. There were delays in the delivery of medical attention, as ambulances did not have access to the fire ground. Avoiding the delays may not have prevented the deaths, but this may nevertheless be an important issue.
8. There is no evidence that prior experience of bushfires was an advantage. Earlier experience would generally have been with fires of less intensity, and those who experienced the Ash Wednesday fires would have been 26 years older in 2009.
9. Even apparently high levels of planning and preparedness usually contained weak points, or aspects that meant that the plans were not fully implemented. Some with sound preparedness were taken by surprise or for other reasons delayed activating their plans.
10. The defendability of many of the properties involved in fatalities was questionable. Given the extreme conditions on 7 February, earlier research showing that the presence of able-bodied individuals is a key factor in house survival should be tested against the pattern for these and other more intense fires.
11. There was a pattern among many fatalities of eventual retreat to shelter in a small room from which there was no alternate means of escape. In some households, people sheltered while one or two defended. Effort is needed to engage those at risk about appropriate safe behaviour for whole households, and for the need for contingency planning for use when the preferred course of action is not possible.
12. Many people left at the last minute by car. Many reached safety, some did not. Many people sheltered in their cars, and some cars survived the fire with little damage while their owners died inside a house or elsewhere. The issue of cars and safety in bushfires should be examined.

13. Broken windows or damaged or missing roofs caused by strong winds, often before the arrival of the fire, can make it all but impossible to successfully defend a home, as ember attack and subsequent fires will likely quickly consume the building.
14. There were often different attitudes and behaviour between males and females, with males almost always wanting to stay and females wanting to leave. This led to changes to plans at the last minute, or failure to commit to an effective course of action in time.
15. A small number of fatalities appear to have been at least somewhat reclusive; with only very occasional communication with family, neighbours or the community. For these people at least, usual communication channels may not be successful, and more innovative strategies may be needed.
16. The age and gender distribution of the fatalities is similar to historic fires.

Part 1

Approach and context

1. Introduction

Saturday 7 February 2009 brought the worst fire danger day in the Australian state of Victoria's history. The weather conditions were significantly worse than predicted with a record high in the state capital's (Melbourne) CBD of 46.4 degrees celsius and higher temperatures elsewhere, very strong winds, and extraordinary low humidity. The day came after 12 years of the state's hottest and longest drought, a string of the hottest years on record in the last decade, a 35 day dry spell for Melbourne through January that was equal second longest in history, topped off by the most severe heatwave on record the week before. There were many warnings during the preceding week that severe fires were likely on the Saturday – and that the day would be the worst in the State's history. The bushfires were intense and very fast moving. They claimed 173 lives of which one was a fire fighter who died during post-fire operations. The 172 remaining fatalities are the subject of this report.

This report was prepared for the Victorian Bushfires Royal Commission by agreement with the Bushfire Cooperative Research Centre (CRC). The Commission provided all 7th February 2009 fatality data used in the project. The Project Brief states:

“The overarching research question concerns the implications of the fatality dataset for the “Stay or go” policy and for broader community safety action and communications”.

The project therefore uses the fatality information to examine the empirical basis for the community safety approach known in shorthand as “Stay or go”, as set out on the AFAC (Australian Fire and Emergency Services Authorities Council) website.

After a review of the methodology used and discussion on the level of uncertainty in this analysis, previous studies of bushfire fatalities are reviewed, and results are presented in sections dealing with vulnerabilities and preparedness, intentions and actions, and the defendability of buildings. The demographics of those who died are compared with those of historical bushfires and of the population of the areas affected by fire in 2009.

Intentions and actions are discussed under the following sub-headings:

- What role did the intention to stay and defend play in fatal outcomes?
- What were people doing in the lead up to their deaths?
- If people died fleeing are there any indications as to why?
- What proportion was sheltering passively?
- What proportion was defending their properties?

The final part of the report is concerned with comparing our results with the previous understanding of bushfire fatalities, and the implications for advice from fire agencies to the community as well as general implications for community safety.

2. Methodology

Key aspects of our approach are:

- The only information used on the fatalities that resulted from the fires of 7 February 2009 came from summaries on each fatality provided by the Royal Commission. These summaries were based on statements collected by the Police and many included details of forensic investigations, medical conditions and the property involved. 172 fatalities were examined. The 173rd fatality was a fire fighter and is not included in this analysis of civilian deaths.
- For the purposes of analysis, each case had to be categorized in terms of preparedness, intentions, actions and so on. A coding scheme was developed for this purpose.
- To allow direct comparison with earlier fire fatality studies we also categorized each case according to the coding system used by Haynes et al (2008) in their study of a century of Australian bushfire fatalities up to 2007.
- Every fatality was coded independently according to that person's individual intent and actions even though there were many cases of multiple fatalities in the same buildings. For example, one household member may have been defending while others sheltered. Children under 12 were assumed to have similar intentions to their parents, but were coded independently for actions. In practice this made no difference as they were always with a parent at time of death.
- The initial 40 cases were read and coded independently by two researchers. Differences and ambiguities were discussed and resolved case by case, and the coding scheme adjusted accordingly. All questions arising during coding of the 172 cases were discussed before final decisions were made. Nevertheless, other researchers might reach different conclusions on individual cases.
- Damien Killalea participated in the development of the coding scheme and its initial trial. He also critically examined progress periodically.
- Uncertainty is part of any coding scheme. It was managed through ensuring internal consistency, and through the use of multiple codes. Multiple codes means, for example, that someone could be categorized as undertaking both some defence and sheltering.
- Many statements in the summaries are from survivors who were at or near the locations of fatalities. These provide insights into effective survival strategies which are commented on in the report. However, this report is about the 172 fatalities. It does not attempt a comparative analysis of the fatalities with all those affected by the 7th February fires.

The dataset:

A fatalities dataset was provided to the Project Team by the Royal Commission. The Project Team drew only on this dataset in compiling this report. The fatalities dataset was in the form of a summary for each fatality, with extracts from material compiled by the police in the form of statements, telephone records and forensic evidence amongst other police evidence. The 172 fatality summaries were provided in tabular form under headings including: “Evidence as to fire fighting efforts”, “Evidence as to sheltering/trying to escape”, “State of property before/after fire”, “Description of fire”, and details of victims.

Coding:

The fatalities dataset from the February 7th fires contains unprecedented detail on the circumstances of each death. To take advantage of the very detailed dataset an approach was needed that would handle multiple factors, and provide ways of categorizing the reality that many people did not simply commit to and undertake a single course of action.

Typically coding classifications use an “exclusive” approach in which the actions of the individuals (in this study individual fatalities) concerned are put into a single or exclusive category. The coder has to choose between categories even when the individual has undertaken more than one distinct activity and the case does not sit comfortably in any one of the defined categories. The advantages of this approach are that coding can be fairly straightforward with clear criteria for inclusion in each category, the results are easy to display and understand, and it can also act against a tendency by coders to place cases in middle categories thereby avoiding clear decisions. A disadvantage is that cases may be forced into categories that do not suit them simply because that is all the coding scheme allows, potentially providing a false sense of certainty and obscuring the complexity of people’s actions.

Another approach is to use “non-exclusive” coding categories which allows a case to be classified in multiple categories for the one question if appropriate. For example, for a question on ‘actions taken’, the individual may have intended to leave, but ended up defending while other family members sheltered in the house, before they all sheltered on a nearby oval. To capture the actions of this individual, multiple coding is required, and that is the approach developed for this study

Each fatality is coded using two coding schemes:

- a new coding scheme developed to utilize the detail contained in the February 7th 2009 data, and with more direct questions about people’s actions. This coding system enables us to use multiple classifications for each fatality if appropriate, thereby making use of the very detailed information available for each fatality. The level of detailed information sets this data apart from earlier fire fatality work, and it is desirable in the interests of accurate results to ensure that the detail is incorporated where practical.
- the pre-existing coding scheme employed in the study of all Australian bushfire fatalities by the Bushfire CRC and Risk Frontiers (Haynes et al. 2008). This was based on the coding scheme devised by Krusel and Petris (1999) for their re-analysis of Victorian Ash Wednesday fatalities using coronial reports. The scheme includes a seven point

classification of intention and decisions and a detailed set of categories for actions. We use all the categories for intentions and three of the action categories: “shelter”, “defend and leave” plus “other”.

The details of the coding scheme were developed at a two day meeting of the Project Team held in January 2010. After this further coding details were developed. The project’s two researchers then examined and independently coded forty cases. These were compared and discussed to resolve differences in approach and the coding forms were modified accordingly. For all other cases any queries or uncertainties were discussed before being resolved. The two researchers have both examined most cases, while Damien Killalea as the independent advisor has examined a selection of cases.

Results are presented for both coding schemes, and considered in terms of whether and how they differed from current understanding of bushfire fatalities.

2.1. Uncertainty

In any analysis there are various sources of uncertainty: there is uncertainty in the data, in the analysis of the data and in the interpretation of the analysis.

In any fatalities dataset there is a significant degree of uncertainty. However, the dataset provided by the Royal Commission contains unprecedented detail on the circumstances surrounding each fatality, given the level of access to telephone records, SMS message records, forensic evidence and police statements amongst other data. Nevertheless, the amount of detail available varies by fatality and as the summaries were drawn from more detailed material additional evidence may be available that we are unaware of. As a result, uncertainty exists in the classification of people’s level of knowledge and awareness, and at the boundaries between defence and sheltering.

Generally, in this classification system, we are confident when categorizing a fatality as satisfying some condition such as receiving a warning because this is usually reasonably clear – and often explicit - in the data.

Uncertainty arises where there was not sufficient evidence to categorise fatalities under a particular condition such as ‘sheltering’. Where there is insufficient evidence to fulfill the condition, the dataset shows a zero. This does not necessarily mean this condition was not fulfilled, but rather demonstrates a lack of available evidence to fulfill the condition. Where data were sufficient and the research questions demanded, a more in-depth system than presence/absence of data was utilised in classifying the fatality data. This is the case for the preparedness and intent classifications as explained below.

There are two further cases where there is explicit uncertainty in the data classification. The first is in the case where a fatality has been classified as sheltering inside a house. On some occasions, the intensity of the fire was such that no bodily remains were available for forensic or police inspection. In these cases, fatalities have been classified as sheltering in the house;

although a proportion of these cases may have been sheltering in the bathroom specifically. It is unlikely that these fatalities would have been outside at the time of death, for fuel load and other circumstances outside the house would be unlikely to achieve temperatures required for complete incineration – house fires generally being more intense than bushfires. The other situation is where there is questionable evidence of firefighting prior to death, but not sufficient evidence to classify fatalities as actively defending. For example, forensic evidence may indicate that some of the ground around the property had been wet, which may indicate wetting down prior to the fire, although it could also indicate something like general garden watering, or water tank failure. In other cases where properties were well prepared, there is evidence that a pump failed or the roof blew off prior to the fire front arriving. In these such cases where no other evidence is available to indicate what, if any, firefighting took place, fatalities are classified as having undertaken ‘some or questionable defence’.

3. Review of the bushfire fatality literature

The idea of staying and defending property has a very long history especially in rural Australia. There is also a history of research into safety, people and houses (e.g. Barrow 1945), although there have been few formal investigations into how people died in bushfires, and little has been published in the peer reviewed scientific literature. Handmer and Tibbits (2005) reviewed the history of the “Stay or go” approach and the underlying evidence, and Haynes et al (2008) undertook an analysis of a dataset of all bushfire fatalities over the last century up to the 2007/08 season. This was done with respect to the “Stay or go” policy. The major findings and studies are set out below.

An investigation into Australia’s first major post-war urban interface fire, the 1967 Hobart fire which resulted in 62 deaths and the loss of 1300 homes, highlighted some of the issues with staying and late evacuation. “Most of the people who died in their homes... were either very old and infirm or ... [had some] physical disability. In the case of about half of the people who died whilst escaping from their homes such home did not catch fire.” (McArthur and Cheney, 1967).

More systematic research after the Ash Wednesday fires in 1983 established a clear evidence base for “Stay or go”. The Victorian “Bushfire Review Committee” identified a number of issues relating to evacuation and community safety. These included timely and accurate warnings, transport problems and evacuation routes (Miller et al. 1984: 27). As a result of the problems arising from late evacuation Miller et al recommended that unless carried out early, evacuation should be seen as a last resort, and that the capacity of people “to defend their own lives, homes and farms” be supported (Miller et al. 1984: 137). Research into the fires by Wilson and Ferguson (1984) and Lazarus and Elley (1984) also stressed the danger of last minute evacuations. In terms of houses, Wilson and Ferguson documented a 90 percent survival rate for houses that were actively defended by able-bodied occupants, although they also highlight the connection between house survival and fire intensity. A re-analysis of the Ash Wednesday data by Petris and Krusel (1992) confirmed the earlier work in terms of the safety value of active defence and dangers of leaving at the last minute. Research by Ramsey et al (1996) of CSIRO concludes that actively defended house are ten times more likely to survive than undefended ones. More recent pre-2009 work has shown that a key factor in house survival

is the presence of able-bodied individuals who know what to do (Blanchi and Leonard (2008). Protecting the house also protects the occupants so this approach was seen to protect lives. It was found that people who survived in their homes generally knew what to do, had made preparations and, most importantly, had an adequate water supply.

To examine the fatalities from all Australian bushfires, Haynes et al (2008) verified and analysed a database of all Australian bushfire fatalities over the past century. The database was originally compiled by Risk Frontiers at Macquarie University and contains details of 566 non-firefighter fatalities. The circumstances surrounding 327 of the deaths shows 18 percent were inside a defensible property and 78 percent were outside (4 percent died in an unknown location). Of particular note is the proportion, 32%, who died while attempting to evacuate. Haynes et al found only 1 fatality of someone who was actively defending. Most were either sheltering or engaged in limited defence.

In addition to substantiating the evidence for the policy, Haynes found that the majority of fire deaths are among men. However, the number of women dying in fires has increased over the past 30 years. For example, during the 2006 Eyre Peninsula fires, eight of the nine people killed, including four children and three adult females, died in or near their cars after attempting to flee (Deputy State Coroner, 2005).

Essentially the report by Haynes et al supports “Stay or go”. A variety of post fire enquiries have also supported the approach: The Hobart fire of 1967 (Chambers and Brettingham-Moore, 1967); Ash Wednesday 1983 (Miller et al., 1984); a report by the Auditor General of Victoria in 2002; Canberra 2003 (McLeod, 2003); a report into the fires of 2003 (Parliament of the Commonwealth of Australia, 2003, p.269); and a report following the Victorian Alpine fires of 2003 (OESC 2005).

However, as documented in Handmer and Tibbits (2005) and Tibbits et al (2008) this position sits on a number of assumptions about fire behaviour based on historical experience: namely, that there is a single fire front which passes in 20 minutes or so, houses burn down from embers which ignite small fires which vigilant people can extinguish, and an implicit assumption that wind associated with the fire will not undermine efforts at house defence. Houses were small and uncomplicated by today’s standards – as made clear by Lazarus and Elley (1984), who conclude that for staying, a house needs to meet certain criteria for bushfire resistance (e.g. constructed of non-flammable materials, single storey, not too many windows etc), a good water supply and good communication channels for receiving warnings (quoted in Handmer and Tibbits 2005). The Dandenong Ranges fires of 1997 appear to be the only fire event with consequences to directly draw into question the ‘safe to stay’ doctrine. These fires resulted in the loss of 3 lives, all persons having died while sheltering in an underhouse garage that they believed to be fire-proof.

Part 2

Results and analysis

The overarching research question guiding this report concerns the implications of the fatality dataset for the “Stay or go” policy. This is considered below after examining a number of more specific questions from the Project Brief concerning community safety, intentions, actions and communication. This section should be read with the earlier discussions on “Methodology” and “Uncertainty” in mind.

Each section starts with a summary statement. This is followed by a detailed discussion which includes the definitions of key terms. Sections conclude with a table of relevant percentages. Note that all percentages are of the total 172 fatalities, unless stated explicitly otherwise. Inconsistencies of one or two percent are due to rounding errors. This is a Victorian study and references to good or recommended practice refer to the CFA (Country Fire Authority). Material on fire severity is drawn from the August 2009 Interim Report of the Royal Commission, and from the data provided on each fatality.

Vulnerabilities

“Were those who died affected by identifiable vulnerabilities, for example health or other conditions that would likely affect their physical or mental capacity?”

Forty four percent (44%) of the 172 cases fell into one or more of the following categories: presence of a chronic disability; presence of an acute disability; aged 70 or over; or under 12. These represent vulnerabilities that could impact on people’s capacity to actively defend property and to survive a fire; through, for example, challenges with mobility, stamina, knowledge or decision-making capacity under intense stress. This is not to say that an identified vulnerability was a key factor in a fatality, but rather to identify vulnerabilities and to raise the possibility that they would have been a factor in at least some of the 172 fatalities.

About a quarter (24%) of all fatalities had chronic clinical health conditions that definitely or probably affected their mobility, judgment or stamina – the figure for Victoria is approximately 20% but this figure does not include those recovering from surgery (ABS 2004 (cat. no. 4446.0) study on Disability, Aging and Carers). There was only one reported case of someone being deaf and none of blindness, but mobility constraints would have prevented some from assessing environmental cues. A much smaller proportion (5%) of fatalities was affected by acute disabling physical or mental conditions occurring on February 7. This includes evidence of cases where fatalities were exhausted from carrying out last minute preparations in the extreme heat, and where there is evidence of the consumption of alcohol from statements in the summaries. The proportion of fatalities with an acute or chronic disability is probably under-estimated as the provision of medical evidence was not comprehensive across all cases. It also seems very likely

given both the unprecedented heat and the fact that it was Saturday afternoon, that there would have been more people exhausted by heat and more people consuming alcohol.

Sixteen percent of fatalities were people aged 70 or more, and nine percent were children, defined as being under 12.

Defining young and old:

The risk analysis literature demonstrates how older people and younger children are both less physically able, and less able in forming decision making strategies. We define older persons as those aged 70 or over, and children as those aged under 12. Both these definitions are consistent with those used in the previous major study of bushfire fatalities by Haynes et al. (2008). There is some independent evidence for the under 12 years old category as this is the minimum age that airlines will allow independent (i.e. non-guardian accompanied) travellers. Notwithstanding, any reported independent fire related activity by those under 12 has been captured in this report.

Considerable risk related evidence on the performance of older people exists in the traffic accident literature. The road safety of elderly road users is to a large extent determined by two factors: functional limitations and physical vulnerability. The fatality rate per driver is reasonably level from the mid 20s to the late 60s, then climbs sharply. Global data show that for older drivers fatal accidents are rarely the result of illegal action unlike their teenage counterparts. Instead, Dutch research highlights the role of judgement and rapid information processing. It shows that the most common fatal crash type for older drivers involves turning across traffic – a manoeuvre that involves a range of judgements and rapid decision-making that older drivers may find difficult. Similarly, the fatality rate per crash is fairly level until 60 and for drivers 70-74 is twice the rate as for drivers under 60 highlighting increased physical vulnerability (Volpe National Transportation Systems Center, US-RITA (US Research and Innovation Technology Administration)). In a bushfire situation older people are not simply at a disadvantage because of physical vulnerability and the demands on their decision-making, they are also likely to be especially adversely affected by the extreme heat. Older people (75+) consistently comprise the vast majority of fatalities in heatwaves. The body's physiological ability to deal with heat declines with age (eg Worfolk 2000).

Vulnerabilities

24% of all cases had a chronic disability
 5% of all cases had an acute disability
 16% of all cases were aged 70 or over
 9% of all cases were aged under 12

The above results do not sum to 44% as some cases code in more than one category as follows:

2% of all cases had both a chronic **and** an acute disability
 9% of all cases had both a chronic disability **and** were aged 70 or over

Details of disabilities:

The categorization presented here is approximate and should be taken as indicative only. Some cases had multiple conditions. Here they are categorised with one condition. Chronic conditions include severe mobility restrictions which include those who are wheelchair bound, suffering from degenerative conditions, obese, results of injuries, or recovering from medical procedures. Other strength and stamina related conditions include fibromyalgia. Mental conditions include depression, anxiety, the results of accidents, and PTSD (post-traumatic stress disorder). The “acute” category may understate the situation as only 8 cases were found including those who were consuming alcohol or who stated that they were very tired.

Details of disabilities:

Chronic:	
<i>Severe mobility issues:</i>	7%
<i>Heart/circulatory conditions:</i>	7%
<i>Mental conditions:</i>	5%
<i>Other (strength & stamina related conditions & diabetes):</i>	5%
Acute:	5%

Preparedness

“What was the level of preparation of those who died?”

The level of property and personal preparation was assessed against a number of criteria according to whether people intended to leave or stay as explained below. Appropriate activity before 1.30pm on Saturday February 7 (when the Hume Highway was closed by out of control fire – see below) was counted as “preparation”. Activity after 1.30pm was defined as “response” rather than preparation. Based on this approach, a majority (58%) of people had made no prior preparations to either stay and defend, or to leave early. In terms of stay and defend, fourteen percent had made some preparations and twenty percent were well prepared. Almost none of the fatalities were well prepared to leave early, but given that many of those who were well prepared to leave early would have left well before the fire threatened their homes, this result is expected. It is also possible that some people who were prepared to leave were waiting for a warning.

Preparedness requires some awareness of the risk and knowledge of what to do. However, about a quarter of the cases did not have a general awareness that they were in a bushfire risk area, while 39% lacked knowledge on what to do.

Thirty percent were taken by surprise undermining the utility of plans and preparedness.

Awareness and knowledge:

To be classified as ‘aware’, evidence of fatalities discussing the general risk of bushfire (ie they knew they were in an area at risk from bushfires) was required. Around a quarter of fatalities (24%) did not have even this very general awareness of bushfire risk. To fulfil the “knowledge” criterion, evidence of knowledge of some actions that can be taken to mitigate fire risk was required (such as patrolling against ember attack, or evacuating before directly threatened by fire in a vehicle with some water and a blanket). A large minority (38%) did not appear to have ‘knowledge’ under this classification.

In some cases, a lack of awareness may have been because fatalities were unfamiliar with the area. For example, some fatalities were house-sitting, and others were on holiday.

Preparation-timing:

To be classified as ‘prior preparation’ action had to be undertaken before 1.30pm on February 7, as by this time, the Kilmore fire had closed the Hume Highway and had jumped containment lines. Sound practice is that fire preparedness should be in place before the day of the fire, but using the 1.30pm cut-off allows leeway in recognising preparations on the day as having some value. Activity after this time is considered “response” rather than preparedness. Note that moving the 1.30 cutoff time to mid afternoon makes little difference to the overall assessment of preparedness .

Levels of preparedness:

In defining preparedness levels we draw on advice **provided by CFA before 2009** as set out in their guide *Living in the bush*. As a result the preparedness levels are measured against expected severe fires, but not necessarily against the extreme conditions experienced by many on 7 February 09. We also looked for evidence of contingency planning, but did not include this in the coding.

To be considered “well prepared” to stay and defend, evidence of fuel management around the property (preparation of defensible space), appropriate fire-fighting gear and clothing, and an independent water supply were needed. As a minimum, fire-fighting gear had to comprise buckets and mops. The minimum standard for an independent water supply was a supply by one or more of a dam, tank, pool or creek. If properties did not have a gravity fed water supply, evidence of a connected diesel or petrol pump, or an electric pump connected to a generator, was required.

Using these conditions, 20% of fatalities were “well prepared” to stay and defend. Note that being “well prepared” refers to the standards before February 2009.

To be classified as having “some preparedness”, actions required were less demanding than those of the well prepared category. Evidence was required of a small independent water supply, appropriate clothing, appropriate fire-fighting gear and some fuel management. As a minimum, the water supply had to consist of a network of troughs or buckets around the property; and buckets and mops formed the minimum standard for fire-fighting gear.

Using these conditions, 14% of fatalities had made some preparations to stay and defend.

To be considered well prepared for evacuation, evidence of a clearly defined destination and trigger to leave were required. Less than 1% were well prepared under these criteria.) Whereas 5% of fatalities had made just some preparations (i.e. had a vague idea of a destination and trigger) to evacuate. As mentioned above this is expected given that those who left early are unlikely to be represented in the fatalities.

A majority (58%) of people had made no preparations before 1.30pm on February 7th to either stay and defend, or leave early.

Some fatalities were very difficult to contact by family or friends on the day or were in denial about the threat.

A few people lived either out of range of any communications media such as ABC Radio or warning sirens, or had no communication capacity. In several cases, those who died specifically mentioned ‘getting away from it all’ over the weekend in the days preceding the 7th February. This was in spite of concerns from friends or relatives about the fire risk in some of these cases.

A few fatalities were in denial of the fire threat to the last, purposefully ignoring – and in some cases mocking – the advice of friends, relatives or agencies. These people had made a conscious decision to take no action. This number is likely to be slightly higher, as evidence elsewhere in the dataset suggests a number of fatalities had taken this approach until the fire was upon them, when they then attempted to evacuate or shelter, so are classified elsewhere.

Fire plans:

The recommended basis of sound preparedness is the development of a fire plan. The Project Brief asks whether “*those who died [were] following “good practice” such as having fire plans?*” Evidence of the existence of a fire plan generally came from the statements of friends or family. In addition, some evidence of a fire plan’s specifics was required - who would undertake which activities and what these activities would be, or similar. Statements acknowledging the existence of a fire plan but with no evidence of what that plan was were not considered sufficient. Even so, this classification is a fairly low bar in terms of fire plan suitability or usefulness.

Using this coding classification, 47% of fatalities had a fire plan. Using our coding more people had plans than were prepared. There are a number of possible reasons for this difference: plans are often statements of intent, what people thought, while preparedness was what they actually did,

Simply appearing to have a fire plan did not appear to be related to better decision making or having contingency plans for use when the preferred course of action failed. A number of fire plans were not discussed among household members, it being assumed that when the time came roles would be allocated. In other cases visitors were unaware of the fire plans.

Fireplans*

22% of all cases had a fire plan **and** intended to 'Stay & Defend'
 9% of all cases had a fire plan **and** intended to leave
 6% of all cases had a fire plan **and** intended to stay and shelter
 10% of all cases had a discernable fire plan **and** their intent was to 'Wait & See'

* Note that 12% had no fire plan (that met the criteria), but still intended to 'Stay & Defend'

Activating plans or preparations:

No matter how thorough preparedness and fire plans, when a fire threatens they need to be activated. This requires some sort of trigger, which may be a specific warning, a high level of perceived threat or something else. It appears that many people did not fully activate their intended actions, fire plans or preparedness. It is noted that just 9% of fatalities appeared to have received a warning about the fire directly from an official source. For this purpose, a warning is a message from an official source (an official) directly to the fatality's household. However, nearly all were warned by neighbours, friends or relatives – and there had been extensive media coverage of the risk over the preceding few days.

It is clear that at least a significant minority (30%) were taken by surprise either by a threatening fire's existence, or by the fire arriving much sooner than expected. This is particularly the case for the fatalities that occurred following the late wind change and sudden arrival of the fire from an unexpected direction. There is compelling evidence that some fatalities did not know of the fire until it was too close to take effective action - despite having made fire plans and having been classified in the analysis as 'well prepared'. This may have been because people were avoiding the extreme heat of February 7th inside air-conditioned houses so may not have seen or heard environmental cues of an approaching fire. Even if people were monitoring the fire threat on the TV or radio as the day progressed, a lack of up-to-date information through these media would have hampered people's knowledge of the approaching fire. There are however cases where people had not activated their fire plans in good time despite being aware of a fire risk.

Although some fatalities had made considerable prior preparations and were classified as 'well prepared', this does not mean that their fire-fighting plans did not have serious weaknesses. For example, there is evidence that at least some part of many fire-fighting water delivery systems travelled through a length of unburied plastic pipe, or through standard garden hoses. Other fire-fighting systems were compromised by unprotected pumps, pumps that were not working properly, pumps on wooden platforms that caught fire, or water supplies that were very low. It may be that in many cases, one 'weak link' in a fire-fighting system let down an otherwise solid approach.

There is evidence that many people overestimated their level of preparation. In addition to the "weak link" issues mentioned above, many people undertook preparations or only activated their plans in the hours, or minutes, before they thought a fire would hit (classified here as "response" rather than "preparation"). Last minute preparations not only resulted in partial readiness, but also meant that individuals were unlikely to have clearly thought through their fire plans; and in addition may have been debilitated even before commencing fire-fighting, considering the extreme heat on the day.

There is also the possibility that many properties were not defensible as explained in a section “building defendability” below.

Preparedness

58% of all cases had made no prior preparations
 53% of all cases had no fire plan
 30% of all cases were taken by surprise
 24% of all cases had no awareness they were at risk of bushfire
 38% of all cases had no knowledge of fire risk mitigation strategies

Prepare to stay:

20% of all cases were well prepared to stay & defend
 14% of all cases had made some preparations to stay & defend

Prepare to leave:

<1% of all cases were well prepared to leave
 5% of all cases had made some preparations to leave

Intentions and actions

“What role did the intention to stay and defend play in fatal outcomes?”

The intention to stay played a significant role in fatalities. But this should be interpreted in the context of the following factors: the very few who actively defended their properties; the large proportion who had no clear intention and simply “waited”; the proportion who were surprised by the fire; and the large proportion who sheltered either by intent, as a default option, or when their preferred action ceased to be viable - as set out in the next section. There are other important factors to consider: a feature of the data is that many neighbours either successfully defended their homes or survived through the strategy of leaving the house once it was fully on fire, and once outside avoiding radiant heat. In some cases some household members survived while others died, in a very few cases those who dies had left houses that did not burn down, and there were many cases where cars or outbuildings survived while their owners died nearby.

Evidence suggests that 34% of fatalities intended to stay and defend their properties, a further 26% intended to wait and see before committing to a course of action which may, or may not, have been to defend their properties. In a further 15% of fatalities, there was no evidence of any intentions; and eight percent of fatalities intended to stay at their property but to seek shelter

rather than actively defend. Sixteen percent of fatalities had intentions to leave, and 1% had made a conscious decision to do nothing (i.e. to deny the fire risk).

There is evidence of disagreements as the fire approached. In virtually all cases this was between women who wanted to leave and take the men with them and men who either wanted to stay and defend or who felt they had to support others in that role. In some cases it appears that the difference in opinion was long standing, in other cases it was only acknowledged at the last minute. This led to some people changing their plans at the last minute. This appears particularly the case for couples. There are instances where women who fled under these circumstances survived. Conversely, there is also evidence of such disagreements where males refused to leave, but relatives decided to stay, leading to additional fatalities – assuming that they would have survived leaving.

Deciding to stay and defend against a bushfire is a serious undertaking. The evidence shows that many fatalities did not actively defend or were not prepared well enough for the task. In particular, evidence of large numbers of people sheltering (see section below for percentages) - particularly in bathrooms - suggests misunderstanding over the role of active defence requiring measured activity both outside, and inside the property as the fire front passes over.

Intentions

34% of all cases intended to stay & defend
 26% of all cases intended to wait and see
 15% of all cases had no discernable intentions
 8% of all cases intended to stay & shelter
 16% of all cases intended to leave
 1% of all cases intended to do nothing

Intentions and preparedness

13% of all cases intended to stay & defend **and** were well prepared to stay & defend
 9% of all cases intended to stay & defend **and** had made some preparations to stay & defend
 11% of all cases intended to stay & defend **and** had made no prior preparations

Surprise

30% of all cases were taken by surprise by the arrival of fire

Note cases do not add to 100% as multiple coding categories are used for this table. Inconsistencies in sub-totals are due to rounding errors.

“What were people doing in the lead up to their deaths?”

There is evidence of four main activities being carried out in the lead up to the fatalities. Preparatory activities (many of which we have classified as “response rather than preparation if they occurred after 1.30pm on February 7th, as explained above under “Preparedness”), “waiting to see” how the situation evolved, fire fighting or active property defence, and sheltering.

The data provides evidence from phone calls with friends and relatives, as well as text messages and statements from fire survivors, that one of the main activities was that of preparing for the

approaching fire. These records indicate that activities such as watering down, filling roof gutters with water, clearing debris from around the house, sorting out fire pumps, changing into appropriate clothing or packing cars for leaving were fairly common. Many of these activities were taking place at the last minute, even as the fire reached the properties concerned.

Evidence set out in the summaries, particularly from the forensic teams, but also from police statements, reveals that 30% of fatalities showed some evidence of fire fighting defence in the lead up to their deaths (5% active defence, 25% some or questionable defence). This ranged in the seriousness of the operation from evidence of the use of a perhaps superficial small independent water supply to evidence of the use of large water supply or working sprinkler systems.

There is also evidence from the coding of 'intentions' that many of the fatalities were 'waiting and seeing' before deciding what to do. From the evidence, it appears at least 26% of fatalities fall into this category, waiting for a trigger - although it is rarely clear what this trigger might be - before making a decision and taking action. This delay meant that their options became very limited.

A majority of fatalities were sheltering and not undertaking defensive action at the time of, and possibly in the lead up to, their deaths. There is evidence that 69% of fatalities were sheltering. Shelter was sought in a variety of locations.

Fourteen percent of fatalities were either fleeing on foot or by car.

A smaller percentage of cases were carrying out other activities besides sheltering, active defence or fleeing prior to their deaths. These activities were dealing with livestock (1.2%), moving between fire-threatened areas by car but not fleeing (one died at the time and a second person died later in hospital of a heart attack), or were camping or bushwalking (3.5%). While people were generally very concerned about their pets and at least one case had indicated that they would not leave without their animals, we could find no cases where attempts to rescue pets had been a significant factor in a fatality. A few (2-3) fatalities deliberately took no action as the fire approached.

It is clear that at least a significant minority were taken by surprise either by a threatening fire's existence, or at least by the fire's speed and extent. Being 'taken by surprise' is here defined as finding out of the existence of a threatening fire with less than an hour before the fatality's death (as determined by phone call data, electricity supply failure, or subsequent knowledge of the fire's spread and behaviour). There is evidence that at least 30% of cases were taken by surprise by the fire under this definition. It is likely that a significantly larger proportion was surprised by the fire's intensity, rate of spread and the length of time taken for the front to pass.

The statements provide some evidence that a number of people attempted to call triple-zero in the lead up to their deaths or that others called on their behalf, and that virtually none of the calls appeared successful in terms of reaching an operator and obtaining assistance. The material in the summaries is uneven on this question, so quantifiable statements about how many fatalities called, and were successful in reaching, triple-zero are not possible from this dataset.

“If people died fleeing are there any indications as to why?”

Fourteen percent of fatalities were fleeing at the time of death, either by vehicle (4%) or by foot (10%). It should be noted that a number of those on foot were originally attempting to flee by vehicle, but had abandoned the vehicle. Forensic and witness evidence suggests that in some cases this may have been as the vehicle caught fire – and it appears that utes were more prone to catching fire than conventional cars probably because of ember attack igniting material in their trays. Forensic evidence suggests few of the fatalities were incapacitated by vehicle accidents prior to fire arrival. Based on statements in the relevant summaries, drinking alcohol may have been a contributing factor to a vehicular accident in at least two fatalities.

People generally survived in conventional cars, in apparent contrast to past fires. There could be a number of reasons for this difference. Modern cars survive accidents better, protecting occupants and allowing them to escape rather than trapping them. Some people did not use their cars to flee but for shelter, sometimes moving the car around to avoid major fire brands and radiant heat. Also, the near universal use of air conditioning in vehicles means that people could potentially keep the inside of their cars below lethal temperature and sit out the fires, so long as they were in a very low fuel load area or where the fire was low intensity for some other reason. This information comes from the summaries provided by the Commission which contained statements from those who survived at or near the same locations as some who perished.

Where fatalities were fleeing on foot (or abandoned their cars to flee on foot), a contributing factor in their deaths appears to have been a lack of appropriate clothing. The ground, either covered with fumes or still very hot, melted soles of the less sturdy shoes on some fatalities. It was the hottest day on record and fatalities were often in shorts and tee-shirts rather than long sleeved tops and trousers; some children were wearing little more than bathing costumes which left them exposed to maximum radiant heat.

“What proportion was sheltering?”

Cases were coded as sheltering when they satisfied one or more of the following criteria. “Sheltering” refers to passive sheltering as opposed to active defence.

1. where sheltering was part of a plan, where people were told to shelter by others, where people stated that they intended to shelter or might shelter – and were found in positions consistent with these intentions;
2. where people had no clear intentions, or were waiting and seeing - and were found in positions consistent with sheltering,
3. where people were in denial about the threat - and were found in positions consistent with sheltering;
4. where people intended to defend but appeared not to have activated their plans;
6. where on reading and considering all the material in the summaries it is most likely that people were sheltering.

Using this scheme, over two thirds (69%) of the fatalities were sheltering at the time they died, although they may have been undertaking a range of activities in the period leading up to sheltering. This includes a large proportion in bathrooms, a small proportion in bunkers and underhouse shelters, and a few elsewhere.

Forensic evidence for a number of cases notes co-mingling of remains, where it appears people were huddled together prior to their deaths. Other evidence for sheltering, rather than active defence, is that few fatalities were found near evidence of the means of firefighting such as bucket handles, or holding hoses. Positions of bodies, such as bodies found in a lying position, or in the bath, suggest passive sheltering rather than active defence.

There was considerable evidence of sheltering in bathrooms as that was the location of 27% of the fatalities. Police statements record the fatalities being advised to shelter in the bathroom by friends, family and some officials. In some cases, this was a last-minute decision as the fire encroached, but in others, it appeared to form part of their intentions and in a few cases of a fire plan.

A number of fatalities (8%) were found sheltering outside. Shelters included sheds, outhouses, spas, bunkers and under-house shelters. Even though some shelters did not burn, people were overcome by toxic gases. People also took shelter in locations that would almost certainly burn, such as in spas situated on wooden decking.

From the statements in the summaries it is clear that many people survived by sheltering in cars. However, this was not generally passive sheltering, as it appears that alertness was important: in keeping the car and air-conditioning running, in moving the car to a very low fuel area, and in moving the car if fire threatened.

It is important to note that the categories of “defending” and “sheltering” are not “either/or” under our coding scheme. Where it is uncertain whether people were passively sheltering or were undertaking active defence against ember attack, the case is coded under both ‘sheltering’ and ‘questionable/some defence’. A proportion (19%) of all fatalities were sheltering but had perhaps undertaken some defence. However, the evidence for defence is often unclear, and defensive actions often appeared to be minimal. Of these 19%, 7% were found sheltering generally in the house, 3% were found in an outhouse, shed, spa or bunker, and 8% were in a bathroom (or other small room with one exit, and hence limited means of escape in the event of entrapment).

Sheltering

69% of all cases were sheltering

34% of all cases were sheltering in the house generally (or exact location could not be determined)

27% of all cases were sheltering in the bathroom

8% of all cases were sheltering outside the main building in a shed, spa, bunker or outhouse

“What proportion was defending their properties?”

Using the definitions below, it appears that 5% of the total number of fatalities were carrying out active defence at the time of their deaths. A further 25% were classified as carrying out some or questionable defence. People were classified as ‘actively defending’ if they had equipment necessary to defend, if they had been actively organising it before the fire and it was in working order, and there was evidence of actions being undertaken to defend property at the time of death. The summaries were also examined for forensic evidence stating that active defence of the property was likely. For example, evidence for a case of ‘active defence’ could be found in police statements about preparation and equipment checks, and forensic evidence of water taps in the ‘on’ position, feeding to a pump and connected to a hose, near to where remains were located. The coding scheme also allowed for cases of ‘questionable or some defence’, where it was not obvious that active defence was being undertaken at the time of death but some fire-fighting activity appeared to have been undertaken; such as in cases where equipment failed as the fire-front arrived and people appeared to have retreated to shelter, or where fatalities were found to have been sheltering but next to firefighting gear such as hoses or buckets.

It appears that 5% of the total number of fatalities were “well prepared” under the definition given earlier, and were carrying out active defence at the time of their deaths. A further 25% were probably carrying out some form of defence.

There are a number of issues with interpreting active defence and passive sheltering. Often some household members defended while others sheltered. It seemed to be understood in many cases that there would be a period of defence and then if things deteriorated people would shelter. Sometimes this shelter was to be in a bunker type location under or near the house. Some of these shelters showed no sign of fire damage but the occupants died from toxic gases.

Staying and defending*

5% of all cases were undertaking active defence

25% of all cases had been undertaking some/questionable defence

5% of all cases were well prepared to stay & defend **and** were undertaking active defence

9% were well prepared to stay & defend **and** had undertaken some/questionable defence

6% were well prepared **and** there was no evidence of defence

8% had made no prior preparations **and** were undertaking some/questionable defence

*note that this does not sum to 100% as fatalities may have been sheltering or fleeing rather than defending

Building defendability:

“Were there any common systemic issues, such as the defendability of the house due to its location, that could be addressed for future events?”

This coding scheme contained a class where “questions were raised about the defendability” of the property concerned. For example, some properties, such as small well maintained houses on flat areas surrounded by grass, gravel or non-native plantings are more defendable than large, rambling or multi-building structures or those on steep slopes with dense native vegetation close by. This is not to say that the first type of house is always defendable, nor that the second type is undefendable. Properties are coded as being of questionable defendability either because the police material contains specific statements questioning property defendability; or because the statements indicate heavy fuel loads very close to the house, and the property is situated on a slope of greater than 10°, and/or the property is very complex in its structure.

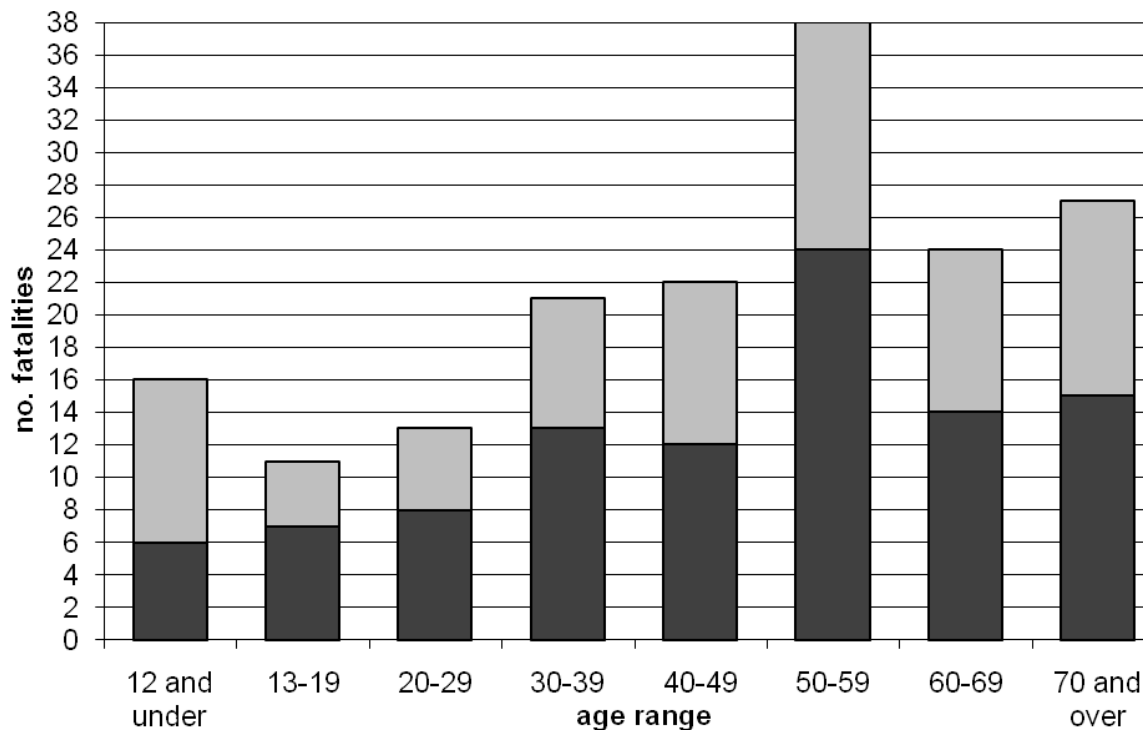
Using this classification, questions were raised over defendability of the buildings occupied by almost a third (32%) of the fatalities. A number (8%) of fatalities occurred with properties that were classified as well prepared, but had questions raised over defendability; 5% were classified as having had some preparedness but had questions over defendability.

**“What were the demographics of those who died
and how does this compare to previous historical fires?”**

Fatalities are grouped by age and gender and then compared with the patterns from earlier fires and with the demographics of the fire affected area.

Fatality age data has been grouped to reflect the decisions taken (as described earlier) for classifying separately those aged under 12, or 70 and over. Other age groups are classified in ranges of ten years. There is a fairly even spread of fatalities across all age ranges, from those aged twelve and under to those aged seventy and over. A notable exception to this is the spike in fatalities in those aged 50-59. There were fewer fatalities in the age groups under 30. In all age ranges except those aged twelve and under, there were more male than female deaths. This is particularly the case for males in their fifties, where there were 24 male to 14 female fatalities. The overall gender breakdown is generally similar to previous fires where male deaths outnumber female fatalities (see bar chart below). In this bushfire event, 58% of the deaths were male and 42% female.

There do not appear to have been any cases where understanding warnings broadcast in English was an issue.



Stacked bar chart showing fatalities in the 'Black Saturday' bushfires. Fatalities are grouped by age group and gender, with dark gray representing male and light grey representing female deaths.

Table of 2009 non-fire-fighter fatalities by age compared with Ash Wednesday(1983), the past 50 years of bushfire fatalities, and the age distribution of the 2009 fire affected area. Expressed as a percentage of the total fatalities for that fire, or for the "Fire affected area" as a percentage of the total population in the area. "N" is the number of fatalities.

AGE Group	"Black Saturday" 7 Feb 2009 (n=172)	Fire affected area, Feb 09. In percent. (S-W Goulburn Statistical District**)	Bushfire fatalities 1956-2007/08.* (n=257)	Ash Wednesday (Vic & SA).* (n=60)
GENDER	Male 58% Female 42%	Male 50.8% Female 49.2%	Male 57% Female 38% Unknown 5%	Male 60% Female 40%
0-11	9	18	8 (0-12)	8 ***

12-19	7	13	6 (12-17)	5
20-29	8	10	10 (18-29)	20
30-39	12	14	12	13
40-49	13	16	9	7
50-59	22	14	13	18
60-69	14	9	16	15
70+	16	8	14	13
Unknown	0	0	11	0

* Haynes et al (2008)

** This statistical district which includes much of the fire affected area north of Melbourne is used as a surrogate for the actual area burnt.

*** No children lost their lives in Victoria. The under 12 deaths are from South Australia.

The comparative Table shows that age distribution of the 7 February 2009 fatalities is very close to that of the historical pattern. This holds whether the comparison is with the 1983 Ash Wednesday fire (in Victoria and South Australia) or the last 50 years of Australian fire fatalities from 1956 to 2007/8. The two comparisons were used in case a major event had a different fatality distribution – a significant difference is that the proportion of people in their 20s who died is much lower on Black Saturday than Ash Wednesday. The percentage of children (under 12 years) and elderly people (70+) is remarkably consistent across fires at about 6-9% and 13-16% respectively. This is surprising as over the last fifty years Australia has a greater proportion of people over 70 and a smaller proportion of children.

When this fire fatality data is compared with the age distribution of the 2009 fire affected area, it highlights two longstanding factors in fire fatalities: far more older people (twice as many) and far fewer children and teenagers (half as many) perished than would be expected from the population figures. The ratio of males to females living in the fire affected area is about even, but 37% more males died than females. The relatively high proportion – although still reasonably consistent with historical data – in the 50-59 category may reflect issues like home ownership and perceived self ability to successfully defend. (Note that the age distribution is from the S-W Goulburn statistical area which includes Kinglake etc. The age pattern is generally similar to that for the Churchill area where the population is slightly older.)

Part 3

Comparisons and implications

How do the results compare with previous understanding of bushfire fatalities?

Previous understanding of Australian bushfire fatalities was based on studies that supported the “Stay or go” approach. A fundamental question is to what extent the analysis of 7 February 09 lines up with this earlier work and subsequent practice. There are also more detailed issues of similarity and difference with the results and assumptions of earlier studies.

There are a number of ways of interpreting our results. One interpretation is that at a general level, our analysis confirms most aspects of the previous understanding of bushfire fatalities, and supports the broad basis of the “Stay or go” approach. To hold this interpretation we need to take into account the fact that in many locations the fire was of exceptional severity, at least 30% of the fatalities were taken by surprise by the fire’s arrival, some 32% occupied dwelling of questionable defendability, and 44% arguably should have been elsewhere. The situation in major historical fires may have been similar, but we do not have the detailed historical evidence. However, there are important differences. Some of these may reflect social and technological changes over the last quarter century including the size and style of houses and gardens, and others highlight the implementation challenges for the approach.

Key similarities are that sheltering without active defence is very dangerous, that active defence and a high level of preparedness and alertness are important, and that fleeing on foot is dangerous. The apparent split in preferred action along gender lines, with men preferring to stay and women wanting to leave, is consistent with some earlier work (Proudley, 2008).

Apparent differences concern cars and movement during the fire. While last minute evacuation in cars is very dangerous, many people survived this course of action, and in contrast to the previous two decades, there was not a single fatality among women and children evacuating in cars in the 7 February 2009 fires. The historical data from Haynes et al (2008) shows that up to 2009 late evacuation was the single largest cause of fatalities. Comments on this are under “Fleeing” above. The summaries provided by the Commission contain statements from those who survived at or near the same locations as some who perished. Based on these statements it appeared that many people who survived without serious injury were active and moved around during the fire for a variety of reasons including leaving their primary shelter when it caught fire, defending buildings and checking on or searching for people and animals. However, some perished outside as well.

A factor rarely commented on in earlier studies is the importance of wind damage. A key or important contributing factor in some fatalities, particularly where properties were well prepared, is from wind damage. It is suspected that this contributed to many window failures, and in some cases appears to have damaged or even blown roofs off prior to the arrival of the fire front. In these cases, no level of preparation is likely to allow the occupants to successfully defend their home, as ember attack and subsequent fires will quickly consume the house. This highlights the need for a contingency plan, should the firefighting effort have to be abandoned.

The high proportion of “vulnerabilities” (primarily chronic medical conditions), the very detailed records showing the wide range of misconceptions about fires and appropriate behaviour, and the range of problems experienced by those caught in the event, suggest that with very fast moving intense fires even good practice in planning and preparedness may not be sufficient. This all draws attention to the challenges facing the successful implementation of community safety policies.

A second interpretation could examine the results from the perspective of those who died. About 30% made some attempt at defending their property – although the level of defence varied greatly. Others who were sheltering were relying on this defence to maintain the structure which was protecting them. Over half the fatalities appeared to believe that by relying on their understanding of staying and defending, they were taking effective action in terms of their safety.

Another interpretation draws on the reality that most fatalities did not, and often could not, respond appropriately to the risk that the bushfires presented for them on 7 February 2009. A large minority may have had difficulties due to mobility, stamina, knowledge or crisis decision making capacities (44%), many people were unclear about or held mistaken beliefs on appropriate action and about the likely fire severity with about 30% being taken by surprise, and fewer than 10% receiving an official warning. In addition, many were in properties of doubtful defendability (32%). Most people sought shelter (69%), and effective defence appears to have been elusive. Rather than emphasizing the importance of preparation, staying and defending, this highlights the key role of timely specific information and clear advice tailored to people’s circumstances, and of safe accessible places for people - including those with very limited mobility - to relocate to. It also suggests implications for policy-makers in the fields of land-use planning, development control and the management of bushfire fuels.

Comparisons based on data and research issues:

The comparison is not simply between fires, it is also between a detailed dataset for the 2009 event compared with more limited earlier datasets. For example, the age of over one third of those in the Risk Frontiers national dataset on bushfire fatalities over the last century is unknown. The detailed forensics for many of the fatalities, numerous statements obtained by the police, detailed phone records and the use of mobile phones by many of the fatalities has resulted in a very detailed picture of what people were doing and why. This detail has not been available before – in particular because of the near universal use of mobile phones and the fact that the mobile network remained operational throughout the fire - and could be expected to change our understanding of bushfire fatalities.

Some earlier studies have assumed that all houses are at least potentially defensible – although the early Wilson and Ferguson (1984) study did not. We have not been in a position to examine this question closely, but have coded those cases where questions were raised about defensibility. Nearly one third of the fatalities occupied houses that are of questionable defensibility. This does not mean that the houses were not defensible: it simply means that it may have been an issue.

A fundamental underpinning principle of Australia's community safety policy is that people protect houses which in turn protect the occupants. The historical evidence is that a major factor in house survival is the presence of people. Up to ninety percent of houses with people survive versus from 10-40 percent without people. We do not have data on how many people stayed and defended their homes and survived – this would be a key set of data for further policy assessment.

Comparison using codes from the Risk Frontiers study (Haynes et al. 2008)

The evidence was also coded according to the scheme developed in the Risk Frontiers study (Haynes et al. 2008). Two meta-categories were considered from the old scheme; decision making at the time of death, and activity at the time of death. The Risk Frontiers scheme which was in turn based on Krusel and Petris (1992), coded exclusively; that is, the coding scheme only allowed one code per fatality for decision making and one for activity at time of death. The scheme developed here by Handmer and O'Neill, in contrast, allowed for fatalities to be coded in multiple categories if the evidence supports such coding.

The 'decision making' codes using the Risk Frontiers coding scheme are broadly consistent with those in the scheme in the February 09 study, although the different nature of the schemes means that they are not directly comparable. Using the wording of the Risk Frontier's codes, of interest are that 30% of fatalities had a fireplan, but carried out ineffective action. A similar percentage (28%) did "not have a plan, or had a plan but panicked" and did not follow it. Nine percent of fatalities coded under the Risk Frontiers scheme realised the risk too late to be able to make effective decisions or undertake effective actions.

More differences are seen in the results of applying the codes derived from the 'activity at time of death' Risk Frontier scheme and the scheme developed for this report. The number of fatalities actively defending at the time of death is 3% under the Risk Frontiers scheme, very close to the 5% coded as actively defending under the Handmer and O'Neill scheme. A larger difference arises when examining 'meagre defence' (Risk Frontiers scheme) and 'questionable or some defence' (Handmer and O'Neill scheme). The percentage of fatalities carrying out meagre defence is 6%, whereas it is 25% for those carrying out 'questionable or some defence'. The Risk Frontiers scheme may underestimate the amount of defence. The Handmer and O'Neill scheme, as mentioned, allows for multiple category coding. As such, it captures more of the uncertainty than the Risk Frontiers scheme allows for. In both the active and meagre defence categories, the Handmer and O'Neill scheme is capturing cases where there is uncertainty (but some evidence) that there may have been some or even active defence. The percentages of passive sheltering and fleeing were similar under both coding schemes.

Applying codes from Haynes et al (2008)

Activity at time of death	% fatalities
Actively defending	3
Meagre defence	6
Sheltering	65
Caught outside	3
Late evacuation	17
Other	5

What are the implications for advice from fire agencies to the community?

General findings and implications are set out in the final section of this report. This penultimate section contains some findings that may have implications for the advice provided by agencies to the community. Both this and the final sections should be read for a full picture.

Fire plans and planning

The threshold for having a fire plan was set at a reasonably low level - the evidence needed was to both mention the plan and some actions associated with that plan. Even with this, many fatalities did not have a fire plan and many of those fire plans that had been made appeared unlikely to meet agency advice about what a fire plan should contain, and were not known by all household members. Plans need to cover properties, and both physical and mental aspects of people's preparedness. It appears that there were serious misconceptions about appropriate behaviour that in some cases were part of fire plans. Fire plans also became inadequate as circumstances changed, for example with house sitters, visitors or relatives staying, or a sudden medical condition.

Fire plans for extreme conditions, if they are to have a high chance of being implemented successfully, cannot have gaps or weak points – yet most preparations had such problems. An important element is a contingency or backup plan. There appear to be few cases of fatalities having a contingency plan for when their preferred course of action ceased to be viable;

Targeted messages

The study found different attitudes and behaviour between males and females. There were also many people with conditions that reduced their ability to defend properties, and to provide for their own safety, successfully. Some were also affected by the heat and a few by alcohol.

There is evidence of last minute disagreements – which were almost always gendered with males wanting to stay and females wanting to leave - about whether to stay or go. This led to people changing their plans at the last minute or failing to commit to an effective course of action in time.

Messages should be directed at the requirements of specific groups.

Limited knowledge of what to do

A large proportion of fatalities were unaware that they were in an area at risk of bushfires, and lacked knowledge, or understanding, about how to mitigate it (or prepare for a bushfire). There were also some consistent misperceptions in particular that it was safe to passively shelter in bathrooms.

Warnings and triggers

A significant proportion of fatalities were taken by surprise by fire. Others appeared to be waiting for an official warning before activating their plans. This indicates that many fatalities had not fully implemented their fire plans - or had only implemented them at the last minute. An early and effective trigger for action should form a key part of the fire plan.

There was an expectation among many that there would be a specific official warning. Nevertheless, almost all were warned by unofficial sources during the day.

Waiting

Many people waited almost until the flames could be seen. People need to understand that fire safety decisions and actions are essential well before fire threatens or reaches them.

Bunkers

The data show that underhouse bunkers can be dangerous places due in part to heat from the house burning above, and also from toxic gases leaking into the bunker. People died as a result of toxic gases in bunkers that were undamaged by fire.

Communication with hard-to-reach community members

At least four fatalities appear to have been somewhat reclusive; with only very occasional communication with family, neighbours or the community. In these cases, the evidence available into the circumstances surrounding the fatality is limited.

For the more reclusive members of the community, the usual community communication channels may be less successful than usual, and more innovative communications may be needed.

From the evidence presented there is no suggestion that language was a barrier to engagement with messages around fire planning.

Key findings and implications

Some key elements of the “Stay or go” approach (also known as a “position” and “policy”) appear to be supported by the analysis of fatalities from 7 February 2009: sheltering passively is dangerous; and alert mobile well prepared people can save themselves and often their properties. However, successful implementation depends on those at risk understanding their personal risk

and limitations, knowing what to do, being well prepared physically and mentally, being alert for sudden changes, being decisive, and having multiple fall-backs or contingency plans. Properties need to be well prepared and defensible, and agencies need to provide timely warnings and information on appropriate action. All this needs to be accomplished without formal training for those at risk.

There are many links in the chain of preparedness, and any one of them breaking can lead to serious consequences. So while the policy may appear sound on paper, implementation presents major challenges.

Alternative interpretations of the results emphasise the need to provide timely specific advice and accessible places for safe sheltering.

- Very few fatalities appear to have had a comprehensive fire plan that addressed all issues necessary to cope with the conditions experienced on the day, let alone contingency plans in the event that some element of their 'survival system' failed.
- Any approach to community safety needs to take account of the significant proportion of people whose options may be limited by chronic physical or psychological medical conditions, post-surgery recovery, disabilities resulting from accidents and issues arising as a result of extreme heat and lifestyle factors.
- There was widespread unawareness of the fire risk, lack of appreciation that February 7th required a different approach due to the extreme conditions, and limited knowledge about what to do. Some were dismissive of the risk;
- There appear to be some fundamental misconceptions about bushfire safety including sheltering in bathrooms – which was a widespread misunderstanding - the need for active patrolling at all times, incorrect beliefs about fire behaviour and the security of buildings and bunkers including underhouse shelters.
- Many people assumed that they would be warned or that they could obtain help by calling triple zero – almost no-one who died received an official warning (a warning direct from an official) or got through to 000. Those whose calls were answered did not receive assistance. This needs to be seen in the context of near universal warnings or advice from friends, neighbours or relatives and the presence of environmental cues.
- Some people survived the fire itself, but were badly injured and subsequently died. There were some delays in the delivery of medical attention as ambulances did not have access to the fire ground. The delays may not have caused the deaths, but raise the issue of timely medical assistance.
- There is no evidence that prior experience of bushfires was an advantage. Those with experience tended to assume that 7 February would be the same as previous 'bad' days. A problem for many was that their last major experience may have been many years ago

or when they were part of a different group of experienced fire fighters. In 2009 they were 26 years older if the experience was Ash Wednesday.

- The age and gender distribution of the fatalities is generally similar to that of historic fires.
- Even apparently high levels of preparedness usually contained weak points, or aspects that mean that the plans were not fully implemented. This was exacerbated by a tendency to wait until it was clear that a fire was close, limiting both time for preparedness and the available options. Some with sound preparedness were taken by surprise or for other reasons delayed activating their plan;
- The defendability of the properties occupied by nearly one third of the fatalities was questioned. This does not mean that all these properties would not have been defendable, but it indicates that property defendability, even among those who appear to be well prepared, is an issue especially in extreme fire conditions. Given the extreme conditions on 7 Feb 09, earlier research showing that the presence of able bodied individuals is a key factor in house survival should be tested against the pattern for the these more recent fires;
- There was a pattern among many fatalities of some defence and then retreat to shelter in a small room from which there was no alternative means of escape. Alternatively, in some households people sheltered passively while one or two defended. Effort is needed to engage those at risk about appropriate safe behaviour for whole households, and for the need for contingency planning;
- Many people left at the last minute by car. Many reached safety, some did not. Many people sheltered in their cars, and many cars survived the fire with little damage while their owners died inside a house or elsewhere. This finding is not consistent with current advice from AFAC, and the issue of cars and safety in bushfires should be re-examined.

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