# Early Warning Information Seeking in the 2009 Victorian Bushfires

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This study examines early warning from the users' perspective as a special category of information seeking. Specifically, we look at the 2009 Victorian bushfires in Australia as an instructive case of early warning information seeking. The bushfires, the worst in Australia's recorded history, were unique in its ferocity and damage caused, but also in the amount of data and research that was generated. We analyzed the affected residents' information needs, seeking and use in terms of their cognitive, affective, and situational dimensions. We found that residents wanted information that would act as a "trigger for action," provide timely warning, and indicate clearly fire severity. Nearly two thirds of residents surveyed did not receive an official warning. Almost half first found out that the bushfire was in their area through personal observation of smoke, embers, or flames. We suggest that a form of normalcy bias may have been at work during information seeking, causing people to interpret their situations as "normal" even when disaster warnings have been issued. Although the authorities had adopted a "Stay or Go" policy to help residents use warning information to decide between staying to defend their property or leaving early, the policy's effectiveness was undermined by information challenges.

## Introduction

The purpose of early warning is to provide communities and individuals with the information they need so that they are able to take appropriate actions to avoid or reduce their exposure to hazards. Early warning then may be considered a special case of information seeking under conditions that are risky, uncertain, and time-constrained. While early warning is clearly a consequential mode of information seeking it has not been often studied as such.

Instead, most studies on early warning approach it as a problem of information supply or provision, where the focus is on systems or agencies that disseminate information to affected populations in a timely manner (Choo, 2009). We believe that it is equally important to look at the information demand side, so that the design of early warning systems and the content of their messages are based on an understanding of citizens' information needs, their trust in and preference for different sources, the way they attend to and interpret messages, and the difficulties they face in using information to make decisions.

This paper is an attempt to contribute to the small corpus of studies that look at early warning from the users' or citizens' perspective. We examine the 2009 Victorian bushfires as an instructive case of early warning information seeking. The Victorian bushfire, both in its aftermath and the events leading up to the disaster, was analyzed in detail by the 2009 Victorian Bushfire Royal Commission and the Bushfire Cooperative Research Centre. The Victorian bushfires is unique and interesting in three aspects. First, it was an extremely fast-moving fire (or megafire) with multiple fronts that was outside the realm of previous experience and proved impossible for fire fighters to control. Many residents reported being unprepared for the ferocity of the fires. Second, extensive data were collected through hearings with experts and officials, interviews with fire-affected residents, and a general household survey that provided insights on residents' information needs and information-seeking patterns. Third, the way that residents used information to decide how to respond to the fire hazard was guided by a policy framework introduced by government authorities to help residents make that decision more effectively. While the framework was intended to be helpful, it had, as we shall see, some unforeseen and unfortunate consequences.

## Literature Review

The most common view of early warning systems today is based on a linear sequence of activities that link observation through warning generation and dissemination (Basher, 2006). Driving the sequence is a technical model of relevant

features and impact of the hazard, including how it would develop over time. This model-based view of early warning leads to systems that are top-down, expert-driven, with little engagement of end users or their representatives. Basher (2006) calls for a move from a linear paradigm to an integrated conceptualization of early warning that includes local actors and feedback from the community and other actors. In this integrated view, two key features become important:

> "The first is the inclusion of actors that often are not recognized as part of the warning system, most notably the political-administrative supporting entities, the district and community actors and the research community. The second feature is the explicit inclusion of multiple linkages and feedback paths, particularly from affected populations through their organizations to the political and technical actors." (Basher, 2006, p. 2175)

Comfort (2007) presents a *bowtie* architecture for communicating risk information and managing the flow of information in a crisis situation. Data from a number of identified key sources *fan in* simultaneously to a central unit (the bowtie's knot), where the data are evaluated, integrated, and interpreted. New information is then *fanned out* to emergency units (e.g., fire, police, medical services) that use the information to adjust their operations and to maintain a global view. Resultant actions and consequences across multiple levels (the municipal, provincial, national, and international) generate feedback and new flows of data back into the system. The architecture is based on the idea of crisis management as a complex, adaptive system with four main decision points: detection of risk, recognition and interpretation of risk, communication of risk, and self-organization and mobilization of a collective, community response system to reduce and respond to risk.

Griffin, Dunwoody, and Neuwirth (1999) and Griffin et al. (2008) propose a model of risk information seeking and processing in which three factors: information sufficiency; perceived information gathering capacity; and relevant channel beliefs all influence the extent to which a person will seek out risk information in both routine and nonroutine channels and the extent to which time and effort are spent on analyzing the risk information systematically. Information sufficiency refers to the confidence one wants to have in one's knowledge about the risk—the information sufficiency threshold. A high threshold would then motivate more effortful information seeking. Perceived information gathering capacity refers to one's perceived ability to perform the information seeking and processing needed to achieve desired outcomes. Relevant channel beliefs refer to beliefs about the trustworthiness and usefulness of information channels and is related to the concept of perceived source characteristics in information science. Taking the three factors together, information sufficiency motivations and information gathering capacities might interact with channel beliefs to influence how people seek and process risk information (Griffin et al., 1999, p. S237).

Those three factors are in turn affected by (a) affective response to the risk, (b) informational subjective norms about risk information gathering, (c) perceived hazard characteristics, and (d) selected individual characteristics (Griffin et al., 1999, p. S233). Thus, one's affective response (such as worry), or felt pressure from relevant others to keep on top of risk information, could influence one's judgment about how much information one needs to have about the risk (information sufficiency).

"Crisis informatics" was introduced by Hagar (2010) to refer to the interconnectedness of people, organizations, information, and technology during crises. Informatics is both concerned with how people adopt and adapt information technologies and how these technologies transform people. For Hagar, crisis informatics also includes the social and human ways of communicating and sharing information that play a key role when technology breaks down during a crisis. She identifies the following as information challenges in a crisis:

- Information overload or, conversely, lack of information.
- Changing information needs at various stages of a crisis: preparedness, warning, impact, response, recovery, and reconstruction.
- The many diverse actors and agencies involved who increase the amount of information produced.
- Integration and coordination of information by these actors and agencies.
- The connection of informal and formal channels of information creation and dissemination.
- Information uncertainty.
- Trustworthy sources of information.
- Conflicting information.
- Getting the right information to the right person at the right time (Hagar, 2010, p. 10).

Palen, Vieweg, and Anderson (2011) examine a dilemma in crisis information seeking: Information needs to be accurate in order to be helpful, but how do people assess information accuracy under dangerous conditions, where the source may not be immediately recognizable as authoritative? With growing use of the web and social networking sites, "seekers often find that they have access to information first—rather than source first—and have to make differently engineered judgments about its viability. . . . The orientation of the seeker here is to the information, with an apparent willingness to field answers from unknown sources" (Palen et al., 2011, pp. 55, 56). In crisis situations, information trust and credibility need to be established quickly, often partially: "We know that 'accuracy' is the ideal, but not the measure, by which people take information and make use of it even—and especially—in disaster. Their goals can only be ones of satisfying" (p. 59).

Palen et al. (2011) explain how certain features of online communication are used to establish source-level credibility and information-level credibility. At the source level, people use network affiliation, local knowledge, self-correction, and words of support to signal their trustworthiness. At the

information level, many people often come together on the web around a common need to gather and share information. Some individuals may emerge as "everyday analysts" who aggregate, synthesize, and corroborate information, thereby increasing the credibility of information being distributed.

Following a systematic review of risk communication theories and their practical implications, Sheppard, Janoske, and Liu (2012) conclude that: "In sum, theories and models of communication applicable to the preparedness phase recommend: (1) incorporating community members into planning, (2) identifying in advance multiple channels to disseminate risk messages during a crisis, and (3) understanding how publics perceive risks prior to disseminating messages" (p. 16).

## Research Method

The objective of this study was to analyze early warning as a special case of information seeking, identifying its particular challenges and requirements so that more effective warning systems and practices may be designed. We selected the February 7th, 2009 Victorian bushfires as a case study that would allow us to address this research goal. Specifically, this study explores three research questions: What information needs, information seeking, and information use patterns characterized people's information behavior during the 2009 Victorian bushfires? What cognitive, affective, and situational factors help explain these information needs and information use behaviors? How did these factors and behaviors influence early warning effectiveness and residents' preparedness for the disaster?

### Data Collection

This study is based primarily on secondary data and document sets that were collected and produced by the 2009 Victorian Bushfire Royal Commission and the Victorian Bushfire Cooperative Research Centre. Specifically, we made extensive use of five sources.

1. The proceedings from the 2009 Victorian Bushfire Royal Commission (VBRC, 2009) served as our primary source. The VBRC commenced on April 20th, 2009 and ended on May 27th, 2010. We examined transcripts of the hearings, interviews, and extensive expert and witness testimony which were summarized in the first Interim Report. Where necessary, we read the full-length witness statements. Particularly useful were two chapters in the Interim Report that focused on information issues:

Chapter 4: "Warnings" provides an overview of the Federal and State government research and initiatives in managing catastrophic fire disasters in Victoria and Australia from 2004. The chapter also provides a detailed breakdown of the press releases, government statements that were broadcast over the radio and also carried in the print media, in the months and days leading up to February 7th, 2009. Most of these releases are no longer available on the Internet, so the Commission reports are

very important in helping us piece the events together retrospectively. Chapter 4 also describes lay witnesses' response to warnings that were broadcast. These testimonies highlighted gaps in information as residents waited for warnings (specifically about whether a fire had reached their towns that would prompt them to leave), and which frequently did not arrive. There is also a detailed analysis of a typical bushfire warning that was issued during the disaster to illustrate the potential for confusion by recipients.

Chapter 5: "Information" deals with the types of information that were provided to the public, and the Fire Danger Index, fire danger ratings, and the Victorian Bushfire Information Line (VBIL).

2. Twenty-six community consultations, the summaries of which are posted on the Royal Commission website.
3. The Bushfire CRC Victorian 2009 Bushfire Research Response Interim Report (Bushfire CRC, 2009) was prepared by a research taskforce established the day after the fiery devastation. Research was begun on February 9th to ensure the accurate collection of data that would "establish authoritative and independent data for the Australian and international fire community" (Bushfire CRC, 2009, p. 3). The research was overseen by the Victorian Bushfire Cooperative Research Centre (CRC) which comprises all the fire and land management agencies in Australia and New Zealand, the Commonwealth Scientific and Industrial Research Organization (CSIRO), the Bureau of Meteorology, the Attorney General's Department, and several other fire-related organizations. According to its website, the CRC researches the "social, environmental and economic" impact of bushfires. The Research Response was a collaborative effort of up to 50 researchers from Australia, New Zealand, and the US. Close to 2,000 staff days went into data collection and analysis.
4. The Bushfire CRC Household Mail Survey containing 83 questions was sent to 6,000 households affected by the fires. The survey considered the research question, "Was the impact of the fires of 7th February consistent with established knowledge or was this the result of previously unidentified behaviours or factors?" (Bushfire CRC, 2010, p.10). About 1,350 completed surveys were returned and analyzed. The final report was published in January 2010 (Bushfire CRC, 2010), and we examine some of the questions and responses in this paper.
5. Print and online media sources, both national and state-based, for accounts leading up to, and immediately after the February 7th bushfires. The main sources we referred to were news articles on the Australian Broadcasting Corporation website and *The Age* (a state-wide Victorian newspaper).

### Data Analysis

Textual and interview data from these sources were examined using qualitative content analysis (Forman & Damschroder, 2008). Content analysis is a set of techniques used to systematically analyze the informational content of textual data. In qualitative content analysis, categories or themes are derived from the data, and in most cases applied to the data through a process of close reading. Qualitative

content analysis may examine the data collected using solely qualitative methods, without the use of counting or statistical techniques (Hsieh & Shannon, 2005; Mayring, 2000).

Qualitative content analysis normally proceeds in three phases: immersion, reduction, and interpretation (Coffey & Atkinson, 1996; Miles & Huberman, 1994). During *immersion*, we engaged with data from the sources to gain a sense of the major events and developments in the 2009 bushfires. We made notes or "memos" to record early thoughts and intuitions about possible themes and categories. During the *reduction* phase we reduced the amount of raw data to that which is relevant to answering our research questions, and reorganize that data into a smaller number of themes that would help us understand information seeking and use during the bushfires. We used theory-driven data coding to categorize themes found in the textual data. For example, transcripts of testimonies by residents or experts were read carefully and, where appropriate, excerpts were coded as pertaining to cognitive, affective, or situational factors. Finally, during the *interpretation* phase we identified patterns, attached significance to particular themes, and placed them within an analytical framework (Forman & Damschroder, 2008).

In addition to qualitative content analysis, data and results from the Household Mail Survey were examined quantitatively to determine the most important information sources identified by residents who were affected by the bushfires.

## The 2009 Victorian Bushfires

### The 2008–09 Australian Bushfire Season

On Saturday February 7th, 2009, Victoria experienced Australia's worst bushfires in its recorded history. Over 2,000 homes and 173 lives were lost, in addition to substantial economic and environmental impacts. Bushfires are very common in Australia, with the fire season running every year from late October to April/May. Victoria's location, climate, and vegetation make the state particularly vulnerable to fire. Meteorological observations in October 2008 predicted an above average fire potential across Australia's coastal regions. Conditions worsened in early 2009, exacerbated by a severe heat wave, and a 10-year long drought. On Saturday February 7th, 2009 temperatures of more than 40°C were accompanied by strong winds of between 100–120 km/h. The Bushfire CRC Interim Report (2009) noted that some of the major fires on February 7th "spread faster by a factor of 2 to 3 times than predicted" by existing models (Chap 1, p. 53). The fires burnt more than 450,000 hectares of land across Victoria, killing 173 people (the highest death toll ever in Australian history), and injuring 414. More than 3,500 buildings (including 2,029 houses), were destroyed and 7,562 people displaced. The total damage was estimated at Aust. $4.4 billion. February 7th, 2009 came to be known as Black Saturday.

### The Victorian Bushfire Royal Commission

As a result of the catastrophic loss of life and property on Black Saturday, the Victorian state government convened a Royal Commission on February 16, 2009, to determine what had gone wrong and make recommendations. A Royal Commission is a major public inquiry into a specific issue. A Royal Commissioner, often a former judge, has considerable powers that are defined by the "Terms of Reference" of the Commission. The Victorian Bushfire Royal Commission was chaired by Bernard Teague, a former judge to the Supreme Court of Victoria. The broad-ranging terms of reference for the VBRC included: an examination of the "current laws, policies, practices, resources and strategies for the prevention, identification, evaluation, management and communication of bushfire threats and risks" (VBRC Terms of Reference 2009, p. 2). In his opening remarks on April 20th, 2009, counsel assisting the Commission, J. Rush, elaborated on the terms of reference, stating that "an examination of the warnings and the "Stay or Go" policy associated with those warnings will be the focus of the first block of hearings" (VBRC Directions Hearings 2009, p. 10). This includes the "effectiveness of warnings, the way in which individuals in the community understood the warnings given" (p. 4). The Royal Commission would also assess the potential for confusion arising out of the "Stay or Go" policy.

### Warnings Before February 7, 2009

Over the course of seven blocks of hearings (from May 11th, 2009 to May 27th, 2010), and 26 public consultations, the Commission determined that a significant body of information about bushfires was made available to the public during the 2008–09 bushfire season and ahead of February 7th, 2009. There was also intensive coverage of weather forecasts, fire danger predictions, and information about the risk of bushfire during the period from October 2008 onwards. This information was carried widely in the media. Announcements, media releases, press conferences, and events were aimed at alerting the community to the extreme fire risk, and these are detailed in chapter 4 of the Interim Report (VBRC, 2009). There was also intense media coverage of the hazard from late January through early February 2009.

For example, Chief Fire Officer Russell Rees warned on October 27th, 2008 that the bushfire season was "rapidly deteriorating" (Best, 2008). In 2009, numerous announcements were made by senior members of government and emergency services warning of the urgency of the situation. This was accelerated from January 30th. On February 6th, 2009, then-Victorian Premier John Brumby issued a warning about the extreme weather conditions expected on February 7th: "It's just as bad a day as you can imagine and on top of that the state is just tinder-dry. People need to exercise real common sense tomorrow" and it was expected to be the "worst day [of fire conditions] in the history of the state" (Moncrief, 2009).

Experts such as Professor John Handmer, who leads the Bushfire CRC, found that statements by the Premier and senior emergency services personnel were effective in conveying a message of generalized high-fire risk (VBRC, 2009, p. 132). However, the 26 public consultations showed that residents did not receive specific local emergency warnings. Communications and warning systems were frequently described by residents as "grossly inadequate" (e.g., VBRC Kinglake West Community Consultation, 2009).

## Early Warning Information Seeking Behavior: A Theoretical Frame

To analyze information behavior in the disaster warning context, we adopt Wilson's (1999) conceptualization of *information-seeking behavior* in terms of the patterns of behavior that people display as they recognize information needs, make choices about where and how to look for information, and reflect or act on the information they see. Information-seeking behavior may thus be analyzed as three overlapping activities: (a) perceiving information needs, (b) information seeking, and (c) information use. The individual becomes aware of or recognizes a problematic situation and perceives *information needs* in terms of information they want to have or are interested in in relation to their goals, interests, or concerns. *Information seeking* is the process whereby people look for and obtain information in order to change their state of knowledge or awareness. During information seeking, typical behaviors include identifying and selecting sources; formulating a query, question, or topic; extracting information; evaluating the information found; and extending, modifying, or repeating the search. *Information use* is the selection and processing of relevant information encountered during the search so that it leads to a change in the state of an individual's awareness, knowledge, or capacity to act.

The work of Saracevic (1997), Kuhlthau (2004), Savolainen (1995), Case (2012), and Choo (2006) leads us to consider each of the information activities as being influenced by cognitive, affective, and situational variables that jointly determine the course and outcome of information seeking. Cognitive variables refer to mental structures that people use to interpret and evaluate information. Affective variables refer to people's feelings, moods, and emotional states as they seek information. Situational variables can cover a wide range of physical, social, cultural, and other features that constitute the pertinent context of information seeking and provision. The inclusion of affective and situational elements would seem highly relevant in early warning scenarios when emotions can run high, and social conditions can have a powerful effect on information behaviors. This approach to examining emergency information seeking is also consistent with related research in risk communication and crisis management. For example, the model of risk information seeking developed by Griffin et al. (2008), discussed earlier, identified theoretically and empirically the

importance of factors such as affective responses, informational norms, channel beliefs, and hazard characteristics.

In the following sections we examine and discuss the information needs, seeking, and use behaviors of residents during the February 7th bushfires.

## Information Needs

*Findings*

The 2009 Victorian Bushfires Royal Commission collected extensive data from interviews and surveys with residents about the information they did or did not get regarding the bushfires. In relation to information needs, three themes emerged from their analysis of the data. Residents wanted information that would act as a "trigger for action", provide timely warning, and indicate clearly the fire severity.

*"Trigger for action."* Residents were expecting to find or receive information that would serve as a trigger for them to take action (e.g., leave the area). In their review of post-Black Saturday research, Whittaker and Handmer (2010a) conclude that "many people intend to wait for advice from emergency services or until they are directly threatened before taking action" (p. 10). This suggests that "one-quarter to one-third of residents in high bushfire risk areas plan to wait for emergency services advice before leaving" (Whittaker & Handmer, 2010b, p. 45), with an even higher proportion in lower bushfire risk areas.

Underlying this information need was the expectation that warnings would have a high degree of specificity in two senses of the term. First, warnings would be specific to residents' particular location or situation. Second, warnings would be unambiguous in terms of their wording.

With regard to locational specificity, a common theme among residents was that "they expected to receive information about whether the fire had reached certain areas or towns, which they regarded as an indication that the fire was 'in their area'" (VBRC, 2009, p. 139). The Bushfire CRC Household Mail Survey showed that while 99% of residents knew that February 7th was a Total Fire Ban day (when open fires were banned and fire permits suspended), 72% expected to receive an official warning that there was a fire *in their area* (Bushfire CRC, 2010, p. 2). Only a small number of residents in at-risk communities appeared to have interpreted the warnings as having implications for their personal safety and the security of their property.

Most witnesses reported to the Commission that they received information via the radio on February 7th. However, they said that very few announcements made references to specific and useful information which would have acted as triggers for them to leave the area. For example, Ms. Jacqueline Hainsworth of Kinglake West heard the warning from the Premier on Friday. But the trigger for her to leave would be news of a bushfire anywhere in her area including Whittlesea, Mount Disappointment, Humevale, Strathewen, St. Andrews, or Kinglake, rather than

declaration of a Total Fire Ban day (VBRC, 2009, p. 139, Sect. 4.139).

With regard to specificity in the wording of warnings, witnesses emphasized the need for messages that use terminology which is meaningful to the general public, as well as messages that are short and in plain language (VBRC, 2009, p. 142). One witness informed the Commission that terms like "going" and "out of control" though meaningful to fire specialists "fail to convey sufficient meaning to the public." Another witness called for the use of plain language: "I feel that when language like 'held within containment lines' . . . what are they? The euphemisms for 'held within containment lines' is, 'oh, we've got it under control' . . . what does that mean? . . . I think we have to be absolutely blunt that, once these fires are out of control, they are out of control. . . ." A third witness stressed the need for short messages: "There were warnings issued from time to time in a very sort of performance type language, 'a warning is issued to the people of such and such that you may be about to endure an ember attack,' this sort of language, and I had to concentrate very carefully on each one of these messages just to see to whom it did apply. If I missed the beginning of the statement, the rest of it was of no consequence whatsoever. These messages went on, very lengthy, using up a lot of valuable time and I kept mumbling to myself, 'get on with it, give short, pithy messages that are up to date.' " (All quotes from VBRC, 2009, p. 141–142).

*"Timely warnings."* Another common theme was the need for information that provided timely warning. For a number of fires there was a serious time lag from the point of activation of emergency services to the provision of information, alert, and warning messages to the community. The issue of time lag was closely examined in Chapters 5 and 9 of the Interim Report (VBRC, 2009), with reference to the Kilmore East Fire, which later merged with the Murrindindi bushfire, burning 168,542 hectares. The Commission found that by 14:00 hours on February 7th, fire authorities were aware that fire in the Kilmore region was burning out of control, yet "between 12:40 and 14:25, no information about the Kilmore East fire was posted on the CFA website," nor were all urgent threat messages uploaded (VBRC, 2010, Vol. 1, p. 85, Sect. 5.3).

It was the lack of timely information about developing threats to communities such as St. Andrews, Strathewen, Kinglake, Kinglake West, Narbethong, and Marysville that may have led to residents being surprised by the sudden impact of the fires. These communities were not initially identified as being under threat, and many residents could have assumed they were not at risk.

The Commission also observed that there were instances where residents were monitoring warning messages continuously but were still surprised when the fire reached their homes:

"Mr D Brown explained that his wife listened to the radio all day and monitored the CFA website. They became aware that there was a fire in Kilmore East early in the afternoon, but were surprised by the speed by which it came to their property" (VBRC, 2009, p. 141, Sect. 4.156).
"Mrs Carol Matthews of St. Andrews knew that her children were monitoring the CFA website while undertaking careful preparatory steps for the approach of possible fires. There was no reference in the material available to her children to fire approaching or reaching the town of St. Andrews. Mrs Matthews listened to 774 ABC Radio herself and could hear no mention of St. Andrews being in the path of the fire. The fire approached the family home rapidly, and tragically took the life of her son" (VBRC, 2009, p. 141, Sect. 4.152).

*"Fire severity."* Residents wanted warnings that clearly indicated the probable severity of the fire that they could be exposed to. Moreover, they wanted this information to be expressed in a form that they could readily understand or interpret. The Bureau of Meteorology and emergency services in Victoria used a Fire Danger Index to indicate the degree of danger of fire on a scale of 0 to 100 and above. The index on February 7th reached much higher than 100, although at such extremes it became difficult for residents to interpret. The VBRC report (VBRC, 2009) found that the prevailing fire rating system was not able to meaningfully indicate a megafire or complex bushfire.

Another method available to the authorities to highlight a potentially catastrophic situation was the declaration of a Total Fire Ban day, when no fire may be lit in the open and all fire permits are suspended. Unfortunately, Australians are accustomed to almost routine declarations of Total Fire Ban days, and would probably would not be able to differentiate between very hot, dry days and potentially catastrophic days.

*Information deficiencies.* At the end of its analysis on warning information, the VBRC concluded that warnings before and during the 2009 February 7th bushfires were deficient with respect to residents' expectations and needs in the following ways:

- Many warnings did not indicate the likely *severity* of the fire; this is a significant shortcoming.
- The warnings rarely identified the *window of time* during which the fire was predicted to reach certain towns or communities; this information is vital to the community.
- Some warnings were *imprecise* in their description of the location of a particular fire or the direction in which the fire was spreading; again, this information is important to those preparing to meet the threat.
- The advice in many warnings was lengthy and *confusing,* sometimes even contradictory; it was difficult to identify the important information.
- The terminology used in some warnings was *vague* and euphemistic; it did not serve to grab the audience's attention
  (VBRC, 2009, p. 142, Sect. 4.163; italics added).

Thus, the need for information to be action-oriented, timely, and clear about risks was confounded by residents' perception that warnings were imprecise, inconsistent, and generic.

*Discussion*

Residents expected authorities to provide early warning of fire hazards. They expected such warnings to be clear and specific about the severity of the hazard, its location, and timing. On hazard severity, residents needed and expected information about the level of danger the fire would pose to their households. On location and timing, residents expected information to be tailored and relevant to their geographical area or special circumstances. Ultimately, residents needed and expected warnings to provide information that they could act on or that included what action they should take.

In a comprehensive review of the research on early warning, Mileti and Sorensen (1990, pp. 3–8) conclude that both the content and the style of the warning message determine its effectiveness. They identify five content and five style attributes that should be considered (Table 1).

In Table 1, "Hazard" refers to content that describes the event as well as how that event would pose a danger to people. "Location" content should provide sufficient details that are easily understood. "Guidance" refers to advice about what people should do to maximize their safety. "Time" refers to indicating how much time is available for preventive actions. "Sources" refers to identifying sources in order to increase message credibility. Alongside these content attributes, stylistic aspects of specificity, consistency, accuracy, certainty, and clarity should be considered. A warning message could then be evaluated by viewing the specificity of the message regarding location, guidance, hazard, and time; the consistency of the message regarding these same content factors; and so on. This framework is consistent with our analysis of information needs in the 2009 Victorian bushfires. Victorian residents indicated explicitly that they needed information about the location and timing of the hazard, accompanied by guidance on what action to take. They also wanted messages to be specific (with regard to location, time, and nature of hazard), clear, and consistent.

*Cognitive, Affective, and Situational Dimensions of Information Needs*

Findings presented in the last section suggest that residents' perceptions and experiencing of information needs could be better understood as the result of the interplay between cognitive, affective, and situational requirements.

TABLE 1. Warning message style and content.

| Message style | Message content | | | | |
| | Hazard | Location | Guidance | Time | Sources |
| --- | --- | --- | --- | --- | --- |
| Specificity | | | | | |
| Consistency | | | | | |
| Accuracy | | | | | |
| Certainty | | | | | |
| Clarity | | | | | |

Mileti & Sorensen 1990, p. 3–10.

In the minds of residents, the information they wanted would provide precise and unambiguous details about the location, timing, and severity of the fire hazard in order for them to be able to assess the threat and to take action. Thus, "a significant number of lay witnesses, when speaking about their experiences of the February 7th fires, impressed upon the Commission the relevance and importance of receiving information about expected fire location, direction and intensity, irrespective of whether their plans were to stay or go" (VBRC, 2009, p. 197, Sect. 7.62). What people needed was "a specific warning identifying a real threat, the time the threat will materialise, and advising specific action to be taken" (VBRC, 2009, p. 197, Sect. 7.62).

Affectively, residents reported a high degree of confusion about the nature of the fire threat. People were emotionally aroused as they sought answers to the questions "Is this just another 'regular' bushfire, or is this truly a 'megafire?' Is this going to be a catastrophe?" Moreover, residents felt confused by the sometimes contradictory advice contained in warnings, and by the vague and general terminology used.

The Household Mail Survey (Bushfire CRC, 2010) also revealed a difference in attitudes and feelings towards bushfire risk between suburban dwellers and those who lived in more rural areas—60% and 49% of respondents in the suburban areas of Bendigo and Horsham "had not considered or decided what they would do if a bushfire occurred, or had decided that they didn't need to do anything" (Bushfire CRC, 2010, p. 8). Similarly, the proportion of respondents in Bendigo (29%) and Horsham (24%) who reported having a firm fire plan was much lower than in the more rural areas of Beechworth–Mudgegonga (77%), Churchill (77%), and Kilmore East (75%) (p. 8).

The situational context of the February 7th bushfires influenced how sensitive residents were about their need for information. As bushfires were an annual event, some residents may have grown confident over time about managing bushfire risk, or that the fires would not, or could not, affect them (Bushfire CRC Interim Report, 2009, Chapter 2, pp. 11, 13). Most residents were expecting to hear warnings that were relevant to their geographical location, messages to indicate that the fire was "in their area." Vulnerable groups in the population were also expecting information that would be highly tailored to their needs and situation.

A general observation here would be that warning messages need to address not just the cognitive needs of residents, but also to take into account their emotional states and their desire for information that is action directed and tailored to their own situation.

## Information Seeking

*Findings*

The Bushfire Cooperative Research Centre (Bushfire CRC) conducted a survey of ~6,000 households in fire-affected areas. In all, 1,350 completed surveys were returned from households that were affected by the February 7th

TABLE 2. First information sources.

| First information source (N = 759) | Frequency | Percent |
|---|---|---|
| a) Heard radio announcement | 64 | 8.4 |
| b) Internet | 10 | 1.3 |
| c) Television | 6 | 0.8 |
| d) Family, friends or neighbors | 215 | 28.3 |
| e) Told by emergency personnel | 20 | 2.6 |
| f) Smelled or saw smoke | 218 | 28.7 |
| g) Saw fire approaching | 93 | 12.3 |
| h) Saw embers landing near the house | 28 | 3.7 |
| i) Saw fire burning near the house | 34 | 4.5 |
| j) Other | 71 | 9.4 |
| Total | 759 | 100 |

Bushfire CRC, Victorian 2009 Bushfire Research Response Household Mail Survey, Jan 2010, p. 17.

TABLE 3. Official sources that provided warning.

| Official sources provided warning (N = 1,104) | Frequency | Percent |
|---|---|---|
| a) ABC Radio | 188 | 17.0 |
| b) Other radio | 24 | 2.2 |
| c) Emergency personnel | 92 | 8.3 |
| d) CFA website | 39 | 3.5 |
| e) DSE website | 12 | 1.1 |
| f) Victorian Bushfire Information Line | 6 | 0.5 |
| g) CFA Community Meeting | 35 | 3.2 |
| h) Television | 10 | 0.9 |
| i) Did not receive an official warning | 698 | 63.2 |
| j) Other | 74 | 6.7 |

Bushfire CRC, Victorian 2009 Bushfire Research Response Household Mail Survey, Jan 2010, p. 18.

TABLE 4. Most important official sources.

| Most important official sources (N = 424) | Frequency | Percent |
|---|---|---|
| a) ABC Radio | 213 | 50.2 |
| b) Other radio | 18 | 4.2 |
| c) Emergency personnel | 58 | 13.7 |
| d) CFA website | 19 | 4.5 |
| e) DSE website | 2 | 0.5 |
| f) Victorian Bushfire Information Line | 0 | 0.0 |
| g) CFA Community Meeting | 30 | 7.1 |
| h) Television | 3 | 0.7 |
| i) Other | 81 | 19.1 |
| Total | 424 | 100 |

Bushfire CRC, Victorian 2009 Bushfire Research Response Household Mail Survey, Jan 2010, p. 19.

bushfires. A total of 1,104 of these surveys were analyzed and data presented in its Household Mail Survey report (Bushfire CRC, 2010). We will highlight results that relate to the information seeking of residents in affected areas.

Table 2 summarizes residents' responses to the question "How did you FIRST find out that the February 7th bushfire was in your town or suburb?"

Nearly half (49%) of respondents reported that they first became aware of the bushfire through sensory cues from the environment (i.e., they saw or smelled smoke or fire, saw embers, etc., items [f–i]). The second most common source of first warning was family, friends, or neighbors (item [d], 28%). Only 13% were first alerted through the more 'official' sources of radio, emergency personnel, Internet, and television.

This finding was supported by another question in the survey: "Did you receive an UNOFFICIAL warning about the fire from family, friends or neighbours?" Here, a majority of respondents (63%) reported receiving a warning about the fire from a family member, friend, or neighbor. As in the earlier question, almost one in three residents received their first inkling of potential fire danger from this unofficial source. This result is also consistent with the Bushfire CRC Research Taskforce interviews (see following text), where residents indicated that they were either first alerted by or confirmed warnings (particularly environmental cues) with a family member, friend, or neighbor.

Table 3 summarizes residents' responses to the question "Did you actually RECEIVE an OFFICIAL warning from any of the following? You may select more than one."

It is noteworthy that nearly two thirds of the 1,104 respondents reported that they "did not receive an official warning" (item [i], n = 698, 63%). Among those who did receive an official warning, ABC (Australian Broadcasting Corporation) Radio was the most frequently reported source, followed by emergency personnel.

A survey question focusing on official sources asked "Which official source was the MOST IMPORTANT in helping you to respond to the bushfire? Select ONE." Responses summarized in Table 4 show that ABC Radio was

by far the most important source of official warning, identified as such by 50% of respondents.

A number of survey questions touched on respondents' perceptions of the timing and information content (location, fire severity) of warnings. Overall, there was a mixed appraisal of the quality of warnings. While a majority of respondents indicated receiving "clear" or "very clear" information that was timely, significant percentages of respondents reported that information about fire location and severity were unclear or not received, or that they did not have enough time to respond safely (see the following findings, all from Bushfire CRC, 2010).

In reply to "Did you receive the warning in enough time to respond to the bushfire safely?" just over two thirds (69%) of the 442 respondents who received a warning reported that they had "ample" or "just enough time" to respond safely. Furthermore, 27% indicated they had "not enough time to respond safely."

In reply to "After finding out the fire was in your town or suburb, how long was it before the fire reached your house?" a total of 41% of the 442 respondents reported having 30 minutes or less in which to respond to the fires, with ~21% reported only having a few minutes.

In reply to "Was the information you received about the LOCATION of the fire clear enough for you to understand

the danger to your household?" nearly 60% of the 432 respondents found the information they received on fire location to be "clear" or "very clear." On the other hand, 20% felt that the information they received was "unclear" about fire location and its danger, and 18% received "no information."

In reply to "Was the information you received about the SEVERITY of the fire clear enough for you to understand the danger to your household?" about 56% of the 437 respondents found the information they received on fire severity to be "clear" or "very clear." On the other hand, 16% felt that the information they received was "unclear" about fire severity and 25% received "no information."

### Interviews

The Bushfire CRC Victorian 2009 Bushfire Research Response Interim Report (Bushfire CRC, 2009) presented findings based on preliminary analysis of 201 (or approximately one third) of the interviews conducted by the research team. Three themes were identified: "the existence of low levels of awareness prior to February 7th, criticisms of some of the sources of information relied on by the community and concerns about an absence of timely warnings" (VBRC, 2009, p. 136; Bushfire CRC, 2009, Chap. 2, p. 13).

Although most interviewees reported receiving information via the radio on February 7th (see also Tables 2, 3), very few made references to specific and useful information having being broadcast. As noted earlier, the lack of timely information about developing threats contributed to residents in several communities (e.g., St. Andrews, Strathewen, Kinglake, Kinglake West, Narbethong, and Marysville) being surprised by the fires.

Many interviewees also reported seeking information from the websites of the CFA (Country Fire Authority) and DSE (Department of Sustainability and Environment) but there were no positive references to the websites. Several negative comments complained that the sites were slow to load and "hours behind in their information"; and that they were only "modestly successful" in informing members of at-risk communities about the bushfire risks (Bushfire CRC, 2009, Chap. 2, pp. 15, 18).

Based on the interviews, the report concluded that:

"In summary, for many of those interviewed, environmental cues as to the risk of fire (smoke, flames, embers) served a useful function in alerting them to a developing threat, and in many instances prompting an active search for more information, or a decision to take active steps to evacuate or to initiate defence. These environmental cues took on special significance in the reported absence of specific warnings via the media and agency websites about imminent threat to many of the affected communities. However, environmental cues, especially remote cues such as smoke, are ambiguous and are likely to add to uncertainty in the absence of accurate, specific, and timely information for residents about developing fire threats." (Bushfire CRC, 2009, Chap. 2, p. 20)

### Discussion

One interesting feature of information seeking and information provision during the 2009 Victorian bushfires is the disconnect between the huge volume of warnings and alerts that were broadcast in the 2008–09 bushfire season and the residents' relative lack of preparation and recognition of how severe the fire hazard would be. As described earlier, warning information was of high quality, often conveyed by persons of authority, and attracted significant media attention. At the same time, many residents were caught by surprise, and a majority of survey respondents indicated that they received no official warning, or that the warnings were not helpful.

Very few of those interviewed indicated that the forecasts and warnings had resulted in them changing their behavior prior to February 7th. Thus, "[t]he most frequent outcome of the early predictions and warnings was to raise general, non specific concern about the possibility of fire, and to probably promote a 'wait and see on the day' response. Only a small minority of residents of at risk communities appear to have interpreted the warnings as having implications for their personal safety and the security of their property resulting in either earlier action to prepare their property for a defence, or a decision to be elsewhere" (VBRC, 2009, p. 136; Bushfire CRC, 2009, p. 17).

A Bushfire CRC review of the February 7th fatalities highlighted "a significant unawareness of the general fire risk, a lack of appreciation that February 7 2009 was a day requiring a different approach due to the extreme conditions, and limited knowledge about what to do. Some people were dismissive of the risk. Many had limited capacity to undertake preparation and property defence" (Bushfire CRC, 2010, p. 6). This review of the fatalities reports included summaries by the Victorian Police. These summaries often included statements of survivors near the locations of fatalities, forensic reports, and telephone and SMS records. Handmer, O'Neill, and Killalea (2010) found that less than a quarter of fatalities did not have even a general awareness that they were located in a bushfire risk area (p. 5).

Even though 99% of people polled were aware that a Total Fire Ban day was in place (Bushfire CRC, 2010, p. 2), they did not interpret the ban as an extremely serious warning that a potentially catastrophic situation was unfolding. Total Fire Ban days are not unusual in the Australian summer and Victorians had become used to official declarations of Total Fire Ban days. For many Victorians, the general awareness messages and advice were not sufficient to alert them to the threat caused by any particular bushfire, nor were they translated into a "call to action" in all cases.

Based on these observations, we suggest that a form of normalcy bias may have been at work during the period leading up to the Victorian bushfires. When people are facing a disaster, they tend to interpret their situations as "normal" (i.e., not unusual) even though disaster warnings have been issued. These perceptions do not change unless people are confronted with undeniable physical evidence

that a disaster is imminent or experience social pressure to reinterpret the situation (Turner, Nigg, & Paz, 1986, p. 88). Even when the information presented is unambiguous, there is a tendency to await confirmation from alternative sources (or simply watch out for what others are doing) before deciding on protective action. The normalcy bias thus refers to the tendency of people to underestimate the probability of a disaster occurring and its dangerous effects (Omer & Alon, 1994), or the tendency in any type of crisis for people to initially interpret their situation as safe and secure (Kuligowski & Gwynne, 2008). Individuals tend to believe in the less alarming options whenever they are presented with conflicting or ambiguous information about danger (Omer & Alon, 1994). Mileti and O'Brien (1992, p. 40) also introduced the concept of a "normalization bias" to explain why persons without any disaster experience are more reluctant to personalize risk and respond to warnings. To counter the normalcy bias and allow for suitable preparation it is necessary to deliver timely, repeated, and unambiguous warnings and instructions.

In addition to the normalcy bias, many of the information-seeking challenges noted by Hagar (2010) and discussed earlier presented themselves during the 2009 Victorian bushfires. These challenges include the relative importance of informal and formal channels; the experiencing of uncertainty due to a lack of specific information or information that was conflicting; getting the right information to right person at right time; and moving from top-down to grass-roots strategies. While official, authoritative sources are important, the Victoria bushfires showed that informal, trusted social sources such as family, friends, and neighbors are often more critical as the first sources of warning information that is relevant to the location and circumstances of the resident. In crisis situations, therefore, residents act as information sources as well as information seekers. According to the actionable risk communication model (Wood et al., 2012), the most effective communicators and motivators for preparedness are not public officials, but rather community members who share information about what actions they have taken to guard against risks with others who are less prepared. We can therefore expect local community meetings and the use of social networking sites and tools to substantially improve the effectiveness of warning information seeking and sharing.

## Information Use

### Findings: "Stay or Go" Policy

The basic objective of bushfire warning is to provide residents with information so that they can decide on actions that would minimize their risk exposure and reduce their vulnerability. During the Victorian bushfires, families and communities made such decisions within a longstanding policy for community safety in bushfires. The policy is known by its slogan "Stay or Go," or more formally "Prepare, Stay and Defend or Leave Early," and is based on

a position paper by the Australasian Fire and Emergency Services Authorities Council (AFAC, 2005). AFAC is a peak body representing fire, land management, and emergency service organizations in Australia and New Zealand. (A peak body is a collection of industries or groups that are involved in developing standards or lobbying government.) In that paper, AFAC explains the core assumption of the policy thus: "With proper preparation, most buildings can be successfully defended from bushfire. People need to prepare their properties so that they can be defended when bushfire threatens. They need to plan to stay and defend them, or plan to leave early" (AFAC, 2005, p. 5). The basic message of the AFAC position is that, where adequate fire protection measures have been implemented, able-bodied people should be encouraged to stay with their homes. This position is supported by more than a century of bushfire experience in Australia, which has seen the number of fatalities due to late evacuation reduced significantly from the 1950s onwards (Haynes et al., 2008).

It is important to note that AFAC's assumption carries an important rider: "It must be recognised that in limited cases, some buildings, due to their construction methods, construction materials, the site they are located on or their proximity to high and unmanageable fuel loads, cannot for all practical purposes be defended against high intensity bushfires. In these circumstances, householders should be encouraged to relocate early if the intensity of an approaching bushfire is likely to make conditions unsafe" (AFAC, 2005, p. 5).

### Discussion: Cognitive, Affective, and Situational Dimensions of Information Use

In order to examine the "Stay or Go" policy as a framework that would help residents, we consider the cognitive, affective, and situational elements that would have influenced its use for decision making during the emergency.

*Cognitive dimensions of information use.* The AFAC position paper emphasizes three cognitive requirements of decision-making using the "Stay or Go" framework: (a) Residents "must become competent to assess whether their homes are 'adequately constructed, maintained and prepared to withstand the impact of a fire at its expected intensity' "; (b) they must have "ready access to accurate information to assist in decision-making, both during periods of high fire danger and during fire events"; (c) they should make contingency plans in case a fire is worse than expected (VBRC, 2009, Sect. 7.11–7.14, p. 189).

The Commission noted that while the policy is intended to help decision making in stressful circumstances, it could have oversimplified a decision which is far more complex in reality: "The notion of stay or go represents a complex decision which agencies are asking the community to make. It has been useful in forcing people to confront and recognise choices, but like all slogans its real meaning is far more significant. The options are underpinned by a series of confusing possibilities and decision making processes. . . . It is

unrealistic to expect people to respond to disasters in a uniform manner, or in a 'rational' manner according to what the emergency services might try to prescribe" (VBRC, 2009, p. 193).

Moreover, it is difficult for residents to make an assessment of a "defendable space" around their home and when to "leave early," which are both central to the policy. Defendable space is a relative concept that depends on a number of factors including the severity of the fire, weather conditions, the design and maintenance of the house, and the kind of active defense that can be initiated during a bushfire (VBRC, 2009, p. 199).

As noted earlier, "leave early" was not well understood in the community. More than half (53%) the respondents in the Bushfire CRC household survey who left their homes did so less than an hour before the fires arrived. More than a third (36%) left less than 20 minutes before the fire arrived (Bushfire CRC 2010, Chap. 2, p. 30).

The VBRC also reported that the fire agencies had not allocated sufficient priority to warnings to support the "Stay or Go" policy which emphasizes early preparation, written fire plans, and individual decision making. "A central message of the Prepare, Stay and Defend or Leave Early policy is that householders are 'on their own' in terms of their individual safety because the fire authorities will be fully engaged in fire suppression" (VBRC, 2010, Vol. 2, Sect. 2.3.6, p. 82).

*Affective dimensions of information use.* Bushfires are seen as a normal part of Australian life during the hot summer months, and research has found that people's confidence about managing bushfire risk increases the longer they stay in the bush and the older they are (Berringer, 2000). Residents' confidence about successfully managing bushfires may be misplaced when they are confronted by complex, fast-moving "megafires." In his prize-winning essay, Griffiths (2009) goes further in his assessment, suggesting that Australians in general, and Victorians in particular, are characterized by an "active, half-conscious denial of the danger of fire, and a kind of community complicity in the deferral of responsibility." It is this communal denial that helped create the horrific loss of life on February 7th.

It was also quite probable that residents felt reluctant to leave their property. Many residents may be concerned about whether there will be a house to return to, and if not, could it be rebuilt? Some residents live in uninsured buildings, and this may have constrained their choice, causing them to be even more vulnerable. The issue of property insurance coverage is a very vexed one in Australia. Insurance taxes in Australia are the highest in the world. About 50% of the households affected by recent natural disasters along Australia's east coast had no insurance or were significantly underinsured. One reason for that is the sheer cost of house and contents insurance. Although risk is an important factor determining premiums, insurance policies are subject to goods and services tax, state government stamp duties, and, in New South Wales and Victoria, fire services

levies. These additional levies can increase the cost to policyholders by as much as 123% (Knowledge@Australian School of Business, 2011). The final report of the Royal Commission also criticized the way insurance is taxed (VBRC Summary 2010, Recommendation 64, p. 36). The Bushfire CRC household mail survey found that 20% of respondents reported they were underinsured, and a further 4% said they had no insurance (Bushfire CRC, 2010, p. 2). For those who were insured, the decision to leave was made easier (Bushfire CRC, 2009, Chap. 2, p. 22).

*Situational dimensions of information use.* While the "Stay or Go" policy is intended to guide residents to evaluate options and make preparations, a consideration of its context of implementation reveals two surprising aspects: (a) the policy was silent on the risks of staying to defend one's property; (b) the policy focused its February 7th warnings on those who have planned and made preparations (to stay).

In its overall evaluation of the policy, the Commission concluded that there was insufficient emphasis on the risks of staying and defending: "To stay requires considerable effort to prepare a property and make it defendable. But some properties, because of their nature and locality, will not be defendable in extremely dangerous bushfires. To defend a property successfully requires considerable physical effort and emotional strain. Often more than one person needs to be involved. It is a task for those who are physically fit and mentally strong. It is not a place for children, older people or the infirm" (VBRC, 2009, p. 19). The prevailing CFA (Country Fire Authority) literature (e.g., "Living in the Bush" Bushfire Survival Plan Workbook) is virtually silent on the dangers and effort involved in staying to defend, particularly in extremely dangerous bushfires. The CFA advice to the community also fails to distinguish between low-intensity and high-intensity bushfires, where risk factors are quite different (VBRC, 2009, Executive Summary, p. 19).

The Commission was particularly harsh on how the policy implicitly assumed that warning information on February 7th would be for those who have decided and planned to stay. In a statement to the Commission, Mr. Bruce Esplin, Emergency Services Commissioner, explained the role of warnings thus:

> "The information provision during the day should be information to help those people who have taken a considered, logical decision that they are capable of staying and defending a property that is capable of being defended. The information that comes, then, is to enable them to activate their planning" (VBRC, 2009, p. 197, Sect. 7.57).

The Commission countered that "a policy framework that warns only the prepared is unrealistic. The policy and practice, in relation to warnings, must cater for both the prepared and the unprepared. People look for warnings when threatened or potentially threatened by fire. The application of the stay or go policy should reflect that reality" (VBRC, 2009, p. 197, Sect. 7.63).

The "Stay or Go" policy is better adapted to more routine fires (O'Neill & Handmer, 2012). The policy is not suitable for dealing with megafires or complex, fast-moving fires. Such fires, with multiple fronts, leave long-lasting consequences for the community (FAO, 2011). Lay witnesses to the Royal Commission expressed helplessness at the "ferocity and speed of the fires" which left many who thought they were prepared to be overwhelmed (VBRC, 2009, pp. 92, 99).

*Summary*

A significant feature of the Victorian bushfires was the adoption of a policy framework that was intended to help residents make decisions about whether to leave early or to stay and defend their property against fire. Two conditions needed to be met for the framework to be useful: Residents had to correctly understand the key concepts that formed the decision premises of the framework, and they had to have information about both benefits and risks of the options in order to make the right choice. Data in the case study suggested that both conditions may not have been satisfied during the 2009 Victorian bushfires. Residents did not understand what constituted "a defendable area" and had varying interpretations about the meaning of "leaving early" and being "well-prepared." Moreover, the risks of staying on to defend their property were not made explicit to residents.

## Summary and Conclusion

This study examined residents' information needs, seeking, and use in the Victorian bushfires of 2009. We looked at cognitive, affective, and situational dimensions of early warning information seeking, and in so doing revealed some of its layered complexity. Three findings from the case study extend our understanding of early warning as a special case of information seeking.

In the Victorian bushfires, residents' information needs were an intricate blend of cognitive, affective, and situational elements. Cognitively, residents wanted information on the severity, location, and timing of imminent fires. Affectively, residents depended on the authorities to provide clear, actionable information that would reduce feelings of ambiguity and confusion which are common during emergencies. Situationally, bushfires were an annual occurrence in Victoria and while early warnings raised general awareness about the possibility of fire, only a minority of residents realized the seriousness of the threat, and some were dismissive of the risk. These findings suggest that in order for warnings to be effective, they would have to address the dynamic, multifaceted nature of information needs during emergencies. Effective warnings would need to take into account residents' expectations about warning content and form; their heightened emotional states; and their history of past experience with the disaster.

Information seeking in disaster situations may not follow the linear, stage-by-stage process depicted in classic models of information seeking and early warning. Often implicit in these models is the assumption that authorities would collect and synthesize data, then disseminate predictions and alerts to a receptive population who will take appropriate action. During the 2009 Victorian bushfires, nearly two thirds of residents surveyed reported that they did not receive an official warning. Almost half of the residents first found out that the bushfire was in their area through personal observation of smoke, embers, or flames. At the same time, two thirds of residents stated that they received an unofficial warning about the fire from family, friends, or neighbors. Thus, residents acted both as information seekers and information sources, and they relied on their social networks or communities for information that was specific and localized.

When faced with a flood of information about possible risks and hazards, residents could benefit from assistance on how to interpret and use that information. During the 2009 Victorian bushfires, the adoption of "Stay or Go" options as a framework for making sense and making decisions is instructive in this regard. Although the framework was intended to guide information use and decision making, its interpretation and application by residents was complicated by at least two information challenges. First, residents did not understand what constituted a "defendable area" and "leaving early"—both of which were key decision premises in the framework. Second, the risks of staying on were not made explicit to residents. The general lesson here seems to be that while authorities can introduce frameworks to help communities respond to hazards, they also need to educate citizens in the use and interpretation of the framework, and to ensure that all relevant information required to use that framework is provided effectively.

Many of the information challenges identified in this case study seem broadly applicable to other emergency situations. Thus, people in such circumstances are seeking information in a heightened state of stress, confusion, and emotional arousal. This affective response may be attenuated or amplified by contextual elements such as history, prior experience, and familiarity with the hazard, all of which could affect people's perception of risk and their sensitivity to warning information. In emergency situations, trust and the influence of peers become important, so that a community-based mode of information sharing that emphasizes dialog and collective action can be a valuable complement to official warning systems. Authorities may introduce policies or guidelines to help citizens use warning information to decide appropriate courses of action, but such interventions can backfire when critical information is missing or misinterpreted. Based on the experience of conducting this case study, we believe that information-behavior research has much to offer to advance our understanding of early warning information seeking.

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## Appendix: Responses to the 2009 Victorian Bushfire Royal Commission Report

The Victorian state government responded mostly posi-
tively to the recommendations in the Royal Commission
Interim Report. With reference to warnings, the government
agreed, in its response to Recommendation 4.2, that warn-
ings would be based "on the principle of maximizing the
potential to save human lives" (Government of Victoria,
2009). Warnings would also be further divided into two
categories: bushfire information (information on an ongoing
fire that may threaten lives) and bushfire warnings (warnings
to the community about a dangerous or extremely dangerous
bushfire, one that is burning out of control.)

The state would also research the development of a new
fire severity scale that could illustrate the risk posed by
particularly ferocious fires. The Country Fire Authority
website now displays a six-stage fire rating scale (CFA,
2012), with Code Red days for the worst bushfire days
(Rood, 2009). In its response, the government agreed that
the CFA would amend its advice to residents—that the safest
option is always to leave early, and not all homes are defend-
able in all circumstances. CFA material would also clearly
state that the risks of staying to defend include the risk of
physical injury and death.

The CFA website home page now clearly advises: "Plan
to leave early, if you can see smoke, it is too late." The
CFA's "Leave Early Guide," available on its website and
downloadable as a template, advises residents to know their
triggers which could be the "fire danger ratings of severe,
extreme, or Code Red." The Code Red Fire Danger Rating,
readily visible on the CFA home page, advises leaving early
and states very clearly that "homes are not designed or
constructed to withstand fires in these conditions."